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Revitalizing Auto Communities Environmental Response Trust (RACER)

AOI 09-A Impacted Soil Removal Work Plan

Buick City Site (Formerly General Motors Corporation North American Operations Facility)

Flint, Michigan

October 10, 2012

ARCADIS

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AOI 09-A Impacted Soil Removal Work Plan

Buick City Site (Formerly General Motors Corporation North American Operations Facility)

Prepared for:
Revitalizing Auto Communities Environmental Response Trust (RACER)

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Table of Contents

1. Introduction

This AOI 09-A Impacted Soil Removal Work Plan (work plan) was prepared by ARCADIS on behalf of Revitalizing Auto Communities Environmental Response Trust (RACER) for the Buick City Site (Site) located in Flint, Michigan. The objective of this work plan is to detail the approach that will be used to remove lead and benzo(a)pyrene impacted soils from the CSX property adjacent to AOI 09-A located in the Southend of the Site, Figure 1.

This work plan was developed in accordance with the *Corrective Measures Implementation (CMI) Work Plan (ARCADIS, 2010)* and the *U.S EPA Final Decision and Response to Comments for Soil and Groundwater Cleanup at The Southend of the Former General Motors Corporation North American Operations (Otherwise known as Buick City) (U.S.EPA, 2010)[the Final Decision].*

2. Soil Removal Activities

In the Final Decision the selected remedy to address the off-Site impacted soils is excavation and off-Site disposal. Off-Site impacted soils with lead concentrations above 900 milligrams per kilogram (mg/kg) (non-residential direct contact criteria) and benzo(a)pyrene concentrations above 8 mg/kg (non-residential direct contact criteria) will be excavated. The approximate extent of soil impacts (shown on Figure 2) is based on data collected during the RFI as well as investigation activities completed in August of 2010. Soils will be disposed of at an off-Site disposal facility consistent with state requirements.

The impacted soils are present on both RACER and CSX property; however, only the impacted soils on the CSX property will be excavated. An access agreement between RACER and CSX was fully executed on April 16, 2012. All provisions outlined in the access agreement will be followed during this excavation activity.

Figure 2 shows the route through the Site truck traffic will be using to access the work area on CSX property.

2.1 Site Preparation

Prior to beginning soil removal activities the following Site Preparation activities will be performed:

- A professional surveyor will stake and mark out the extent of each excavation and stake the historical soil boring locations, to be used as reference points. The estimated extent of offsite benzo(a)pyrene soil excavation is shown on Figure 3 and the lead soil excavation is shown on Figure 4.

- Work zones and staging areas for vehicles and equipment will be designated accordingly.

- Removal of existing perimeter fence as necessary to complete this scope of work.

- Construction safety fence or appropriate barricades will be installed just outside the excavation boundaries to eliminate a fall hazard and keep bystanders out of the work zones.

- A designated loading area will be established and appropriate measures will be taken to ensure impacted soil does not come into contact will non-impacted soils. Excavated soils will be directly loaded into trucks/roll-off boxes over a pad covered with poly plastic sheeting (or similar) to protect the underlying ground.

- Proper utility clearance procedures and one call activities will be completed.

2.2 Soil Erosion and Sedimentation Control

As the area of land to be excavated is less than 1 acre; a Sediment Erosion and Sedimentation Control Plan (SESC) Plan is not required. However, removal activities will be completed in a way that minimizes the potential for erosion and transport of soil from the removal areas to the adjacent surface-water bodies or nearby catch basins. During the soil excavation, the contractor will excavate the impacted soil and place the soil directly into a truck or staged roll-off, reducing or eliminating the need for stockpiling. However in the event that direct loading of impacted soil and unloading of fill soil cannot be achieved, soil stockpiles will be contained on plastic sheeting, and covered with plastic sheeting to prevent erosion. SESC control measure shall be removed upon completion of surface restoration and 90% vegetation coverage, where appropriate.

2.3 Soil Removal

The benzo(a)pyrene soil removal will be performed prior to the lead soil removal. In the event that additional excavation is required, excavation equipment shall be properly decontaminated prior to exiting either soil removal area.

2.3.1 Benzo(a)pyrene Soil Removal

During the benzo(a)pyrene delineation activities several additional polynuclear aromatic hydrocarbons (PNAs) were also detected at concentrations exceeding non-residential criteria. Although several PNAs have been detected above criteria in this area, it will continue to be referred to as the benzo(a)pyrene soil removal area, for consistency's sake. The PNA impacted soils will be excavated using heavy equipment and transported offsite to an approved disposal facility.

The estimated initial extent of the benzo(a)pyrene removal area is shown on Figure 3. The estimated area to be excavated is approximately 22 feet wide by 28 feet long by 2.5 feet deep. The area is bounded by the RACER/CSX property boundary to the west and by soil borings SB-09-35, SB-09-03, SB-09-33, and SB-09-34 to the south and east. The northern extent of impact has not been fully delineated. The estimated volume of soil to be removed is approximately 60 cubic yards. Any surface concrete / asphalt and/or debris removed during the excavation will be incorporated into the waste.

Confirmation sampling will be performed on the floor and sidewalls of the excavation as detailed in Section 2.5.1. In the event that a confirmation sample exceeds non-residential cleanup criteria then additional excavation and sampling will be performed as needed.

2.3.2 Lead-impacted Soil Removal

Lead impacted soils will be excavated using heavy equipment and transported offsite to an approved facility for disposal. All removed soil is assumed to be hazardous waste based on Site investigations which show that the Toxicity Characteristic Leaching Procedure (TCLP) results from soil samples exceeding 900 mg/kg also exceed the Resource Conservation and Recovery Act (RCRA) TCLP standard of 5 mg/l. Hazardous soils will be transported offsite for stabilization treatment and disposal.

The estimated initial extent of lead soil removal is shown on Figure 4. The estimated area to be excavated is approximately 12 feet wide by 100 feet long by 3.5 feet deep. The area is bounded by the RACER/CSX property boundary to the west and by soil borings RFI-09-50, SB-09-23, SB-09-25, SB-09-26, SB-09-28, SB-09-30, SB-09-17, and SB-09-18 to the north, east, and south. The excavation area was defined based on laboratory analytical data from RCRA Facility Investigation (RFI) activities and the August 2010 lead soil investigation which includes both laboratory analysis and X-ray florescence (XRF) field screening for lead concentrations. The data from the soil borings identified above as SB-XX-XX are XRF field screening data. An evaluation of the XRF data was previously presented in the 2011 CMI Annual Report. In general high XRF readings correlated to high laboratory total lead concentrations and low XRF readings correlated to low laboratory total lead concentrations; however, the field screening and laboratory results were not directly comparable. The approximate volume to be removed is estimated to be 200 cubic yards. Any surface concrete/ asphalt and/or debris removed during the excavation will also be disposed of.

Confirmation sampling will be performed on the floor and sidewalls of the excavation and is explained in detail in Section 2.4. In the event that a confirmation sample exceeds non-residential cleanup criteria then additional excavation and sampling will be performed as needed.

2.3.3 Air Monitoring and Dust Suppression

Air monitoring will be performed and documented throughout all dust generating activities due to the potential for inhalation exposure to dust containing lead and the potential presence of PNAs. Air quality will be continuously monitored with a particulate meter and flame ionization detector (FID) within and around the work zone to monitor potential exposure to workers and others (e.g., property users, occupants, or adjacent land owners). Appendix A presents the Standard Operating Procedure (SOP) for FID Air Monitoring and Field Screening.

2.3.3.1 Wind Direction Monitoring

One wind direction measurement device (wind sock or equivalent) will be located in an open area within the Site (unobstructed by buildings or trees) that will provide an accurate wind direction.

Wind direction will be measured continuously during soil removal activities. Field staff will check readings at least hourly. The results of the wind direction monitoring

will be used to determine placement of perimeter monitoring stations. Soil handling activities will cease if wind speed is reported by the National Weather Service to exceed 40 mph unless soil is saturated or it is raining.

2.3.3.2 Particulate Monitoring

Air quality will be continuously monitored at temporary air monitoring stations using a MIE Data RAM (or equivalent) which measures total suspended particulate (dust) in micrograms/cubic meter of air ($\mu g/m^3$). Monitoring will be completed real time at a minimum of two monitoring stations (1 upwind and 1 downwind of the excavation area) continuously during excavation activities. Field staff will verify operation of the equipment and record measurements of total suspended particulate, date, time, and wind direction at least hourly during excavation activities. The number, location, and frequency of temporary individual monitoring stations will depend on the activities being conducted and the predominant wind direction.

Based on the shallow depths of the proposed excavations (0 to 3.5 foot below ground surface [bgs]) and the limited lateral extent of these excavations, dust problems are not anticipated during soil removal activities. However, if the action levels presented in Appendix A are exceeded at any time, work will be stopped immediately, and a plan to reduce dust emissions will be established. These measures may include, but are not limited to, spraying the excavations lightly with clean water to minimize dust emissions. The action levels for the contaminants of concern are included in Appendix A.

2.4 Confirmation Sampling

Confirmation samples will be collected following the soil removal action using the "statistical" sampling approach identified as the Systematic Random Sampling method in Section 2.4.2.2 of the 2002 Michigan Department of Environmental Quality (MDEQ) Sampling Strategies and Statistics Training Materials (S3TM) for Part 201 Cleanup Criteria (excerpted in Appendix B).

2.4.1 Benzo(a)pyrene-impacted soil sampling

The excavation area is bounded by the RACER/CSX property boundary to the west and by soil borings SB-09-35, SB-09-03, SB-09-33, and SB-09-34 to the south and east. Sidewall samples will not be collected from the west wall of the excavation area due to the fact that excavation will not be performed on the RACER property to the west.

For the remainder of the excavation sidewall and bottom confirmation samples will be collected on a grid-based system as recommended in the S3TM with grid spacing set at 7 feet based on the excavation square footage of 600 square feet. Confirmation samples will be collected at the grid nodes (i.e., points of intersection); however, samples will be biased towards staining or indications of impact, if noted. In addition FID will be utilized during the excavation process to monitor for potential exposure and to screen soil at the limits (floor and sidewalls) of the excavation to aid in determining the extents.? Soil sample collection will also be biased towards elevated FID readings.

Confirmation samples will be collected after the anticipated depth and lateral extent of the excavation is reached. Confirmation samples will be collected in laboratory-provided containers using a decontaminated stainless-steel scoop or shovel. All sampling, analysis, and decontamination activities will be performed in accordance with the Site *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP) (BBL, 2001), Addendum Number 1 to Appendix C of the March 30, 2001 *RCRA Facility Investigation Work Plan – Field Sampling Plan/Quality Assurance Project Plan* (2005) and Addendum Number 2 (2005), and HASP (ARCADIS, 2010). Pertinent sections of the FSP/QAPP have been excerpted and are presented in Appendix C of this work plan**.** Sample containers will be labeled with the sample location identification, date of sample collection, and intended analysis. The samples will be immediately placed on ice in a cooler awaiting transport to the laboratory by courier. Samples will be submitted to the laboratory for PNA analysis.

2.4.2 Lead-impacted soil sampling

The excavation area is bounded by the RACER/CSX property boundary to the west. Sidewall samples will not be collected from the west wall of the excavation area due to the fact that excavation will not be performed on the RACER property to the west.

For the remainder of the excavation sidewall and bottom confirmation samples will be collected on a grid-based system as recommended in the S3TM with grid spacing set at 10 feet based on the excavation square footage of 1,200 square feet. Confirmation samples will be collected at the grid nodes (i.e., points of intersection); however, samples will be biased towards staining or indications of impact, if noted.

Confirmation samples will be collected after the anticipated depth and lateral extent of the excavation is reached. Confirmation samples will be collected in laboratory-provided containers using a decontaminated stainless-steel scoop or shovel. Sampling, analysis, and decontamination activities will be performed in accordance

with the FSP/QAPP (BBL, 2001, 2005) and HASP (ARCADIS, 2010). Sample containers will be labeled with the sample location identification, date of sample collection, and intended analysis). The samples will be immediately placed on ice in a cooler awaiting transport to the laboratory by courier. Samples will be submitted to the laboratory for total lead analysis.

Based upon the available soil chemistry data, the depth of the excavation is assumed to be less than 4 feet and therefore no shoring will be required prior to an individual entering the excavation for sampling. If the sample results necessitate excavating deeper than 4 feet, the excavation will be stabilized as described in Section 2.6.

2.5 Soil Transport and Disposal Management

Excavated soil will be live-loaded into trucks or roll-off boxes staged at the Site during the removal action to minimize the need for stockpiling soils. All soils will be transported to an appropriate disposal facility.

Loaded trucks will follow a prescribed transportation route to the designated disposal facility. ARCADIS will provide oversight of the work on behalf of RACER. ARCADIS will review, approve, and sign all waste profiles and waste shipping documents/manifests prior to the shipment of soil from the Site. ARCADIS will obtain weight tickets, tare/gross weight slips, and waste shipping documents from each truckload of soil transported from the Site. The volume of material removed from the Site will be recorded in the field notes in accordance with the FSP/QAPP (BBL, 2001, 2005) and HASP (ARCADIS, 2010). Certificates of disposal will be obtained from the disposal facilities. Copies of all transport and disposal documentation will be provided in the removal action completion report and will be kept on file as part of the administrative record by RACER as long as is appropriate.

2.6 Shoring and Dewatering

Due to depth and relative width of the excavation shoring/benching of excavation slopes will not be necessary during the excavation process. If re-excavation is deemed necessary and a shear wall of 4 feet or greater will be created as a result, that portion of the excavation will be sloped appropriately in accordance with the OSHA 29 Code of Federal Regulations Section 1926.650-652. Due to the depth of the excavation it is not anticipated that groundwater will be encountered. Any storm water encountered that does not infiltrate to the ground will be containerized and properly disposed.

2.7 Site Restoration

The excavation will be backfilled to approximately 6 inches bgs with unimpacted fill soil, and the remaining 6 inches will be backfilled with topsoil. A letter of virgin material or sample analytical results verifying that the material is clean will be provided prior to any backfill activities. The backfill material will be compacted in the excavated areas. The topsoil will be covered with grass seed to re-vegetate the ground surface to prevent erosion. If necessary, additional grass seed will be placed at locations outside the excavation areas to repair grass that was disrupted by removal activities. Every effort will be made to minimize disturbance to non-impacted areas of the Site during removal. Following stabilization of the ground surface, all temporary measures will be removed. Upon completion of work, any chain link security fence removed to allow for excavation shall be replaced.

3. Reporting

A brief memo-style report will be prepared to document the activities and final confirmation sample results associated with this work plan. The report will include the following information:

- Description of the field activities performed during the course of the excavation and related activities;
- The final excavation limits and locations of all confirmation samples;
- Additional relevant information, including, but not limited to, field forms and analytical data.

4. References

BBL, 2001. *Field Sampling Plan/Quality Assurance Project Plan, March 30, 2001*

ARCADIS, 2005. *Addendum Number 1 to Appendix C of the March 30, 2001 RCRA Facility Investigation Work Plan – Field Sampling Plan/Quality Assurance Project Plan, May13, 2005.*

ARCADIS, 2005. *Addendum Number 2 to Appendix C of the March 30, 2001 RCRA Facility Investigation Work Plan – Field Sampling Plan/Quality Assurance Project Plan, November 7, 2005.*

ARCADIS, 2010. *Health and Safety Plan, July 29, 2010.*

Michigan Department of Environmental Quality, 2002. *Sampling Strategies and Statistics training Material for Part 201 Cleanup Criteria, 2002.*

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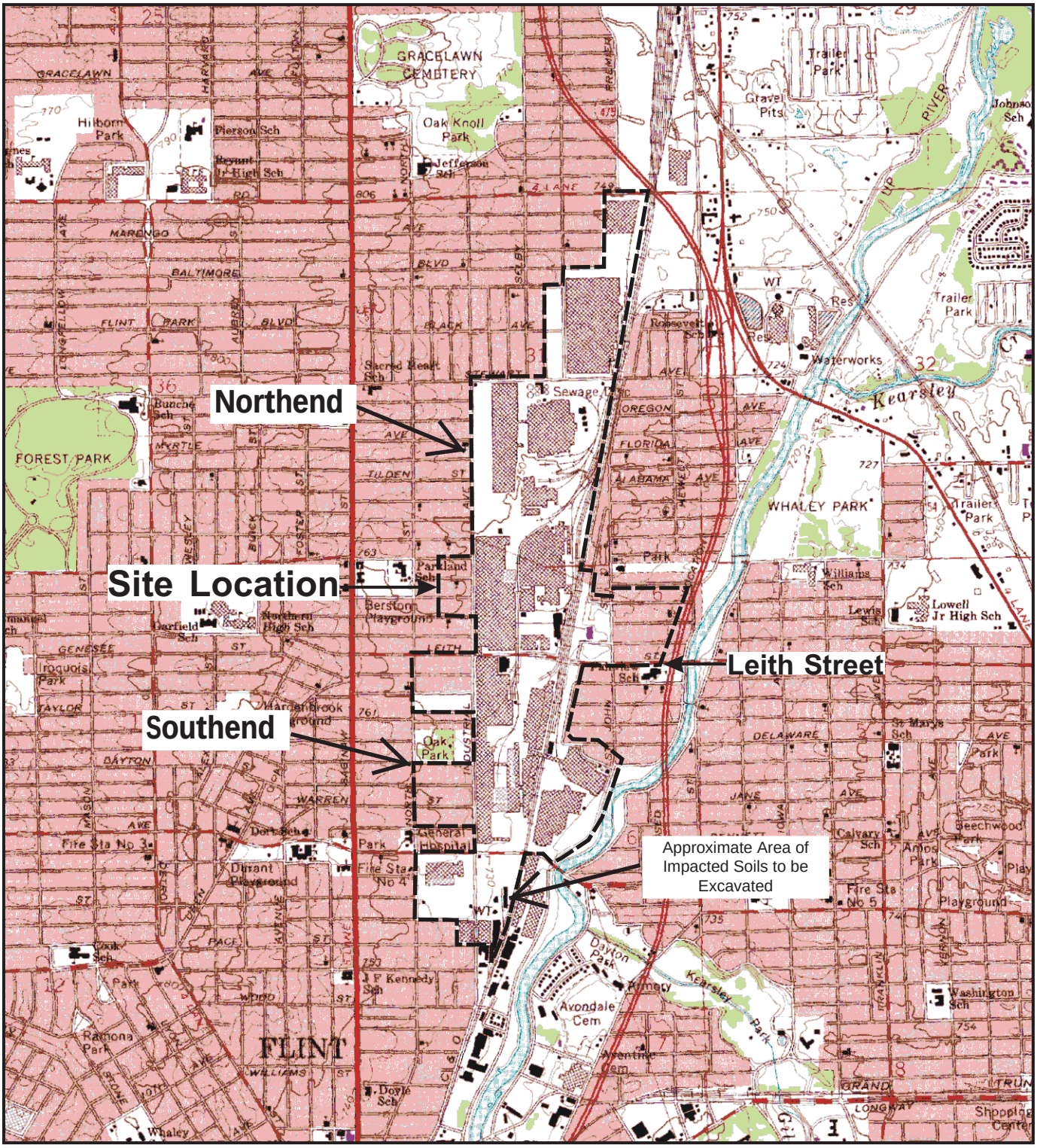
Figures



REFERENCE: Base Map Source: USGS 7.5 Min. Topo. Quad., Flint North, Mich. (1969, Photorevised 1975).

2000' 0 2000'

Approximate Scale: 1" = 2000'

Area Location

RACER TRUST
BUICK CITY - FLINT, MICHIGAN
AOI 09-A IMPACTED SOIL REMOVAL WORK PLAN

SITE LOCATION

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FIGURE
1

05/07/2012 SYRACUSE, NY-ENV/CAD-DJHOWES
B0064410/4012/00104/CDR/64410N02.CDR

HAMILTON AVE

CSX PROPERTY

RACER PROPERTY

ESTIMATED LEAD SOIL EXCAVATION AREA

BLDG. 9

ESTIMATED BENZO(A)PYRENE SOIL EXCAVATION AREA

TRUCK ROUTE

INDUSTRIAL AVE

LEGEND:

- RACER/CSX PROPERTY BOUNDARY
- RAILROAD
- X FENCE
- FORMER BUILDING

NOTES:

1. BASE MAP INFORMATION FROM A SURVEY BY BMJ INC., DATED APRIL 2001, AT A SCALE OF 1:100.
2. ALL LOCATIONS ARE APPROXIMATE.

0 60' 120'

GRAPHIC SCALE

RACER TRUST
BUICK CITY - FLINT, MICHIGAN
AOI 09-A IMPACTED SOIL REMOVAL WORK PLAN

SITE PLAN

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FIGURE
2

ESTIMATED EXTENT OF BENZO(A)PYRENE EXCAVATION

SB-09-34
SB-09-33
SB-09-02
RFI-09-19
RFI-09-03
SB-09-03
SB-09-36
SBFL3-34
RFI-09-20
SB-09-35
SB-09-04
RFI-09-03R
SB-09-01
RFI-09-21

CSX PROPERTY
RACER PROPERTY

BLDG. 09

LEGEND:

- RACER/CSX PROPERTY BOUNDARY
- STORM PIPING
- RAILROAD
- FENCE
- FORMER BUILDING
- SOIL BORING (8/16/10-8/20/10)
- HISTORICAL RFI SOIL BORING
- HISTORICAL SOIL BORING

NOTES:

1. BASE MAP INFORMATION FROM A SURVEY BY BMJ INC., DATED APRIL 2001, AT A SCALE OF 1:100.
2. ALL LOCATIONS ARE APPROXIMATE.

0 10' 20'
GRAPHIC SCALE

RACER TRUST
BUICK CITY - FLINT, MICHIGAN
AOI 09-A IMPACTED SOIL REMOVAL WORK PLAN

ESTIMATED EXTENTS OF BENZO(A)PYRENE EXCAVATION

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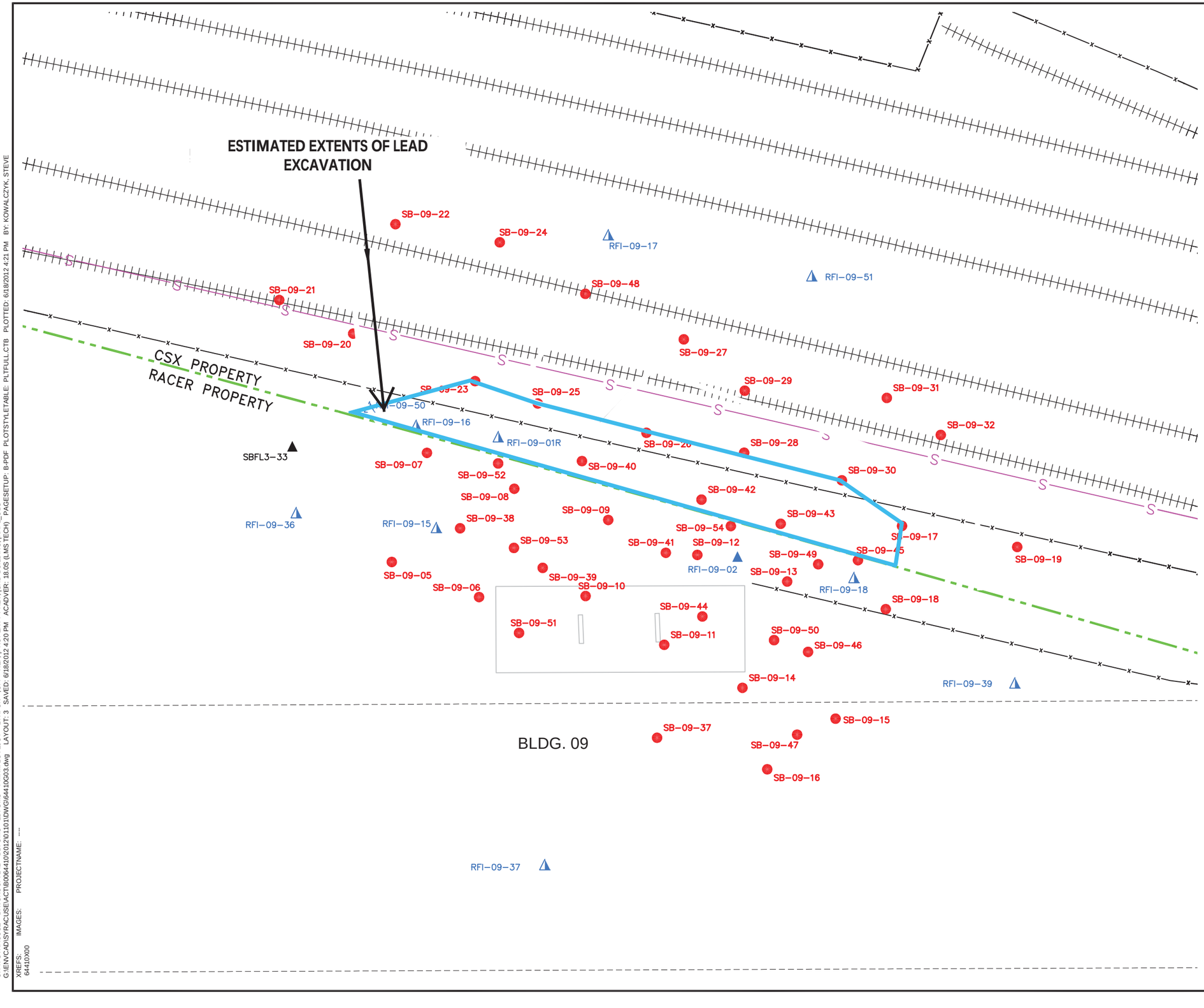
FIGURE
3



LEGEND:

- RACER/CSX PROPERTY BOUNDARY
- STORM PIPING
- RAILROAD
- FENCE
- FORMER BUILDING
- SOIL BORING (8/16/10–8/20/10)
- HISTORICAL RFI SOIL BORING
- HISTORICAL SOIL BORING

NOTES:

1. BASE MAP INFORMATION FROM A SURVEY BY BMJ INC., DATED APRIL 2001, AT A SCALE OF 1:100.
2. ALL LOCATIONS ARE APPROXIMATE.

0 20' 40'

GRAPHIC SCALE

RACER TRUST
BUICK CITY - FLINT, MICHIGAN
AOI 09-A IMPACTED SOIL REMOVAL WORK PLAN

ESTIMATED EXTENTS OF LEAD EXCAVATION

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FIGURE
4

CITY: SYRACUSE DIV/GROUP: 141 DB: GMS LD: GMS PM: M. LOVEJOY LYR: ON=*;OFF=*REF, |PROPERTY-PREV, |SHD-BUILDING, |NAPL_OBS
G:\ENVCAD\SYRACUSE\ACTIVE\B0064410\2012\601101\DWG\64410G03.dwg LAYOUT: 3 SAVED: 6/18/2012 4:20 PM ACADVER: 18.0S (LMS TECH) PAGESETUP: B-PDF PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 6/19/2012 4:21 PM BY: KOWALCZYK, STEVE
XREFS: IMAGES: PROJECTNAME: ---
64410X00

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Appendix A

Standard Operating Procedures and Action Levels

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Flame Ionization Detector Air Monitoring and Field Screening

Rev. #: 0

Rev Date: July 25, 2003

Approval Signatures

Prepared by: _____ Date: _____

Reviewed by: _____ Date: _____
(Technical Expert)

Reviewed by: _____ Date: _____
(Project Manager)

I. Scope and Application

Field screening with a flame ionization detector (FID), such as an organic vaporizer analyzer (OVA), is a procedure to measure relative concentrations of volatile organic compounds (VOCs) and other compounds in air. The characteristics of the OVA are presented in Attachment 1; the compounds which it can detect are presented in Attachment 2; indicators of malfunction are summarized in Attachment 3; and the OVA Calibration and Maintenance Log is included in Attachment 4 (this form needs to be attached). Field screening will be conducted on the following:

- Work area air to assess exposure to on-site workers of air contaminants via the air pathway;
- Well headspaces as a precautionary measure each time the well cover is opened; and
- Soil samples obtained with split-barrel sampler.

II. Personnel Qualifications

To be completed by Preparer and reviewed by Technical Expert.

III. Equipment List

The following materials, as required, shall be available while performing OVA field screening:

- personal protective equipment (PPE), as required by the site Health and Safety Plan (HASP);
- OVA operating manual;
- calibration gas canisters; and
- field notebook.

IV. Cautions

To be completed by Preparer and reviewed by Technical Expert.

V. Health and Safety Considerations

To be completed by Preparer and reviewed by Technical Expert.

VI. Procedure

The OVA will be operated according to the procedures contained in the operating manual. A summary of basic start-up and shut-down procedures is provided below.

Start-Up

1. Move PUMP Switch to ON and check battery condition by moving the INSTR Switch to the BATT position.

2. Move INSTR Switch to ON and allow 5 minutes for warm up.

3. Set Alarm Level Adjust knob on back of Readout Assembly to desired level and adjust volume.

4. Check calibration with HIGH/LOW Calibrate Switch. End the check by going to HIGH position and then to OFF. Turn PUMP Switch ON.

5. Place instrument panel in vertical position and check sample flow rate indication.

6. Open the H2 TANK VALVE and the H2 SUPPLY VALVE.

7. Depress the igniter button until burner lights. Do not depress igniter button for more than 6 seconds (if burner does not ignite, let instrument run for several minutes and again attempt ignition).

8. The instrument is now ready for use.

Shut Down

1. Close the H2 SUPPLY VALVE and H2 TANK VALVE.

2. Move the INSTR Switch and PUMP Switch to OFF.

3. Instrument in now in shut down configuration.

OVA Calibration

OVA field instruments will be calibrated to methane and operated to yield measurements of "total organic vapor" in ppm (v/v). OVA operation, maintenance, and calibration shall be performed in accordance with the manufacturer's instructions and entered on the OVA Calibration and Maintenance Log (Attachment 4). Instructions for OVA calibration are summarized as follows:

Electronic Adjustments for Calibration Using Methane as the Standard

Calibrate the instrument as follows:

1. Prepare two known concentrations of methane gas in air, preferably 100 ppm and 10,000 ppm (1%).

2. Place the OVA in normal operation and permit it to warm up for at least 15 minutes.

3. Introduce the 100 ppm sample and rotate the Calibration Adjust knob for 100 ppm on the meter.

4. Introduce the 10,000 ppm mixture and adjust R-4 on the electronics board for 10,000 ppm.

5. Repeat Steps 3 and 4 until no further adjustment is necessary.

6. Close the Hydrogen Supply Valve and wait until the flame is extinguished.

7. Place the Calibrate Switch in the Low position and rotate the GAS Select knob until the meter reads 10 ppm.

8. Place the Calibrate Switch in the High position and adjust R-16 on the electronics board for 10,000 ppm.

9. Repeat Steps 7 and 8 until no further adjustment is necessary.

Work Area Air Monitoring

1. Measure and record the background OVA reading.

2. Measure and record breathing space reading.

3. Adjust level of PPE, as described in the HASP, and proceed.

4. Record OVA readings.

VII. Waste Management

To be completed by Preparer and reviewed by Technical Expert.

VIII. Data Recording and Management

To be completed by Preparer and reviewed by Technical Expert.

IX. Quality Assurance

To be completed by Preparer and reviewed by Technical Expert.

X. References

To be completed by Preparer and reviewed by Technical Expert.

ATTACHMENT 1

CHARACTERISTICS OF THE OVA

The organic vapor analyzer (OVA) is one type of flame ionization detector (FID). All FID instruments use ionization as the detection method, much the same as in the photoionization detector (PID), except that the ionization is caused by a hydrogen flame rather than by a UV light. This flame has sufficient energy to ionize any organic species with an ionization potential of 15.4 or less. Inside the detector chamber, the sample is exposed to a hydrogen flame which ionizes the organic vapors. When most organic vapors burn, positively charged carbon-containing ions are produced which are collected by a negatively charged collecting electrode in the chamber. An electric field exists between the conductors surrounding the flame and a collecting electrode. As the positive ions are collected, a current proportional to the hydrocarbon concentration is generated on the input electrode. This current is measured with a preamplifier which has an output signal proportional to the ionization current.

A signal conducting amplifier is used to amplify the signal from the pre-amp and to condition it for subsequent meter or external recorder display.

The Foxboro OVA consists of two major parts:

- A 9-pound package containing the sampling pump, battery pack, support electronics, FID, hydrogen gas cylinder, and an optional gas chromatography (GC) column; and

- A hand-held meter/sampling probe assembly.

The OVA is generally calibrated to methane, but can be calibrated to the species of interest.

The OVA can be operated in a GC mode or survey mode. During normal survey mode operation, a sample is drawn into the probe and transported to the detector chamber by an internal pumping system. When the sample reaches the FID, it is ionized as described above and the resulting signal is translated on the meter for direct-reading concentration as total organic vapors or recorded as a peak on the chart. The meter display is an integral part of the probe/read-out assembly and has a scale from 0 to 10 which can be set to read 0-10, 0-100, or 0-1,000 ppm.

With the GC option, individual components can be detected and measured independently. In the GC mode, a small sample of ambient air is injected into a chromatographic column and carried through the column by a stream of hydrogen gas. Two valves are used in the GC system: the sample inject valve and the backflush valve. The sample inject valve diverts a fixed volume of vapor contained in the sample loop into the hydrogen gas carrier and through the chromatographic column for separation identification, and quantification of individual components present. The backflush valve reverses the flow of the hydrogen flow through the GC column to clear the column of any contamination. In the GC mode, backflush plays a significant role in determining the presence of high boiling contaminants. If no peaks are observed after the desired run time, the user might assume no contaminants are present; however, high boiling volatiles may still be present. Backflushing allows for the detection of high boiling volatile components.

Compounds with different chemical structures are retained on the column for different lengths of time (known as retention times) and, hence, are detected separately by the FID. As each component exits the column into the detector, it is ionized and a proportional output voltage is recorded on a strip chart recorder. A strip chart recorder can be used to record the retention times, which are then compared to the retention times of a standard with known chemical constituents.

An instrument output meter serves to indicate, in ppm units, the concentration of total organic vapor. The concentration (in ppm) represents a summation of the percent relative response values characteristic of each individual organic compound in the sample. The sample can either be injected into the column from the air sampling hose or injected directly with a gas-tight syringe.

ATTACHMENT 2

RESPONSE FACTORS FOR THE OVA

CHEMICAL COMPOUND	RESPONSE FACTOR (%)
Acetonitrile	70
Acrylonitrile	70
Allyl Alcohol	30
Allyl Chloride	50
BenzenE	150
2-Bromo-2-chloro-1,1,1-trifluoroethane (Halothane)	45
Bromomethane	75
1-Bromopropane	75
2-Butane	60
n-Butanol	50
2-Butanol	65
n-Butyl Acetate	80
n-Butyl Acrylate	60
2-Butyl Acrylate	70
n-Butyl Formate	50
2-Butyl Formate	60
n-Butyl Methacrylate	60
2-Butyl Methacrylate	80
Carbon Tetrachloride	10
Chlorobenzene	200
Chlorodifluoromethane (Freon 22)	40
Chloroform	65
1-Chloropropane	76
2-Chloropropane	90
2-Chloro-1,1,2-trifluoroethyl difluoromethyl ether (Ethane)	150
Cumene	100
Cyclohexane	85
Cyclohexanone	100
n-Decane	75
O-Dichlorobenzene	50
Dichlorodifluoromethane (Freon 12)	15
1,1-Dichloroethane	80
1,2-Dichloroethane	80
trans-1,2-Dichloroethylene	50
Dichlorofluoromethane (Freon 21)	70
Dichloromethane	100
1,2-Dichloropropane	90
1,3-Dichloropropane	80
1,2-Dichloro 1,1,2,2-tetrafluoroethane (Freon 114)	110

CHEMICAL COMPOUND	RESPONSE FACTOR (%)
Diethyl Ether	50
Diethyl Ketone	80
p-Dioxane	30
Ethane	80
Ethanethiol	30
Ethanol	25
Ethyl Acetate	65
Ethyl Acrylate	40
Ethyl Benzene	100
Ethyl Butyrate	70
Ethyl Formate	40
Ethyl Methacrylate	70
Ethyl Propionate	65
Ethylene Dibromide	50
Ethylene Dichloride	60
Ethylene Oxide	70
Fluorotrichloromethane (Freon 11)	10
Heptane	75
Hexane	70
Isoprene	50
Methane	100
Methyl Alcohol	12
Methyl Acetate	41
Methyl Acrylate	40
Methyl Cyclohexane	100
Methyl Cyclopentane	80
Methyl Ethyl Ketone	80
Methyl Isobutyl Ketone	80
Methyl Methacrylate	50
Methyl Propyl Ketone	70
Nitromethane	35
1-Nitropropane	60
2-Nitropropane	70
Nonane	90
Octane	80
Pentane	65
Pentanol	40
Propane	80
n-Propanol	40
2-Propanol	65
n-Propyl Acetate	75
n-Propyl Ether	65
n-Propyl Formate	50

CHEMICAL COMPOUND	RESPONSE FACTOR (%)
Pyridine	128
Styrene	85
1,1,1,2-Tetrachloroethane	100
1,1,2,2-Tetrachloroethane	100
Tetrachloroethylene	70
Tetrahydrofuran	40
Toluene	110
1,1,1-Trichloroethane	105
1,1,2-Trichloroethane	85
Trichloroethylene	70
Trichlorofluoroethane (Freon 113)	80
Triethylamine	70
Vinyl Acetate	50
Vinyl Chloride	35
Vinylidene Chloride	40
m-Xylene	111
o-Xylene	116
p-Xylene	116

Note:

[1] Response factors for Foxboro Century OVA when instrument is calibrated to methane. For example, the instrument response factor for benzene is 150% and a 100 ppm concentration of benzene in air would register as 150 ppm on the instrument read-out.

ATTACHMENT 3

INDICATORS OF MALFUNCTION OF THE OVA

INDICATION	POSSIBLE CAUSES
• High Background Reading (more than 10 ppm)	1. Contaminated hydrogen 2. Contaminated sample line
• Continual Flameout	1. Hydrogen leak 2. Dirty burner chamber 3. Dirty air filters
• Low Air Flow	1. Dirty air filter 2. Pump malfunction 3. Line obstruction
• Flame Will Not Light	1. Low battery 2. Igniter broken 3. Hydrogen leak 4. Dirty burner chamber 5. Air flow restricted
• No Power to Pump	1. Low battery 2. Short circuit
• Hydrogen Leak (instrument not in use)	1. Leak in regulator 2. Leak in valves

ATTACHMENT 4

OVA CALIBRATION AND MAINTENANCE LOG

ARCADIS
Infrastructure, environment, facilities

Imagine the result

Air Monitoring Instruments

Rev. #: 0

Rev Date: August 21, 2003

Approval Signatures

Prepared by: _____ Date: _____

Reviewed by: _____ Date: _____
(Technical Expert)

Reviewed by: _____ Date: _____
(Project Manager)

I. Scope and Application

This Standard Operating Procedure (SOP) provides the accepted methods of calibration of the HNu Model PI-101 Photoionization Detector (HNu) and the Foxboro Model 128 Organic Vapor Analyzer (OVA).

Proper calibration of air monitoring instruments is essential to evidence property evaluation of ambient air readings for the purpose of health and safety screening and for evidentiary air data collection. Without proper instrument calibration to a known concentration of a calibration gas standard, the usefulness of the data cannot be determined.

The following terminology is applicable to calibration of the HNu and OVA.

- • HNu - A photoionization detector that uses an ultraviolet light source to ionize organic and some inorganic gases and vapors for subsequent detection.
- • OVA - A flame ionization detector that uses a hydrogen flame to ionize organic vapors and gases for subsequent detection.
- • Ionization - A process by which a compound is broken down into the atoms that make up the compound, thereby forming positive and negative ions.
- • Gas - A substance that exists in a gaseous state at ordinary temperatures and pressures.
- • Vapor - The gaseous state of a substance that is a liquid or solid at ordinary temperatures and pressures.
- • Trimpot - A screw-type variable resistor incorporated into the electronic circuitry of the HNu and OVA used as a potentiometer to calibrate the instrument.
- • Primary Calibration - Instrument calibration of the HNu and OVA against a known standard calibration gas.
- • Secondary Calibration - In-field calibration check of the HNu or OVA for a stable background reading (zero adjust) and for response to a gaseous organic source.

II. Personnel Qualifications

The Air Equipment Coordinator is responsible for performing routine maintenance on the HNu and OVA and is responsible for the primary calibration of instruments for field

use on a site-specific basis. The Field Investigation Manager (FIM) is responsible for the mobilization of the HNu and OVA, and is also responsible for the mobilization of calibration equipment when site stays are to be extended or when sites are clustered, thereby causing the need for primary instrument calibration. The Health and Safety Supervisor (HSS) is responsible for primary and secondary calibration of the HNu and OVA in the field. The FIM is responsible for documenting instrument calibration in the field logbook. The FIM is accountable to the Project Manager (PM) to ensure successful calibration of air monitoring equipment.

III. Equipment List

To be completed by Preparer and reviewed by Technical Expert.

IV. Cautions

To be completed by Preparer and reviewed by Technical Expert.

V. Health and Safety Considerations

To be completed by Preparer and reviewed by Technical Expert.

VI. Procedure

The following procedures may be employed for primary and secondary calibration of the HNu PI-101 Photoionization Detector:

Calibration

1. Startup and shutdown of the HNu;
2. Maintenance and calibration schedules;
3. HNu calibration;
4. Cleaning the UV light-source window; and
5. Cleaning the ionization chamber.

The aforementioned procedures are from the Compendium of Superfund Field Operations Methods (EPA, 1987).

Startup

- • Check the FUNCTION switch on the control panel to make sure it is in the OFF position. Attach the probe to the readout unit. Match the alignment key and twist the connector clockwise until a distinct locking is felt.

- • Turn the FUNCTION switch to the BATTERY CHECK position. Check that the indicator reads within or beyond the green battery arc on the scale plate. If the indicator is below the green arc or if the red LED comes on, the battery must be charged before using.

- • To zero the instrument, turn the FUNCTION switch to the STANDBY position and rotate the ZERO POTENTIOMETER until the meter reads zero. Wait 15 to 20 seconds to confirm that the zero adjustment is stable. If it is not, then readjust.

- • Check to see that the SPAN POTENTIOMETER is set at the appropriate setting for the probe being used (5.0 for 9.5eV probe; 9.8 for 10.2eV; and 5.0 for 11.7eV).

- • Set the FUNCTION switch to the desired parts per million (ppm) range.

- • Listen for the fan operation to verify fan function.

- • Check instrument with an organic point source, such as a “Sharpie,” before survey to verify instrument function.

Shutdown

- • Turn FUNCTION switch to OFF.

- • Place the instrument on the charger.

Maintenance and Calibration Schedule

The following maintenance/calibration schedule should be followed to ensure proper operation of the HNu.

Function	Frequency
Perform primary calibration	Prior to each use*
Initial factory checkout and calibration	Yearly, when malfunctioning, or after changing UV light source
Wipe down readout unit	After each use
Clean UV light source window	Every month or as use and site conditions dictate
Clean the ionization chamber	Monthly
Recharge battery	After each use

* During extended field use, the HNu PI-101 must be calibrated at least once every 3 days.

Primary Calibration

1. Start up the HNu.

2. Acquire the HNu calibration gas canister. The primary HNu calibration gas is benzene (or isobutylene, a benzene equivalent).

3. Connect the HNu probe to the gas canister using flexible tubing.

4. Allow the calibration gas to be drawn into the probe and check the HNu response in ppm.

5. Adjust the span potentiometer to 9.8 to match the concentration of the isobutylene calibration gas. This procedure should be followed only until the span potentiometer reaches the following limits:

1. Probe	2. Initial Span Potentiometer Setting	3. Maximum Acceptance Span Potentiometer Setting
4. 9.5eV	5. 5.0	6. 1.0
7. 10.2eV	8. 9.8	9. 8.5
10. 11.7eV	11. 5.0	12. 2.0

6. If these limits are exceeded, the HNu must be calibrated. Calibration is accomplished by first adjusting the span potentiometer to its initial setting. The trimpot inside the instrument must then be adjusted to obtain the concentration reading of the calibration gas (9.8). This trimpot is located inside the HNu case on the right side of the instrument.

Calibration Records

The following information should be documented in the field logbook when in field primary calibration of the HNu is required:

1. Serial number of the HNu.

2. Data of calibration.

3. Method of calibration.

4. Results of calibration.

5. Initial reading prior to adjustment.

6. Identification of the person responsible for instrument calibration.

7. Identification of the calibration gas (source, type, concentration, lot number).

Cleaning the UV Light-Source Window

The following procedures may be followed in the field, should the need arise, to clean the UV Light-Source Window:

1. Turn the FUNCTION switch to the OFF position and disconnect the sensor/probe from the Readout/Control unit.

2. Remove the exhaust screw located near the base of the probe. Grasp the end cap in one hand and the probe shell in the other. Separate the end cap and lamp housing from the shell.

3. Loosen the screws on top of the end cap and separate the end cap and ion chamber from the lamp and lamp housing, taking care that the lamp does not fall out of the lamp housing.

4. Tilt the lamp housing with one hand over the opening so that the lamp slides out of the housing into your hand.

5. The lamp window may now be cleaned using lens paper with any of the following compounds:

    a. Use HNu Cleaning Compound on all lamps except the 11.7eV.

    b. Clean the 11.7eV lamp with freon or chlorinated organic solvent. Do not use HNu cleaner, water, or water miscible solvents (i.e., acetone and methanol).

6. Following cleaning, reassemble by first sliding the lamp back into the lamp housing. Place the ion chamber on top of the housing, making sure the contacts are properly aligned.

7. Place the end cap on top of the ion chamber and replace the two screws. Tighten the screws only enough to seal the O-ring. Do not overtighten.

8. Line up the pins on the base of the lamp housing with pins inside the probe shell and slide the housing assembly into the shell. It will fit only one way.

9. Replace the exhaust screw.

Cleaning the Ionization Chamber

The following procedures may be followed in the field, should the need arise, to clean the HNu ionization chamber.

1. Turn the FUNCTION switch to the OFF position and disconnect the sensor/probe from the Readout/Control unit.

2. Remove the exhaust screws located near the base of the probe. Grasp the end cap in one hand and the probe shell in the other. Separate the end cap and lamp housing from the shell.

3. Loosen the screws on top of the end cap and separate the end cap and ion chamber from the lamp and lamp housing, taking care that the lamp does not fall out of the lamp housing.

4. The ion chamber may now be cleaned according to the following sequence:

    a. Clean with methanol using a Q-tip.

    b. Dry gently at 50ºC to 60ºC for 2 hours.

5. Place the ion chamber on top of the housing, making sure the contacts are properly aligned.

6. Place the end cap on top of the ion chamber and replace the two screws. Tighten the screws only enough to seal the O-ring. Do not overtighten.

7. Line up the pins on the base of the lamp housing with pins inside the probe shell and slide the housing assembly into the shell. It will fit only one way.

The following procedures may be employed for primary and secondary calibration of the Foxboro Model 128 Organic Vapor Analyzer (OVA):

Calibration

1. Startup and shutdown of the OVA;

2. Maintenance and calibration schedules;

3. OVA calibration;

4. Hydrogen recharge of the OVA;

5. Pump system checkout; and

6. Cleaning the burner chamber.

The aforementioned procedures are from the Compendium of Superfund Field Operations Methods (EPA, 1987).

Startup

1. Connect the probe/readout connectors to the side-pack assembly.

2. Check battery condition and hydrogen supply.

3. For measurements taken as methane equivalent, check that the GAS SELECT dial is set at 300.

4. Turn the electronics on by moving the INST switch to the ON position, and allow 5 minutes for warm-up.

5. Set CALIBRATE switch to X10; use CALIBRATE knob to set indicator to 0.

6. Open the H2 supply valve all the way. Check that the hydrogen supply gauge reads between 8.0 and 12.0 psig.

7. Turn the PUMP switch ON and check the flow system.

8. Check that the BACKFLUSH and INJECT valves are in the UP position.

9. To light the flame, depress the igniter switch until a meter deflection is observed. The igniter switch may be depressed for up to 5 seconds. Do not depress for longer than 5 seconds, as it may burn out the igniter coil. If the instrument does not light, allow the instrument to run several minutes and repeat ignition attempt.

10. Confirm OVA operational state by using an organic source, such as a “Sharpie.”

11. Establish a background level in a clean area or by using the charcoal scrubber attachment to the probe (depress the sample inject valve) and by recording measurements referenced to background.

12. Set the alarm level, if desired.

Shutdown

1. Close H2 supply valve and H2 tank valve (do not overtighten valves).

2. Turn INST switch to OFF.

3. Wait until H2 supply gauge indicates system is purged of H2, then switch off pump (approximately 10 seconds).

4. Put instrument on electrical charger at completion of day’s activities.

Maintenance and Calibration Schedule

Function	Frequency
Secondary calibration	Prior to project startup
Primary calibration	Monthly, or if secondary check is off by more than +10%
Check pumping system	Prior to project startup
Check particle filters	Weekly, or as needed
Clean burner chamber	Monthly, or as needed
Quad ring service	Monthly, or as needed
Replace charcoal	120 hours of use or when background readings are higher with the inject valve down then with the inject valve up in a clean environment

Primary and Secondary Calibration Procedures for OVA Model 128

Procedures for primary and secondary calibration of the OVA are as follows:

Primary Calibration

1. Remove instrument components from the instrument shell.

2. Turn on electronics and zero instrument on X10 scale. Gas select dial to 300.

3. Turn on PUMP and HYDROGEN. Ignite flame. Go to SURVEY MODE.

4. Introduce a methane standard near 100 ppm.

5. Adjust R32 Trimpot on circuit board to make meter read to standard.

6. Turn off hydrogen flame and adjust meter needle to read 40 ppm (calibrate at X10) using the calibration adjust knob.

7. Switch to X100 scale and adjust meter to read 0.4 on the 1 to 10 meter markings (0.4 x 100 = 40 ppm). If the reading is off, adjust with R33 Trimpot.

8. Return to X10 scale and adjust meter to read 0.4 on the 1 to 10 meter markings using the calibration adjust. Switch to X1 scale. The meter should read 4 ppm. If the reading is off, adjust using the R31 Trimpot.

Secondary Calibration

1. Acquire a gas canister with 100 ppm (certified) methane calibration gas.

2. Connect the outlet of the air-sampling bag to the air-sampling line of the OVA.

3. Record the reading obtained from the meter on the calibration record.

Calibration Records for the OVA

The following information should be documented in the field logbook when in-field primary calibration of the OVA is required:

1. Serial number of the OVA.

2. Date of calibration.

3. Method of calibration.

4. Result of calibration.

5. Identification of person who calibrated the instrument.

6. Identification of the calibration gas (concentration and serial number of cylinder).

Charging the OVA with Hydrogen

1. High grade hydrogen (99.999%) is required. Maximum pressure the instrument can handle is 2,300 psig.

2. Connect the fill hose to the REFILL FITTING on the side pack assembly with FILL//BLEED valve on the OFF position.

3. Open the cylinder of 99.999% hydrogen.

4. Place FILL/BLEED valve on FILL Hose in BLEED position momentarily to purge any air out of the system.

5. Open the instrument tank valve.

6. Open REFILL valve on instrument.

7. Place FILL/BLEED valve in FILL position until the instrument pressure gauge equalizes with the hydrogen cylinder gauge.

8. Close tank valve, REFILL valve, and FILL/BLEED valve.

9. Turn FILL/BLEED valve to BLEED until the pressure in the hose is released.

10. Disconnect the FILL HOSE and replace protective nut on the REFILL FITTING.

OVA Pump System Checkout

1. With pump on, hold unit upright and observe flow gauge.

2. Ball level significantly below a reading of 2 is inadequate flow.

3. Check connections at the sample hose.

4. Clean or replace particle filters if flow is impaired or it is time for scheduled service.

5. Reassemble and retest flow.

6. If flow still inadequate, replace pump diaphragm and valves.

7. If flow is normal, plug air intake. Pump should slow and stop.

8. If no noticeable change in pump, tighten fittings and retest.

9. If still no change, replace pump diaphragm and valves.

10. Document this function in the maintenance records.

Burner Chamber Cleaning

The following procedures may be followed in the field, should the need arise, to clean the OVA burner chamber:

1. Remove plastic exhaust port cover.

2. Unscrew exhaust port.

3. Use wire brush to clean burner tip and electrode. Use wood stick to clean the Teflon housing.

4. Brush inside of exhaust port.

5. Blow out chamber with a gentle air flow.

6. Reassemble and test unit.

7. Document this function in the maintenance records.

Particle Filter Servicing

There are two points in the air sampling line of the OVA where filters have been placed to keep particulate from entering the instrument. The locations of these filters are indicated on the attached figure. The first filter is located in the probe assembly and the second filter (primary filter) is located on the side pack assembly. Cleaning procedures are as follows:

1. Detach the probe assembly from the readout assembly.

2. Disassemble the probe (the components unscrew).

3. The particle filter located within the probe can be cleaned by blowing air through the filter.

4. Reassemble the probe.

5. The primary filter, located behind the sample inlet connector on the side pack assembly, is accessed by removing the sample inlet connector with a thin-walled 7/16-inch socket wrench. Remove the filter and clean as above.

6. Reassemble the sample inlet fitting and filter to the side pack assembly.

7. Check sample flow rate.

Quad Ring Service

1. Remove OVA guts from protective shell.

2. Remove clip ring from bottom of valve.

3. Unscrew nut from top of valve.

4. Gently pull valve shaft upward and free of housing.

5. Observe rings for signs of damage - replace as necessary.

6. Lightly grease rings with silicone grease.

7. Reassemble valve - do not pitch rings during shaft insertion.

8. Document this function in the maintenance records.

VII. Waste Management

To be completed by Preparer and reviewed by Technical Expert.

VIII. Data Recording and Management

Field documentation of air monitoring equipment calibration must provide sufficient information and data to both enable reconstruction of field activities and evidence proper calibration methods.

The following documentation will be retained in the project file:

1. Field logbooks.

2. Records of calibration, maintenance, and field checkout procedures for any measuring and test equipment used.

IX. Quality Assurance

To be completed by Preparer and reviewed by Technical Expert.

X. References

Century Systems (Foxboro). Service Procedures: Organic Vapor Analyzer; 128GC.

HNu Systems, Inc. Instruction Manual for Model PI-101 Photoionization Analyzer.

EPA, 1987. *A Compendium of Superfund Field Operations Methods*. Section 15.2: HNu PI-101, pp. 15-17 to 15-30. Section 15.3: Organic Vapor Analyzes (OVA-128), pp. 15-30 to 15-38. Office of Emergency and Remedial Response, Office of Waste Programs Enforcement. U.S. Environmental Protection Agency, Washington, D.C. EPA/540/p-87/001. December 1987.

ATTACHMENT A
HNu TROUBLESHOOTING
To be performed by qualified technician only.

A. No meter response in any switch position (including BATT CHK)

1. Broken meter movement

   a. Tip instrument rapidly from side to side. Meter needle should move freely, and return to zero.

2. Electrical connection to meter is broken

   a. Check all wires leading to meter and clean the contacts of quick-disconnects.

3. Battery is completely dead

   a. Disconnect battery and check voltage with volt-ohm meter.

4. If none of the above solves the problem, consult the factory.

B. Meter responds in BATT CHK position, but reads zero or near zero for all others.

1. Power supply defective

   a. Check power supply voltages per Figure 11 of the HNu owner's manual. If any voltage is out of specification, consult the factory.

2. Input transistor or amplifier has failed

   a. Rotate zero control; meter should deflect up/down as control is turned.

   b. Open probe. Both transistors should be fully seated in sockets.

3. Input signal connection broken in probe or readout.

   a. Check input connector on printed circuit board. The input connector should be firmly pressed down.

   b. Check components on back side or printed circuit board. All connections should be solid, and no wires should touch any other object.

   c. Check all wires in readout for solid connections.

C. Instrument responds correctly in BATT CHK, and STBY, but not in measuring mode

1. Check to see that light source is on.

D. Instrument responds correctly in all positions, but signal is lower than expected.

1. Check span stetting for correct value.
2. Clean window of light source.
3. Double check preparation of standards.
4. Check for proper fan operation.
5. Rotate span setting. Response should change if span pot is working properly.

E. Instrument responds in all switch positions, but is noisy (erratic meter movement)

1. Open circuit in feedback circuit. Consult the factory.
2. Open circuit in cable shield or probe shield. Consult the factory.

F. Instrument response is slow and/or irreproducible.

1. Fan operating improperly.
2. Check calibration and operation.

G. Low battery indicator

1. Indicator comes on if battery charge is low.
2. Indicator also comes on if ionization voltage is too high.

ATTACHMENT B
OVA TROUBLESHOOTING

Indication	Possible Causes
High Background Reading (More than 10 ppm)	1. Contaminated Hydrogen 2. Contaminated Sample Line
Continual Flameout	1. Hydrogen Leak 2. Dirty Burner Chamber 3. Dirty Air Filters
Low Air Flow	1. Dirty Air Filter 2. Pump Malfunction 3. Line Obstruction
Flame Will Not Light	1. Low Battery 2. Igniter Broken 3. Hydrogen Leak 4. Dirty Burner Chamber 5. Air Flow Restricted
No Power to Pump	1. Low Battery 2. Short Circuit
Hydrogen Leak (Instrument Not in Use)	1. Leak in Regulator 2. Leak in Valves

To be performed by qualified technician only.

A. No meter response in any switch position (including BATT CHK).

1. Broken meter movement

a. Tip instrument rapidly from side to side. Meter needle should move freely, and return to zero.

2. Electrical connection to meter is broken

b. Check all wires leading to meter and clean the contacts of quick-disconnects.

3. Battery is completely dead.

a. Disconnect battery and check voltage with a volt-ohm meter.

4. If none of the above solves the problem, consult the factory.

B. Meter responds in BATT CHK position, but reads zero or near zero for all others.

1. Power Supply Defective

a. Check power supply voltages per the HNu owner's manual. If any voltage is out of specification, consult the factory.

2. Input transistor or amplifier has failed.

a. Check input connector on printed circuit board. The input connector should be firmly pressed down.

b. Check components on back side of printed circuit board. All connections should be solid, and no wires should touch any other object.

c. Check all wires in readout for solid connections.

ATTACHMENT C
SHIPPING

Since the OVA-128 contains hydrogen, it is subject to shipping restrictions.

As Personal Luggage

The OVA-128 can be taken on a plane as luggage as a permit has been issued from the Department of Transportation (DOT) to the manufacturer (Foxboro).

Air Express

The following labels must be affixed to both sides of the VA case when shipping OVA by Air Express.

1. Danger - Peligro
2. Flammable Gas
3. Inside Container Complies with DOT Regulations
4. Hydrogen UN #1049
5. Name and Address of Recipient

A hazardous air bill must be filled out. The following information is requested.

Proper Shipping Name	Hydrogen
Classification	Flammable Gas
I.D. No.	UN 1049
Net Quantity	75 Cubic Centimeter

In addition, the shipping's certification must be signed and marked CARGO AIRCRAFT ONLY.

Excerpt from **Table 2: Chemical Hazard Information (HASP, ARCADIS 2010) – Updated for Lead and PNA Excavation Activities.**

Chemical Name	IP (eV)	Routes of Entry/ Exposure Symptoms	8-hr TWA[1] (ppm or mg/m3)	IDLH (NIOSH) (ppm)	STEL (ppm)
Lead	NA	Inhalation, Ingestion, Contact with Skin/Eyes. Lassitude, insomnia; facial pallor, low-weight, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of the wrists and ankles; encephalopathy; kidney disease; irritation of the eyes; hypotension.	0.05 mg/m3	100 mg/m3	NA
Coal Tar Pitch Volatiles	NA	Inhalation, skin and/or eye contact. Symptoms- dermatitis, bronchitis, [potential occupational carcinogen]	0.2 mg/m3	80 mg/m3	NA
Naphthalene	8.12	Inhalation, skin absorption, ingestion, skin and/or eye contact. Symptoms irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	10 ppm	250 ppm	15 ppm
2-methylnaphthalene	NA	Inhalation and Ingestion. Inhalation symptoms – cough. Contact with eyes will cause redness and pain.	0.5 ppm	NA	NA

TWAs are ACGIH 8 hr-TLVs unless noted.

Excerpt from Table 3: **Exposure Monitoring Requirements (HASP, ARCADIS 2010) – Updated for Lead and PNA Excavation Activities.**

Exposure Hazard	Monitoring Equipment	Monitoring Frequency	Action Level	Required Action
VOCs	Photo ionization detector (PID) (10.6 eV lamp or greater)	Continuous in Breathing Zone/Work Zone	≤ 0.5 ppm > 0.5 ppm ≥ 2.5 ppm > 5 ppm	- Normal operations - Begin Monitoring with colorimetric tubes - Upgrade to level C PPE - Stop work and investigate cause of reading; contact SSO/PM
PNAs	Flame Ionization detector (FID)	Continuous in Breathing Zone/Work Zone of PNA Excavation Area	≤ 0.5 ppm > 0.5 ppm ≥ 2.5 ppm	Normal operations - Upgrade to level C PPE - Stop work and investigate cause of reading; contact SSO/PM
Benzene	Colorimetric tube	As dictated by total VOC action level above	≤ 0.5 ppm > 0.5 ppm, ≤ 1.0 ppm > 1.0 ppm	- Normal operations - Upgrade to level C PPE - Stop work and investigate cause of reading; contact SSO/PM
Vinyl Chloride	Colorimetric tube	As dictated by total VOC action level above	≤ 0.5 ppm > 0.5 ppm, ≤ 1.0 ppm	- Normal operations - Stop work and investigate cause of reading; contact SSO/PM.
Particulate	MIE PDR 1000 Data RAM	Continuous in Breathing Zone	0 to 0.05 mg/m^3 0.05 to 0.2 mg/m^3 > 0.2 mg/m^3	- Normal operations. - Implement wetting procedures or appropriate engineering controls to reduce. - Stop work activity, reassess hazards. Contact ARCADIS SSO/PM.

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Appendix B

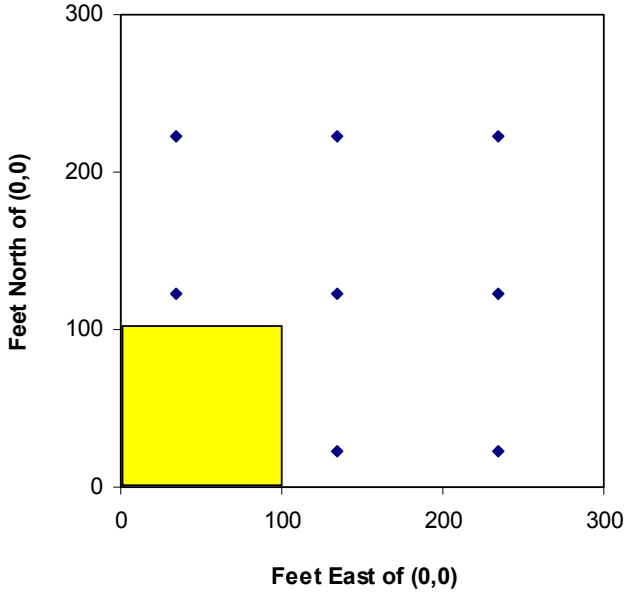
Excerpt from Section 2.4.2.2 of the 202 Michigan Department of Environmental Quality Sampling Strategies and Statistics Training Materials Plan

2.4.2.2 Systematic *RANDOM* Sampling

A preferable alternative to simple *RANDOM* sampling is systematic *RANDOM* sampling. This sampling design consists of dividing the total area to be sampled into subsections based on the number of samples to be collected (e.g., for nine samples, divide the total area into nine subsections) and *RANDOMLY* selecting a starting point within the first subsection. Subsequent sampling locations are then identified on a grid that is anchored at the starting point. The grid nodes represent locations to be sampled and all nodes are located based on the first *RANDOMLY*-selected location.

Figure 2.3 illustrates how systematic *RANDOM* sampling works. First, a 300 ft x 300 ft area was divided into nine subsections of equal area (100 ft x 100 ft). A point was *RANDOMLY* selected from the lower left cell of the *EXPOSURE UNIT*. Subsequent samples were identified systematically using a 100 ft grid extended from the first point.

Figure 2.3 Systematic *RANDOM* Sample of Nine Observations Collected from a 300 ft x 300 ft *EXPOSURE UNIT*.



The shaded area represents the cell from which the first sample was *RANDOMLY* selected.

The advantages of this design are numerous. First, it results in a *RANDOMIZED* sample from the population, thus satisfying the statistical requirements. Second, once the first location has been selected, locating the remaining sample locations is relatively straightforward and doesn't require a computer or GPS system. Third, because the coverage is fairly uniform, most of the *EXPOSURE UNIT* will be sampled and the likelihood of missing a large *HOT SPOT* is reduced. Furthermore, since sample locations are identified using a grid, statistical tools described in the tabbed section titled, "Identification and Consideration of *HOT SPOTS*," may be used to estimate the size of a *HOT SPOT* that might be identified (or missed) using this sampling approach. However, there is a danger that, if contamination occurs with some pattern, samples located on

a grid could systematically "miss" the contamination. If this is a concern, use of an unaligned grid (Gilbert, 1987, page 93) should be considered.

To determine the grid spacing, first determine the number of samples that are to be collected. The recommended minimum number is nine, based on statistical considerations only. Additional samples may be necessary to adequately represent spatial variability in the *EXPOSURE UNIT*. Next, use the following equation to determine an approximate grid interval:

$$\text{Grid Interval} = \sqrt{\frac{Area}{n}}$$

Where *Area* represents the total area of the *EXPOSURE UNIT* and *n* represents the number of samples that are to be collected.

The grid interval equation given above provides a rough approximation to a reasonable grid interval. The unique shape and size of the *EXPOSURE UNIT*, as well as the number of samples to be collected, will influence what the appropriate grid interval should be and where samples should be collected. The aim of systematic *RANDOM* sampling is to evenly cover the sampled area while collecting a *RANDOM* sample. Judgment must be used to decide on a sampling plan that is appropriate for individual *EXPOSURE UNITS*.

Example 2.9 Systematic *RANDOM* Sampling

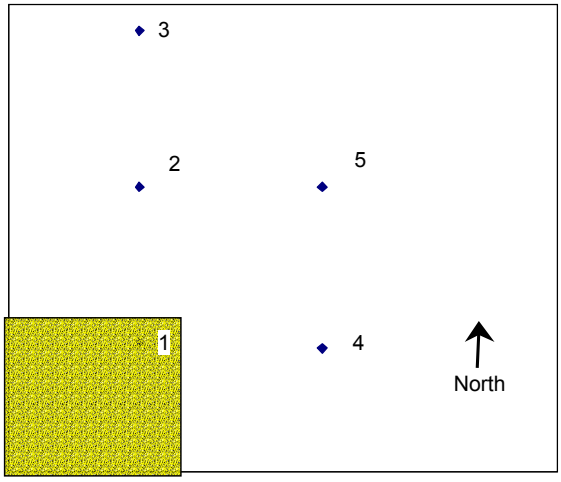
Figure 2.4 represents a square *EXPOSURE UNIT* of approximately two acres (i.e., 300 ft x 300 ft). Suppose that nine samples are to be collected. Using the above equation, the resulting grid interval is 100 ft. The *EXPOSURE UNIT* was divided into nine subsections of equal area (100 ft x 100 ft) and a sample location was *RANDOMLY* selected from the 100 ft x 100 ft cell in the lower left corner of the *EXPOSURE UNIT*. Based on the point selected, subsequent points are collected at the nodes of a grid with the grid interval equal to 100 ft.

The initial *RANDOM* sample location within the 100 x 100 ft cell in the southwest corner of the *EXPOSURE UNIT* was obtained as follows (which corner you start from is irrelevant, but for the sake of consistency, we recommend beginning in the southwest corner). First, generate two *RANDOM* numbers between 0 and 100 using the Microsoft Excel function:

=RANDBETWEEN(L,U)

where L is the lower number (set to 0 in this case) and U is the upper number (set to 100 in this case). The results were 80 and 94. Starting from the southwest corner of the *EXPOSURE UNIT*, move 80 ft east and 94 ft north to establish the *RANDOM* starting point within the southwest cell. The remaining eight sample locations are then positioned at the nodes of a grid with a 100 ft grid interval. For example, the second sample would be located 100 ft north of the first and the third would be located 200 ft north of the first. The fourth would be located 100 ft east of the first, and the fifth would be located 100 ft north of the fourth. This process would continue until all nine systematic *RANDOM* sample locations had been identified.

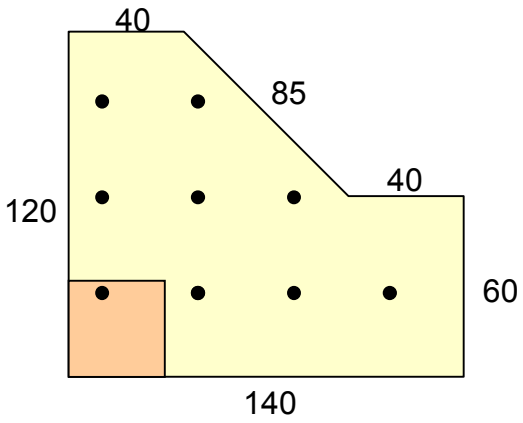
Figure 2.4 Systematic *RANDOM* Sampling of a Two Acre *EXPOSURE UNIT*



Example 2.10 Systematic *RANDOM* Sampling of an Odd-Shaped *EXPOSURE UNIT*

Figure 2.5 represents an odd-shaped *EXPOSURE UNIT* with the dimensions as listed (in feet). The first step is to determine the total area of the polygon, which is 12,600 ft^2. Suppose that nine samples need to be collected by systematic *RANDOM* sampling. Using the above equation, the approximate grid interval is 37 ft. To determine the *RANDOM* starting point, we generate two *RANDOM* numbers, 9 and 27. Starting in the lower-left corner of the polygon, we move nine ft east and 27 ft north to establish the first sample location. Subsequent samples are located on a grid anchored on the first point with a grid interval of 37 ft. If we denote the lower-left corner of the polygon as the (0,0) point on a (x, y) coordinate plane, the nine sample locations depicted are at (9,27), (9,64), (9,101), (46,27), (46,64), (46,101), (83,27), (83,64), and (120,27). Professional judgment may be used to increase the number of samples to be collected if nine samples do not appear to provide adequate coverage of an odd-shaped *EXPOSURE UNIT*.

Figure 2.5 Systematic *RANDOM* Sampling of an Odd-Shaped *EXPOSURE UNIT*



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Appendix C

Excerpts from the Field Sampling Plan/Quality Assurance Project Plan (FSP/QAPP) presented as Appendix c of the March 30, 2001 RCRA Facility Investigation Work Plan

4. General Field Protocols

4.1 Sampling

Samples will be collected at the locations and frequencies specified in the RFI Work Plan and in accordance with the procedures identified herein.

The following protocols will be employed during all sampling conducted during the RFI:

1. Prior to the collection of samples for laboratory analysis at each location, all sampling instruments and equipment must be cleaned in accordance with the protocols presented herein and in Attachment H.

2. A new pair of disposable nitrile gloves must be used for the collection of samples at each location. If, during the course of sample collection, the gloves are observed to be torn, or the gloves are suspected of being soiled from a source other than the sample media at hand, the gloves must be replaced.

3. Quality assurance samples will be collected as outlined in Section 10.

4. All personal protective equipment wastes generated during sampling, such as gloves, Tyveks, etc., will be collected and containerized for proper disposal.

5. Samples will be identified using labels affixed to the sample container. Sample labels will identify the site, sample location, sample interval (if appropriate), laboratory analysis required, preservative added, date and time of collection, and sampler's initials. A hardcover bound field book and/or field forms will be used to record the information associated with the sampling events and sample collection.

6. Sample containers and preservation requirements will be determined by the requirements of the laboratory analytical analysis. All sample containers will be provided by the laboratory and will be prepared using a standard laboratory validated washing procedure. The sample bottles will be delivered by the laboratory to the Site in sealed containers.

7. All properly labeled collected samples will be shipped to the laboratory for laboratory analysis in laboratory-supplied coolers. The coolers must be packed with ice to maintain the required preservation temperature as

identified in Section 7, any remaining space will be filled with packing to cushion the containers. Each cooler will be sealed with two seals comprised of BBL's chain of custody tape and/or the sampler's name. The coolers will then be properly sealed with packing tape.

All samples will be delivered to the laboratory by commercial courier or laboratory personnel the day of or the day following sample collection.

8. Samples will be shipped under the chain of custody procedures as outlined in Section 7.

4.2 Equipment Cleaning

Upon mobilization of the equipment on the Site, and prior to commencing work, all equipment must be thoroughly cleaned. The cleaning shall, at a minimum, consist of the use of pressurized water or steam wash to remove oil, grease, mud, and other foreign matter. The equipment will be inspected by the on-site BBL representative to check that all seals and gaskets are intact and that no fluids are leaking. After the visual inspection has been completed, the on-site BBL representative will determine if additional cleaning is required. If additional cleaning is required, the equipment will receive a thorough recleaning using pressurized water or steam wash. If a drill rig is used, the augers and tooling will be decontaminated between soil borings, as required. Soil sampling equipment will be decontaminated between samples by washing thoroughly with non-phosphate detergent and potable water using a brush to remove particulate matter or surface film, if any.

Prior to the collection of any samples for laboratory analyses, all reusable sampling equipment and tools, or dedicated equipment, will be thoroughly cleaned in accordance with the Equipment Decontamination Procedures included in Attachment H.

Upon completion of activities, the equipment will be thoroughly cleaned by pressurized water or steam wash to remove soils and other foreign matter prior to demobilization from the Site.

Fluids used for cleaning will not be recycled.

4.3 Waste Handling

All water, and excess sampling waters developed as a result of cleaning, will be placed in GM-supplied drums and stored in GM's disposal area (as required) and labeled by BBL. The material contained within the drums will be laboratory analyzed for waste characterization prior to disposal. All other waste materials developed as a result of RFI activities, such as personal protective equipment, will be placed in GM-supplied drums and stored in GM's disposal area (as required). An inventory of all drums containing waste materials will be kept by the supervising geologist.

Investigation-derived waste (IDW), including soil cuttings generated as a result of drilling and sampling will be placed in GM-supplied drums and stored in GM's disposal area (as required) and labeled by BBL. The IDW within the drums will be laboratory analyzed for waste characterization prior to disposal. All IDW generated from RFI activities will be properly disposed of by GM in accordance with appropriate protocols. An inventory of all IDW generated during the investigation will be kept by the supervising geologist.

Additional protocols specific to each sampling method are presented in the following sections.

4.4 Soil Boring Protocols

Soil borings will be completed at the locations identified in the RFI Work Plan. Soil borings will be completed using standard procedures and in accordance with the protocols identified in Section 6. Soil borings will generally be completed to the encountered water table. Representative soil samples will be typically collected in 2-foot depth intervals. Field oil-water shake tests will be conducted on soil samples in areas of known or suspected NAPL occurrence and based on visual and PID readings.

If NAPL is observed during installation of a soil boring, a monitoring well will be installed and a new soil boring(s) will be proposed nearby following the Decision Logic Flow Chart (Figure 2) of the RFI Work Plan in an attempt to delineate the extent of NAPL in the area. These new soil borings will be installed following appropriate utility clearance, and in the same manner as other planned soil borings.

Refer to Attachment D for the procedure for soil boring completion.

4.4.1 Surface Soil Sampling Procedure

Subsurface soil samples will be collected at each soil boring location identified in the RFI Work Plan. The surface soil samples will consist of the material from the ground surface (or immediately beneath the pavement) to a depth of 2 feet. Also, surface soil samples will be collected from selected locations for characterization of direct-contact criteria. The samples will consist of the 0- to 2-foot interval (only) at each location.

Refer to Attachment D for the procedure for surface soil sample collection.

4.4.2 Subsurface Soil Sampling Protocols

Subsurface soil samples will be collected at the soil boring locations identified in the RFI Work Plan. Up to three subsurface soil samples may be collected from each soil boring. The following indicates the locations of subsurface soil sample collection for each soil boring location:

- One subsurface soil sample will be collected from the 8- to 10-foot depth increment unless shallow water table conditions exist (10 feet below grade or less) in which case this sample will not be collected;
- One subsurface soil sample will be collected from the 2-foot depth increment immediately above the groundwater table; and
- Up to one other subsurface sample may be collected based on high PID reading at a boring location or visual evidence of contamination as determined by the supervising geologist.

All soil samples will be collected using the standard methods. Alternate sampling techniques may be proposed to USEPA if the identified method proves to be ineffective or is not feasible due to field constraints (e.g., limited access). Soils will be described and classified according to the Unified Soil Classification System (USCS).

The laboratory QA/QC procedures for the subsurface soil sample collection will be in accordance with Section 10.

Refer to Attachment D for the procedures for subsurface soil sample collection.

4.5 Monitoring Well Installation Procedures

Monitoring well installations will be completed at the locations identified in the RFI Work Plan. All monitoring wells will be installed and developed in accordance with Attachments B and C, and in accordance with USEPA technical guidance. Soil samples for stratigraphic definition will be collected continuously using a split-spoon or direct-push methods. In areas where dense nonaqueous phase liquid (DNAPL) is not suspected, monitoring wells will generally be screened to straddle the encountered water table with well screen lengths of either 5 or 10 feet.

In areas where DNAPL is suspected, monitoring wells will be screened below the water table such that the lower portion of the screen intersects the upper contact of the first confining unit. The well screen will be fitted with a 2-foot-long sump at the bottom of the screen and installed into the upper contact of the confining unit to allow the collection of DNAPL, if present.

A typical monitoring well installation detail is presented in Attachment B-1. An alternative detailed flushmount installation detailed is presented on Attachment B-2. A typical DNAPL monitoring well installation is presented in Attachment B-3.

Refer to Attachments B and C for the procedures for monitoring well installation and development.

4.6 Groundwater and NAPL Sampling Protocols

Groundwater samples will be collected at the locations identified in the RFI Work Plan. Following the installation and development of monitoring wells, two rounds of groundwater sampling will be conducted. The first round of groundwater sampling will consist of sampling all wells installed as part of the RFI Work Plan and those existing wells selected for additional sampling. A subsequent round of groundwater samples will be collected only from the wells where the confirmation of the presence or absence of site-specific constituents are required to address RFI objectives. All groundwater samples will be collected using standard hand-bailing or low-flow sampling methods. Refer to Attachments J and L for the procedures for groundwater sampling using hand-bailing or low-flow, respectively. Prior to the collection of groundwater samples, water level measurements will be obtained. Refer to Attachment I for the procedure for water level measurements.

If LNAPL or DNAPL are encountered in monitoring wells at the time of groundwater sampling, a representative sample of NAPL will be collected and laboratory analyzed in accordance with the RFI Work Plan. Refer to Attachment P for the procedures for LNAPL sample collection and Attachment U for DNAPL sample collection.

Hydraulic conductivity testing using the specific capacity tests procedure will be performed at selected monitoring wells. Refer to Attachment O for the procedure for specific capacity testing.

4.7 Surface Water Sampling Protocols

Surface water sampling may be performed during the RFI field activities at specific locations. These locations may include interior basements of buildings, and shafts or pits associated with buildings that may contain standing water. Procedures for the collection of surface water samples are provided in Attachment W.

4.8 Geophysical Survey

Geophysical investigation methods may be implemented during the RFI will be in accordance with the following objectives:

- Provide geophysical data to supplement soil boring and well data to delineate subsurface conditions (i.e., stratigraphy);
- Identify potential subsurface preferential pathways (i.e., Site piping/utilities) at various AOI locations; and
- Provide a supplemental method to soil borings and monitoring wells to assist in the delineation of potential NAPL areas.

These objectives will be addressed by performing a geophysical investigation consisting of ground-penetrating radar (GPR) and magnetic surveys. Performing the GPR and magnetic surveys may aid in identifying these subsurface features at the Site.

The identification and location of such features may be useful in determining the final location of proposed sampling locations and may be used to supplement the data between proposed sampling locations.

The magnetic survey may be used (if deemed necessary) in areas outside of Site buildings. Detailed operating procedures for the magnetometer are provided in Attachment R.

The GPR survey may be used (if deemed appropriate) in areas both inside and outside of Site buildings. The GPR system's data can be reviewed "real time" to assist in the field evaluation of the targeted subsurface features of interest. Detailed operating procedures for the GPR survey are provided in Attachment S.

4.9 Test Pit Excavation Procedures

The completion of test pit excavations during the RFI field activities is not planned; nevertheless, there may be a need to perform test pit excavations for the RFI program. Test pit excavations may be performed based on the need to identify subsurface structures, facilitate the collection of soil samples that cannot be collected by soil borings, and in areas requiring excavations for Interim Measure (IM) design or implementation. Refer to Attachment V for the procedure for test pit excavation.

5. Quality Assurance Objectives for Measurement Data

Data quality objectives (DQOs) are qualitative and quantitative statements that specify the quality of the data required to support decisions made during Site-related activities associated with the soil and groundwater investigations and are based on the end uses of the data to be collected as part of these programs. DQOs were developed with the intention that the data generated during field investigations will produce a representative characterization of Site conditions that will be of adequate quality and sufficient quantity to form a sound basis for decision making purposes. A DQO summary for the sampling investigation effort is presented below. The summary consists of stated DQOs relative to: data uses, data types, data quantity, sampling and analytical methods, and data measurement performance criteria.

Two data categories have been defined to address various analytical data uses and the associated QA/QC effort. A description and the methods required to achieve the desired levels of quality for each of these categories are:

Screening Data: Screening data afford a quick assessment of Site characteristics or conditions. This objective for data quality is applicable to data collection activities that involve rapid, non-rigorous methods of analysis and quality assurance. This objective is generally applied to: physical and/or chemical properties of samples; degree of contamination relative to concentration differences; and a preliminary health and safety assessment.

Definitive Data: Definitive data are generated using analytical methods, such as approved USEPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce raw data (e.g., chromatograms, spectra, concentration values) in the form of paper printouts or computer-generated electronic files.

It is anticipated that both the screening and definitive data categories will be used during the investigation. Field parameters (i.e., dissolved oxygen, conductivity, temperature and pH) which will be obtained during groundwater column sampling for use in qualitatively interpreting other Site data will be determined using screening techniques. Oil-water shake testing for identification of occurrence of NAPL and PID field screening will also be used for select samples. All remaining parameters will be determined using definitive techniques.

For this project, two levels of data reporting have been defined. They are as follows:

Level 1 - Minimal Reporting: Minimal or "results only" reporting is used for analyses which, either due to their nature (i.e., field monitoring) or the intended data use (i.e., preliminary screening), do not generate or require extensive supporting documentation.

Level 2 - Full Reporting: Full "CLP-type" reporting is used for those analyses which, based on the intended data use, require full documentation (particularly to support data validation efforts). Definitive data during site characterization and delineation sampling will normally fall under this level of reporting.

A DQO summary and associated reporting levels for the field investigation activities is presented below. The summary consists of stated DQOs relative to the following items:

- Data uses;
- Data types;
- Data quantity;
- Sampling and analytical methods; and
- Measurement performance criteria.

5.1 Objectives

The purpose of this FSP/QAPP is to present specific QA/QC procedures to be implemented during Site investigation activities to provide data quality that is sufficient to meet the investigation objectives. The overall objective of the soil investigation is to provide the data necessary to complete the characterization of the Site soil and to facilitate the preparation of the final RFI reporting.

5.1.1 Soil Sampling

The overall objective of soil sampling as part of Site investigation activities is to provide the data necessary to complete the characterization of the Site areas to facilitate the preparation of the RFI reporting.

Three soil sampling tasks will be performed during the soil investigations to support this objective including:

1. Oil-water shake tests on selected samples;
2. PID headspace testing; and
3. Soil analysis sampling.

Data Uses

Oil-water shake tests will be used as a field method to evaluate for potential NAPL in subsurface soils in areas of known or suspected NAPL occurrence. PID headspace measurements will be conducted to investigate the potential presence of volatile organics in subsurface soils. Both PID and oil-water shake tests will be used for screening level and gross non-chemical specific soil analysis. Soil analysis sampling will be used to delineate, through fixed-based laboratory analysis, the potential presence of PAL VOCs, PAL SVOCs, PCBs, and PAL metals in the surface and subsurface soils. The chemical-specific analytical results will be used to determine Site potential health risks and, if necessary, to determine whether remedial actions are necessary at select areas of the Site.

Data Types

The soil investigations will include the collection and analysis of surface and subsurface soil samples that will be analyzed by a commercial analytical laboratory for PAL VOCs, PAL SVOCs, PCBs, and PAL metals. Visual examination of soil samples from various depth intervals will also be conducted to evaluate subsurface conditions at the Site. The following testing will be conducted for the three soil sampling tasks:

1. Oil-Water Shake Tests - Field shake testing for potential presence of NAPL products. The presence of a sheen will be used to indicate whether organic material is present in subsurface soils.

2. PID Headspace Measurements - Field test used to determine the gross presence of volatile organics.

3. Soil Analysis Sampling - Analytical laboratory analysis for PAL VOCs, SVOCs, PCBs, and PAL metals.

Data Quantity

Table 1 contains a summary of the number of samples to be collected and associated QC analyses for laboratory-based analyses. Oil-water shake tests will be performed at borings in areas of known or suspected NAPL occurrence. Soil samples will be collected from the 0- to 2-foot, 8- to 10-foot, and unsaturated zone immediately above the water table where the water table is at a depth 12 feet or greater. If the water table is found to be 10 feet or less, a single soil sample (in addition to the 0- to 2-foot sample) will be collected just above the water table. All soil samples will undergo PID headspace testing.

Sampling and Analytical Methods

Samples will be collected during the boring operations for each monitoring well/soil boring installation. Procedures for sample collection are presented in Attachment D. The laboratory methods to be utilized are listed in Table 1. Reporting for the oil-water shake tests and PID headspace measurements will be Level 1. Reporting for the laboratory-based PAL VOCs, PAL SVOCs, PCBs, and PAL metals analyses will be Level 2.

Measurement Performance Criteria

Precision and accuracy QC limits for chemical constituents which are used during data review to assess analytical performance are included in the analytical laboratory's (CT&E) Quality Assurance Plan (Attachment T).

Data representativeness is addressed by the sample quantities and locations included in the soil investigation program design. Data comparability is intended to be achieved through the use of standard USEPA approved methods, which are presented in Table 1. Data completeness will be assessed at the end of the soil investigation.

5.1.2 Groundwater Sampling

The overall objective of groundwater sampling as part of Site investigation activities is to provide the data necessary to complete the characterization of the Site areas to facilitate the preparation of the RFI reporting.

Groundwater samples will be collected either manually by use of a bailer or by using low-flow sampling techniques from selected existing wells and each new monitoring well installed during the investigation. During groundwater sampling, each well will be visually inspected for NAPL. Water table elevation measurements will be taken and groundwater will be tested for NAPL with a groundwater/interface probe. After the completion of the monitoring well stabilization period (approximately seven days), groundwater samples will be collected from area specific wells to characterize water quality. Additionally, in-situ grab groundwater samples (e.g., hydropunch) will be collected at locations specified in the RFI Work Plan. In-situ grab groundwater samples will be collected from area-specific locations to characterize water quality.

Data Uses

Groundwater samples will be visually inspected for product in each well sampled. Groundwater samples will be collected from select well locations to provide sufficient groundwater data for use in determining whether groundwater contamination has been delineated for areas investigated.

Data Types

Data types include both hydrogeologic and water quality data. Hydrogeologic data will consist of water level and hydraulic conductivity information which may be used to calculate other hydrogeologic parameters (gradient, flow conditions, etc.). Water quality data will consist of field parameters, including water/NAPL interface measurements, visual inspections for NAPL, conductivity, dissolved oxygen, pH, and temperature, as well as laboratory parameters for PAL VOCs, PAL SVOCs, PCBs (filtered and unfiltered), and PAL metals (filtered).

Data Quantity

The subsurface investigation activities will involve the collection of groundwater samples from select newly installed monitoring wells, select existing wells, and in-situ grab sample locations (as appropriate or determined by a specific investigation activity). Groundwater elevations will be established at all new wells and the selected existing wells used for the groundwater investigation.

Sampling and Analytical Methods

Samples will be collected using standard hand bailers or sampling pumps (e.g., peristaltic pump). Samples will be visually inspected for and be sampled for NAPL with a groundwater interface probe. Procedures for sample collection are provided in Attachment J. Section 5 contains a description of the water quality measurement procedures and groundwater sampling procedures to be followed during the groundwater investigations. Reporting for field-measured parameters will be Level 1. Reporting for laboratory analyses will be Level 2.

Measurement Performance Criteria

Precision and accuracy QC limits for chemical constituents which are used during data review to assess analytical performance are included in the analytical laboratory's (CT&E's) Quality Assurance Plan (Attachment T).

Data representativeness is addressed by the sample quantities and locations associated with groundwater investigation work activities. Data comparability is intended to be achieved through the use of standard USEPA-approved methods, which are presented in Table 1. Data completeness will be assessed at the end of the groundwater investigations.

5.1.3 Surface Water Sampling

Surface water sampling may be performed during the RFI field activities at specific locations as described below.

Data Uses

Surface water samples may be collected from select locations to provide water quality data for use in determining whether standing water contains hazardous constituents.

Data Types

Data types include only water quality data. Water quality data will consist of field parameters, including water/NAPL interface measurements, visual inspection for NAPL, pH, conductivity and temperature. Laboratory parameters will consist of PAL VOCs, PAL SVOCs, PCBs, PAL metals, and possible waste characterization data (TCLP analysis).

Data Quantity

During the RFI field activities, surface water samples may be collected at specific locations (e.g., Building 40 basement). These locations may include interior basements of buildings, and shafts or pits associated with buildings (as appropriate) that may contain standing water. The number of surface water samples to be collected and analyzed as part of the RFI field activities is anticipated to be less than 10 locations.

Sampling and Analytical Methods

Samples will be collected using standard hand bailers or sampling pumps (e.g., peristaltic pump). Procedures for the collection of surface water samples are provided in Attachment W. Surface water samples will be visually inspected for sheens or evidence of NAPL at each sample location. Reporting for field-measured parameters will be Level 1. Reporting for laboratory analyses will be Level 2.

Measurement Performance Criteria

Precision and accuracy QC limits for constituents used during data review to assess analytical performance are included in the analytical laboratory's (CT&E's) Quality Assurance Plan (Attachment T).

Data representativeness is addressed by the sample quantities and locations associated with groundwater investigation work activities. Data comparability is intended to be achieved through the use of standard USEPA-

approved methods, which are presented in Table 1. Data completeness will be assessed at the end of the groundwater investigations.

5.1.4 Nonaqueous Phase Liquid (NAPL) Sampling

NAPL sampling will be performed during the RFI field activities in areas where LNAPL or DNAPL is identified in existing or newly installed monitoring wells and in areas where analytical data are currently not available.

Data Uses

NAPL samples will be collected from select monitoring well locations to determine both physical and chemical characteristic data of the NAPL for use in determining the presence of hazardous constituents in the product, as well as physical characteristics (e.g., viscosity, specific gravity) as they pertain to NAPL recovery.

Data Types

Data types include both field parameters and laboratory data. Field data will consist of general parameters, including NAPL thickness measurements and visual inspection of the NAPL for color and general viscosity. Laboratory parameters will consist of chemical analyses for PAL VOCs, PAL SVOCs, PCBs, PAL metals, and physical analysis for viscosity, specific gravity, and interfacial tension.

Data Quantity

NAPL, if identified, will be collected at existing or newly installed monitoring wells, as appropriate, to represent areas containing NAPL where analytical data are currently not available. These locations may include select existing or newly installed well locations within interior or exterior building areas. NAPL thickness measurements and elevations will be collected at locations containing NAPL and used for the groundwater investigation.

Sampling and Analytical Methods

NAPL samples will be visually inspected for color, relative viscosity and thickness at each sample location. Samples will be collected using standard hand bailers or sampling pumps (e.g., peristaltic pump). NAPL data will consist of field parameters, including NAPL thickness measurements, and visual inspection of the NAPL for color and general viscosity. Procedures for the collection of LNAPL and DNAPL samples are provided in Attachments

P and U, respectively. Laboratory parameters will consist of chemical analyses for PAL VOCs, PAL SVOCs, PCBs, PAL metals, and physical analysis for viscosity, specific gravity, and interfacial tension. Reporting for field-measured parameters will be Level 1. Reporting for laboratory analyses will be Level 2.

Measurement Performance Criteria

Precision and accuracy QC limits for chemical and physical constituents that are used during data review to assess analytical performance are included in the analytical laboratory's (CT&E) Quality Assurance Plan (Attachment T).

Data representativeness is addressed by the sample quantities and locations associated with NAPL occurrence. Data comparability is intended to be achieved through the use of standard USEPA-approved methods. Data completeness will be assessed on an interim basis at the end of each NAPL sampling program for each AOI or facility area (as appropriate).

6. Sampling Procedures

Groundwater and soil samples will be collected as required for the soil and groundwater investigation programs. Sample tracking and identification of the investigations is part of the sampling procedures. An important aspect of sample tracking and identification is based on the ability to discern the difference between and document the origin of a number of environmental samples collected for future reference in reporting and performing an assessment of the distribution of chemical analytical results in any specific area. Detailed descriptions of the sample designation system, documentation, and reporting requirements are presented below.

6.1 Sample Designation System

A four-tier sample designation code and the sample date will provide each sample with a unique "name" or identifier. This alphanumeric system will apply to all samples collected that are to be transmitted to the laboratory for analysis. The sample designation code system includes the prefix "RFI" followed by another prefix indicating the sample location (i.e., Building 31 area) followed by a sequential number assigned at the time of installation for monitoring wells or at the installation of soil borings. These codes are followed with a depth interval in the case of soil borings, and with a date designation in the case of monitoring wells.

Example sample designation codes for groundwater samples and soil samples under this system would be RFI 70-161 (3/21/99) and 20-277 (8-10), respectively. Additional sample volumes collected for matrix spike ("MS") and matrix spike duplicate ("MSD") analysis will be noted on the chain of custody forms, and the associated additional sample containers will be labeled with the appropriate suffix ("MS" or "MSD").

6.2 Field Documentation

Field personnel will provide comprehensive documentation covering all aspects of field sampling, field analysis, and sample chain of custody. This documentation constitutes a record that allows reconstruction of all field events to aid in the data review and interpretation process. All documents, records, and information relating to the performance of the field work will be retained in the project file.

The various forms of documentation to be maintained throughout the investigation activities include:

- Daily Production Documentation - A field logbook consisting of a waterproof, bound notebook that will contain a record of all activities performed at the Site. All logbook entries will be made in pen. Any additions or corrections to the field logbook information will be single-lined out, dated, and initialed.

- Sampling Information - Detailed notes will be made as to the exact site of sampling, physical observations, personnel present, and weather conditions (as appropriate).

- Sample Chain of Custody – Chain of custody forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. Chain of custody forms will be filled out at each sampling site, at a group of sampling sites, or at the end of each day of sampling by BBL's field personnel designated to be responsible for sample custody. In the event that the samples are relinquished by the designated sampling person to other sampling or field personnel, the chain of custody form will be signed and dated by the appropriate personnel to document the sample transfer. The original chain of custody form will accompany the samples to the laboratory and copies will be forwarded to the project files. A sample chain of custody form is included in Attachment A.

- Field Equipment, Calibration, and Maintenance Logs - To document the calibration and maintenance of field instrumentation, calibration and maintenance logs will be maintained for each piece of field equipment that is not only factory-calibrated.

6.3 Field Data Reporting

Information collected in the field through visual observation, manual measurement and/or field instrumentation will be recorded in field notebooks or data sheets, and/or on pre-prepared forms. Such data will be reviewed by the appropriate Task Manager for adherence to the specific requirements associated with the soil and groundwater investigation requirements and for consistency. Concerns identified as a result of this review will be discussed with the field personnel, corrected if possible, and as necessary, incorporated into the data evaluation process.

Where appropriate, field data forms and calculations will be processed and included in appendices to investigation reports. The original field logs, documents, and data reductions will be maintained with the project file at the BBL office in Syracuse, New York.

6.4 Sampling Methods

The project-specific scope of work is presented in detail in the RFI Work Plan. The sampling procedures for the various investigation tasks are summarized in the following subsections. Detailed field procedures are included in the attachments to this FSP/QAPP. The attachments also contain other investigation supportive procedures such as for cleaning equipment, packing, handling, executing chain of custody, shipping samples, and obtaining field measurements.

6.5 Monitoring Well and Boring Installation

New monitoring wells will be installed to augment the existing wells. Additionally, boreholes will be completed for the additional characterization of surface and subsurface soil conditions.

Shallow monitoring wells (water table wells) will be constructed of 1.5- or 2-inch-diameter, Schedule 40, machine-slotted PVC. Monitoring well installation procedures are provided in Attachment B. Prior to groundwater sample collection, all monitoring wells will be developed in accordance with the procedures described in Attachment C.

If boring refusal is encountered, either a new boring will be initiated (with the previous boring being abandoned following procedures described in Attachment D) or a tri-cone or hammer-head drill bit, or equivalent method, will be used to penetrate through the zone of refusal. If physically possible, a sample will be obtained for identification purposes from the zone of refusal. Any sheen observed during the drilling and monitoring well installation will be noted on the boring logs.

Lithologic Characterization

To provide a vertical profile of the subsurface, soil samples will be collected continuously for visual classification using split-spoon sampling methods from the ground surface to the bottom of each boring. Soil boring completion, soil sample collection, and lithologic characterization will be performed in accordance with the procedures described in Attachment D. A PID will be used to obtain PID headspace readings of each sample interval, as well as provide health and safety monitoring for field personnel during the drilling program as described in Attachment E. Oil-water shake tests will be performed on samples taken from boreholes in areas where NAPL may be present following the procedures outlined in Attachment F.

The visual descriptions of the subsurface lithology will be evaluated to assess the extent to which the geologic unit may influence migration of NAPL and dissolved-phase constituents at the Site and will provide a vertical profile of the subsurface. This information will be used to prepare detailed boring/well logs and geologic cross sections of the subsurface area. Specific details in the lithologic descriptions normally include the following:

Color/discoloration
Fill component description
(cinder, clay, metal, tires, etc.)
Odors
Principal components
Contacts when observed
Mottling/staining
Minor Components
Particle angularity/shape
Weathering
Structure and bedding
Particle sizes

PID Measurements
Field moisture conditions
Moisture content
Unified Soil Classification System group symbol
Fill or geologic origin, if known
Organic content
Vertical fractures
Sheen
Relative cohesiveness
Item which may indicate age of deposit
(identification of archeological artifacts, newspapers, etc.)

6.6 Soil Sampling and Analysis

Soil samples will be selected for analytical characterization from samples collected during the installation of the soil boreholes. In general, three or four soil samples will be collected from each borehole in areas where the water table is 12 feet or greater below ground surface (bgs). Samples submitted for analytical laboratory testing will consist of soil collected at the following intervals: at the surface (0 to 2 feet bgs) or the remaining interval present beneath concrete pads or pavement, the 8 to 10 feet bgs interval, and at or immediately above the water table interface. In areas where the water table is found to be 10 feet or less (bgs), a single soil sample will be collected just above the water table. Additionally, one more 2-foot soil interval may be submitted for analysis if unusually high PID readings are encountered.

Soil samples will be obtained following the sampling criteria identified in Section 5 of the RFI Work Plan. Soil samples will be collected in accordance with the procedures outlined in Attachment D with samples to be submitted for VOC analysis being collected following the procedures outlined in Attachment G. These soil samples will be

used to assess potential source materials at each area where a monitoring well or borehole is installed. The soil samples will be analyzed for PAL VOCs, PAL SVOCs, PCBs, and PAL metals.

Soil samples will be identified, packaged, and shipped to the analytical laboratory using the chain of custody procedures set forth in Attachment A. Equipment decontamination will be performed in accordance with the procedures described in Attachment H.

6.7 Groundwater Sampling and Analysis

Water level measurements will be obtained from each monitoring well in accordance with procedures set forth in Attachment I. In general, measurements will be obtained with a water level probe and measured to the nearest 0.01 foot. Water levels will be converted to elevations using the surveyed measurement point (i.e., top of casing) elevations.

The water level measurements will be used to determine groundwater elevations and determine groundwater flow directions.

Groundwater samples will be collected from newly installed monitoring wells upon completion of well development and associated stabilization period. Standard hand bailing techniques or low-flow sampling will be utilized for groundwater sampling at each selected monitoring well location using sampling procedures as described in Attachment J or Attachment L.

A representative groundwater sample from each monitoring well will be collected in the field and measured for dissolved oxygen (DO), temperature, conductivity, turbidity, and pH. Specific field procedures for measurement of these water quality parameters are described in Attachment K. If low-flow purging is used, additional water quality measurements for temperature and turbidity will also be used to determine well stability and when purging is complete.

Groundwater samples will be analyzed using USEPA SW-846 methods at the laboratory for PAL VOCs, PAL SVOCs, PCBs (filtered and unfiltered), and PAL metals (filtered).

Filtered samples will be collected for PCB and metals analyses. A 0.45-micron filter will be used to filter groundwater samples for PCB and metals analyses. Filtered only groundwater samples will be collected for metals

because of the fines encountered in water accumulating in the monitoring well as a result of drilling and even sampling.

To characterize the hydraulic conductivity at selected monitoring well locations, data will be obtained during well purging consistent with specific capacity testing procedures. Specific capacity tests entail pumping a well at an approximately constant rate and measuring the drawdown inside the pumped well. To optimize the efficiency of data acquisition, specific capacity tests will be performed as part of purging prior to groundwater sampling. The relationship between the specific capacity test duration and pumping rate, the measured drawdown, and the geometry of the well intake section (wetted sand filter pack) will be used to estimate the hydraulic conductivity of the water-bearing formation surrounding the well intake section. Specific capacity testing will be performed in accordance with the procedures specified in Attachment O.

6.8 Oil/Sludge Grab Sampling Procedures

Oil/sludge samples from sumps, pits, trenches, etc., may be collected, if encountered, for chemical analysis. Oil/sludge samples may be collected utilizing a grab sampler, hand-held dredge, peristaltic pump, and/or a hand bucket auger. The specific procedures for collection of oil/sludge grab samples are presented in Attachment M.

6.9 NAPL Sampling and Passive Oil Recovery

NAPL samples may be collected to facilitate laboratory characterization of these materials. Standard procedures for the collection of NAPL samples and passive oil recovery are presented in Attachments P and U for LNAPL and DNAPL, respectively. The procedures for determining oil layer thickness in monitoring wells is presented in Attachment Q.

If NAPL is measured in any of the new wells or in any of the existing wells (associated with each subsurface investigation area) where it was not previously found and sampled, a representative sample of the liquid, if present in sufficient quantity, will be collected in place of a groundwater sample. The location and physical characteristics of the NAPL will be noted in the field logs. The NAPL will be analyzed for density, viscosity, interfacial tension, PAL VOCs, PAL SVOCs, PCBs, and PAL metals.

6.10 Magnetometer and Ground-Penetrating Radar Surveys

Magnetometer and ground-penetrating radar (GPR) procedures may be used to identify the location of buried materials, if deemed necessary during subsurface investigation activities. These surveys will be conducted following the procedures presented in Attachments R and S, respectively.

6.11 Surface Water Sampling

Surface water sampling may be performed during the RFI field activities at specific locations. These locations may include interior basements of buildings (e.g., Building 40 basement), and shafts or pits associated with buildings that may contain standing water. In general, surface water sampling will be performed using either bailers or a sampling pump (e.g., peristaltic pump). Procedures for the collection of surface water samples are provided in Attachment W.

7. Custody Procedures

7.1 Sample Containers and Preservation

Appropriate sample containers, preservation methods, and laboratory holding time requirements for planned environmental samples are shown in Table 1.

The analytical laboratory will supply appropriate sample containers and preservatives, as necessary. The bottles will be purchased pre-cleaned to USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9240.05A requirements. The field personnel will be responsible for properly labeling containers and preserving samples (as appropriate). Sample labeling procedures are described in Attachment A.

7.2 Packing, Handling, and Shipping Requirements

Sample packaging and shipment procedures are designed to ensure that the samples will arrive at the laboratory with the custody intact.

Samples will be packaged for shipment as outlined below:

- Ensure that all sample containers have the sample labels securely affixed to the container with clear packing tape;
- Check the caps on the sample containers to ensure that they are properly sealed;
- Wrap the sample container cap with clear packing tape to prevent it from becoming loose;
- Complete the chain of custody form with the required sampling information and ensure that the recorded information matches the sample labels. NOTE: If the designated sampler relinquishes the samples to other sampling or field personnel for packing or other purposes, the sampler will complete the chain of custody prior to this transfer. The appropriate personnel will sign and date the chain of custody form the document the sample custody transfer.
- Using duct tape, secure the outside drain plug at the bottom of the cooler;
- Wrap sample containers in bubble wrap or other cushioning material (not vermiculite);
- Place 1 to 2 inches of cushioning material at the bottom of the cooler;
- Place the sealed sample containers into the cooler;

- Place ice in plastic bags and seal. Place loosely in the cooler;
- Fill the remaining space in the cooler with cushioning material;
- Place chain of custody forms in a plastic bag and seal. Tape the forms to the inside of the cooler lid;
- Close the lid of the cooler, lock, and secure with duct tape;
- Wrap strapping tape around both ends of the cooler at least twice;
- Mark the cooler on the outside with the following information: shipping address, return address, "Fragile" labels, and arrows indicating "this side up." Cover the cooler label with clear plastic tape. Place a signed custody seal over the cooler lid.

All samples will be packaged by the field personnel and transported as low-concentration environmental samples. The coolers will be hand-delivered or delivered by an express carrier to be received within 48 hours of the time of collection. All shipments will be accompanied by the chain of custody form identifying the contents. The original form will accompany the shipment; copies will be retained by the sampler for the sampling office records. If the samples are sent by common carrier, a bill of lading should be used. Receipts or bills of lading will be retained as part of the permanent project documentation. Commercial carriers are not required to sign off on the chain of custody form as long as the forms are sealed inside the sample cooler and the custody seals remain intact.

Sample custody seals and packing materials for filled sample containers will be provided by the analytical laboratory. The filled, labeled, and sealed containers will be placed in a cooler on ice and carefully packed to eliminate the possibility of container breakage. Trip blank(s) of analyte-free water will be provided by the laboratory and included in each cooler containing aqueous samples to be analyzed for VOCs.

General procedures for packing, handling, and shipping environmental samples are included in Attachment A and in Attachment N.

7.3 Field Custody Procedures

The objective of field sample custody is to assure that samples are not tampered with from the time of sample collection through time of receipt by the analytical laboratory. Persons will have "custody of samples" when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.
Field custody documentation consists of both field logbooks and field chain of custody forms.

7.3.1 Field Logbooks

Field logbooks will provide the means of recording data collection activities performed. As such, entries will be described in as much detail as possible so that persons going to the Site could re-construct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in a secure location when not in use. Each logbook will be identified by the project-specific document number. The title page of each logbook will contain the following:

- Person to whom the logbook is assigned;
- Logbook number;
- Project name;
- Project start date; and
- End date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the Site, field sampling or investigation team personnel, and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. All entries will be made in ink and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration of any field instruments used.

Samples will be collected following the sampling procedures documented in Section 6. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume and number of containers. A sample identification number will be assigned prior to sample collection for each environmental sample. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description.

Preprinted sample labels will be affixed to sample bottles prior to delivery to the sampling location. The following information is required on each sample label:

- Project;
- Date collected;
- Time collected;
- Location;
- Sampler;
- Analysis to be performed;
- Preservative; and
- Sample number.

7.3.2 Field Chain of Custody Form

Completed chain of custody forms will be required for all samples to be analyzed. Chain of custody forms will be initiated by the sampling crew in the field. The chain of custody forms will contain the sample's unique identification number, sample date and time, sample description, sample type, preservation (if any), and analyses required. The original chain of custody form will accompany the samples to the laboratory. Copies of the chain of custody will be made prior to shipment (or multiple copy forms used) for field documentation. The chain of custody forms will remain with the samples at all times. The samples and signed chain of custody forms will remain in the possession of the sampling crew until the samples are delivered to the express carrier (e.g., FedEx) or hand delivered to the fixed-based laboratory, or placed in secure storage.

Sample labels are completed for each sample using waterproof ink unless prohibited by weather conditions. The labels include sample information such as sample number and location, type of sample, date and time of sampling, sampler's name or initials, preservation, and analyses to be performed. The completed sample labels are affixed to each sample bottle and covered with clear tape.

7.4 Laboratory Custody Procedures

Upon sample receipt, laboratory personnel will be responsible for sample custody. The original field chain of custody form will accompany all samples requiring laboratory analysis. The laboratory will use chain of custody guidelines described in the USEPA guidance documents. Samples will be kept secured in the laboratory until all

stages of analysis are complete. All laboratory personnel having samples in their custody will be responsible for documenting and maintaining sample integrity. The selected commercial analytical laboratory's custody procedures are described in the CT&E Quality Assurance Plan (QAP) (Attachment T).

7.4.1 Sample Receipt and Storage

Immediately upon sample receipt, the laboratory sample custodian will verify the package seal, open the package, and compare the contents against the field chain of custody. If a sample container is received broken, the sample is in an inappropriate container, or has not been preserved by appropriate means, BBL will be notified. The laboratory sample custodian will be responsible for logging the samples in, assigning a unique laboratory identification number to each sample, labeling the sample bottle with the laboratory identification number, and moving the sample to an appropriate storage location to await analysis. The project name, field sample code, date sampled, date received, analysis required, storage location and date, and action for final disposition will be recorded in the laboratory logbook. All relevant custody documentation will be placed in the project file.

7.4.2 Sample Analysis

Analysis of an acceptable sample will be initiated by laboratory documentation that contain all pertinent information for analysis. The analyst will sign and date the laboratory chain of custody form when removing the samples from storage.

Samples will be organized into sample delivery groups (SDGs) by the laboratory. A SDG may contain up to 20 field samples (field duplicates, trip blanks, and rinse blanks are considered field samples for the purposes of SDG assignment). All field samples assigned to a single SDG shall be received by the laboratory over a maximum of fourteen calendar days and must be processed through the laboratory (preparation, analysis, and reporting) as a group. Every SDG must include a minimum of one site-specific matrix spike/matrix spike duplicate or MS/Dup pair, which shall be received by the laboratory at the start of the SDG assignment.

Each SDG will be self-contained for all of the required QC samples. All parameters within an SDG will be extracted or prepared and analyzed together in the laboratory. At no time will the laboratory be allowed to run any sample (including QC samples) at an earlier or later time than the rest of the SDG. These rules for analysis will ensure that the QC samples for an SDG are applicable to the field samples of the same SDG and that the best possible comparisons may be made.

7.4.3 Sample Storage Following Analysis

All samples will be maintained by the laboratory for one month after the final report is delivered to BBL. After this period, the samples will be disposed of in accordance with applicable rules and regulations.

10. Internal Quality Control Checks

The overall quality assurance objective for this FSP/QAPP is to develop and implement procedures for sampling, chain of custody, laboratory analysis, instrument calibration, data reduction and reporting, internal QC, audits, preventive maintenance, and corrective action, such that valid data will be generated. These procedures are presented or referenced in the sections of the FSP/QAPP. General field QC checks and laboratory QC checks related to the sampling and analysis planned for these investigations are discussed below. QA/QC limits for laboratory and field QC checks are presented in Table 4.

10.1 Field Quality Control Checks

10.1.1 Field Measurements

To verify the quality of data using field instrumentation, duplicate measurements will be obtained and reported for all field measurements. A duplicate measurement will involve obtaining measurements a second time at the same sampling location. Both results will be recorded in field logs.

10.1.2 Sample Containers

New, certified-clean sample containers (I-Chem 300 series or equivalent) will be supplied by the analytical laboratory. Certificates of analysis demonstrating these containers to be analyte-free will be filed in the project file.

10.1.3 Field Duplicates

Field duplicates will be collected for groundwater and soil samples to check reproducibility of the sampling methods. In general, soil and groundwater sample field duplicates will be analyzed at a 5% frequency (every 20 samples) for the chemical constituents. Specific sampling procedures for collecting field duplicates are included in the appropriate attachments.

10.1.4 Rinse Blanks

Rinse blanks are used to monitor the cleanliness of the sampling equipment and the effectiveness of the cleaning procedures used. Rinse blanks will be prepared and submitted for analysis at a frequency of one per day (when sample equipment cleaning occurs) or once for every 20 samples collected, whichever is more. Rinse blanks will be prepared by filling sample containers with analyte-free water (supplied by the laboratory) which has been routed through a cleaned sampling device. When dedicated sampling devices are used or sample containers are used to collect the samples, rinse blanks will not be necessary.

10.1.5 Trip Blanks

Trip blanks will be used to assess whether samples have been exposed to volatile constituents during sample storage and transport. Trip blanks will be analyzed at a frequency of one per cooler containing groundwater samples to be analyzed for volatile organic constituents. A trip blank will consist of a container filled with analyte-free water (supplied and prepared by the laboratory) which remains unopened with field samples throughout the sampling event. Trip blanks will only be analyzed for volatile organic constituents.

10.2 Laboratory Quality Control Checks

Internal laboratory QC checks will be used to monitor data integrity. These checks will include method blanks, matrix spikes (and matrix spike duplicates), spike blanks, internal standards, surrogate spikes, calibration standards, and reference standards. Project QC limits for duplicates and matrix spikes are identified in Table 4. Laboratory control charts will be used to determine long-term instrument trends.

10.2.1 Method Blanks

Sources of contamination in the analytical process, whether specific analytes or interferences, need to be identified, isolated, and corrected. The method blank is useful in identifying possible sources of contamination within the analytical process. The laboratory will analyze blank samples as a check on possible sample collection, preparation, and analytical background interferences or contamination. At a minimum, one method blank will be prepared and analyzed with each analytical series associated with no more than 20 samples.

Attachment A

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Sample Handling, Packing, and Shipping Procedures

Attachment A

Sample Handling, Packing, and Shipping Procedures

I. Chain of Custody Procedures

1. Prior to collecting samples, complete the chain of custody form (Attachment A-3) header information by filling in the project number, project name, and the name(s) of the sampling technician(s). Please note that it is important that chain of custody information is printed legibly using indelible ink.

2. After sample collection, enter the individual sample information by filling in the following chain of custody fields:

   a. STA. NO. - Indicates the station number or location that the sample was collected from. Appropriate values for this field include well locations, grid points, or soil boring identification numbers (e.g., MW-3, X-20, SB-30, etc.).

   b. Date - Indicates the date that the sample was collected. The date format to be followed should be mm/dd/yyyy (e.g., 03/07/2000).

   c. Time - Indicates the time at which the sample was collected. The time value should be presented using the military format. For example, 3:15 P.M. should be entered as 15:15.

   d. Comp - This field should be marked with an "X" if the sample was collected as a composite.

   e. Grab - This field should be marked with an "X" if the sample was collected as an individual grab sample.

   f. Station Location - This field should represent the complete sample name. Although, in some instances it may be similar to the STA. NO. field. An example of a complete sample name is SB-3 (0.5-1.0), where the 0.5-1.0 represents the depth interval in feet from where the sample was collected. Please note that it is very important that the use of hyphens in sample names and the depth units (i.e., feet or inches) remain consistent for all samples entered on the chain of custody form. Sample names may also use the abbreviations "MS/MSD", "FB", "TB", and "DUP" as prefixes or suffixes to indicate that the sample is a matrix spike/matrix spike duplicate, field blank, trip blank, or field duplicate, respectively.

   g. Number of Containers - This field represents the number of containers that were collected at the sampling location to be submitted for analysis.

   h. Analytical Parameters - The analytical parameters that the samples are being analyzed for should be written legibly on the diagonal lines to the right of the "number of containers" column. The analytical parameters should be chosen from those presented in Table 1 of the FSP/QAPP. As much detail as

possible should be presented to allow the analytical laboratory to properly analyze the samples. For example, polychlorinated biphenyls (PCBs) analyses may be represented by entering "PCBs" or Method 8082." Multiple methods and/or analytical parameters may be combined for each column (e.g., PCBs/VOCs/SVOCs or 8082/8260/8270). These columns should also be used to present project specific parameter lists (i.e., Appendix IX excluding herbicides and pesticides). QA/QC information may also be entered in a separate column for each parameter (e.g., PCBs - MS/MSD) to identify a sample that the laboratory is to use for a specific QA/QC requirement. Each sample that requires a particular parameter analysis will be identified by placing an "X" in the appropriate analytical parameter column.

i. Remarks - The remarks field should be used to communicate special analytical requirements to the laboratory. These requirements may be on a per sample basis such as "extract and hold sample until notified" or may be used to inform the laboratory of special reporting requirements for the entire SDG. Reporting requirements that should be specified in the remarks column include: 1) turn around time, 2) required detection limits, 3) contact and address where data reports should be sent, 4) name of laboratory project manager, and 5) type of sample preservation that was utilized.

j. Relinquished By - This field should contain the signature of the sampling technician that relinquished custody of the samples to the shipping courier or the analytical laboratory.

k. Date - Indicates the date that the samples were relinquished. The date format should be mm/dd/yyyy (e.g., 03/07/2000).

l. Time - Indicates the time that the samples were relinquished. The time value should be presented using the military format. For example, 3:15 P.M. should be entered as 15:15.

m. Received By - This field should contain the signature of the sample courier or laboratory representative that received the samples from the sampling technician.

3. Complete as many chain of custody forms as necessary to properly document the collection and transfer of the samples to the analytical laboratory.

4. Upon completion of the chain of custody forms, forward two copies to the analytical laboratory and retain one for the field records. The field records copy should also be sent to Ms. Jessica Whisher at BBL by facsimile at (315) 449-0017.

II. Handling

1. After completing the sample collection procedures, record the following information in the field notebook with indelible ink:

- Project number and site name;
- Sample identification code and other sample identification information, if appropriate;
- Sampling method;

- Date;
- Name of sampler(s);
- Time;
- Location (project reference); and
- Any comments.

2. Fill in sample label (Attachment A-1) with the following information in indelible ink:

   - Sample matrix (e.g., groundwater);
   - Project number and site name;
   - Sample identification code and other sample identification information, if applicable;
   - Analysis required;
   - Date;
   - Time sampled;
   - Initials of sampling personnel;
   - Sample type (composite or discrete);
   - Tissue preparation procedure (biota; e.g., fillets, whole body), if applicable; and
   - Preservative added, if applicable.

3. Cover the label with clear packing tape to secure the label onto the container.

4. Check the caps on the sample containers to ensure that they are tightly sealed.

5. Wrap the sample container cap with clear packing tape to prevent it from becoming loose.

6. Place a signed custody seal label (Attachment A-2) over the cap such that the cap cannot be removed without breaking the custody seal. Alternatively, if shipping several containers in a cooler, custody seal evidence tape may be placed on the shipping container as described below.

III. Packing

1. Using duct tape, secure the outside and inside of the drain plug at the bottom of the cooler that is used for sample transport.

2. Place each container or package in individual polyethylene bags (resealable-type) and seal. If a cooler temperature blank is supplied by the laboratory, it should be packaged following the same procedures as the samples. If the laboratory did not include a temperature blank, do not add one, since the sample temperature will be determined by the laboratory using a calibrated infrared thermometer.

3. Place 1 to 2 inches of cushioning material (i.e., vermiculite) at the bottom of the cooler. See Section 6.

4. Place the sealed sample containers upright in the cooler.

5. Package ice or blue ice in small resealable-type plastic bags and place loosely in the cooler. Do not pack ice so tightly that it may prevent addition of sufficient cushioning material. Samples placed on ice will be cooled to and maintained at a temperature of approximately 4°C.

6. Fill the remaining space in the cooler with cushioning material.

7. Place the completed chain of custody forms (Attachment A-3) in a large resealable-type bag and tape the bag to the inside of the cooler lid.

8. Close the lid of the cooler and fasten with packing tape.

9. Wrap strapping tape around both ends of the cooler.

10. Mark the cooler on the outside with the following information: shipping address, return address, "Fragile" labels (Attachment A-4) on the top and on one side, and arrows indicating "This Side Up" (Attachment A-4) on two adjacent sides.

11. Place custody seal evidence tape (Attachment A-2) over front right and back left of the cooler lid and cover with clear plastic tape.

Note: Procedure numbers 2, 3, 5, and 6 may be modified in cases where laboratories provide customized shipping coolers. These coolers are designed so the sample bottles and ice packs fit snugly within preformed styrofoam cushioning and insulating packing material.

IV. Shipping

All samples will be delivered by an express carrier within 48 hours of sample collection. Alternatively, a laboratory courier may be used for sample pickup. If parameters with short holding times are being analyzed [e.g., VOCs (EnCore™ Sampler)], sampling personnel will take precautions to assure that the maximum holding times for these parameters will not be exceeded.

The following chain of custody procedures will apply to sample shipping:

- Relinquish the sample containers to the laboratory via express carrier or laboratory courier. The signed and dated forms should be included in the cooler. The express carrier will not be required to sign the chain of custody forms.

- When the samples are received by the laboratory, the laboratory personnel shall complete the chain of custody by recording the date and time of receipt of samples, measure and record the internal temperature of the shipping container, and then check the sample identification numbers on the containers to ensure that they correspond to the chain of custody forms.

Attachment A-1

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Sample Label

BBL
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PROJECT #		
SAMPLE I.D.		DATE
SAMPLE TYPE ☐ Soil/Sediment ☐ Water	COLLECTION MODE ☐ Composite ☐ Grab	TIME
ANALYSIS		
SAMPLER(S)	PRESERVATIVE	

Attachment A-2

BLASLAND, BOUCK & LEE, INC.
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Custody Seal Label

CUSTODY SEAL

BBL

BLASLAND, BOUCK & LEE, INC.
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6723 Towpath Road, Box 66, Syracuse, N.Y. 13214-0066
TEL (315) 446-9120

SEALED BY

_____

DATE_____ TIME _____

Attachment A-3

BLASLAND, BOUCK & LEE, INC.
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Chain of Custody Form

BLASLAND, BOUCK & LEE, INC.
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6723 Towpath Road, P.O. Box 66
Syracuse, New York 13214-0066
TEL: (315) 446-9120

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
SAMPLERS: *(Signature)*	

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	Number of Containers	REMARKS

Relinquished by: *(Signature)*	DATE	TIME	Received by: *(Signature)*	Relinquished by: *(Signature)*	DATE	TIME	Relinquished by: *(Signature)*
Relinquished by: *(Signature)*	DATE	TIME	Received by: *(Signature)*	Relinquished by: *(Signature)*	DATE	TIME	Relinquished by: *(Signature)*
Relinquished by: *(Signature)*	DATE	TIME	Received for Laboratory by: *(Signature)*	DATE	TIME	Remarks:	

10/23/95
5951188L.CDR

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

Attachment A-4

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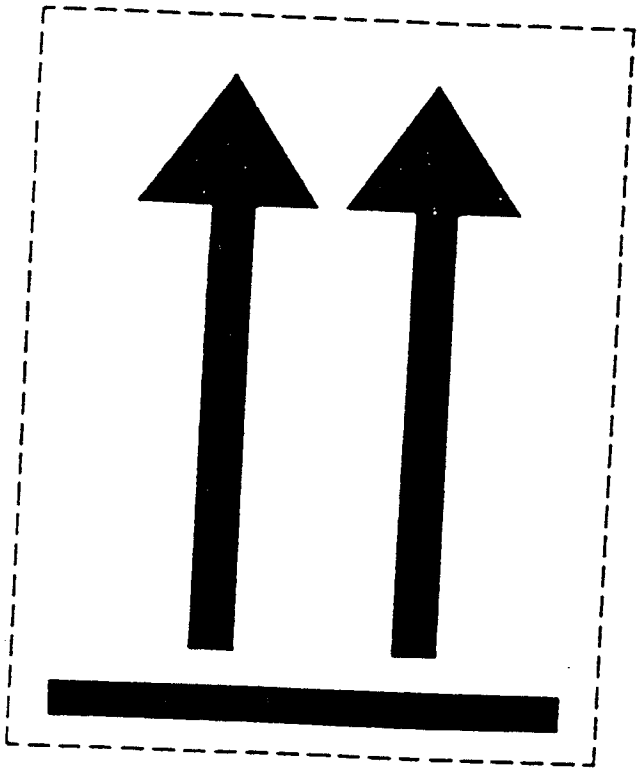
Shippers Certification for Restricted Articles


fragile
HANDLE
WITH CARE



Attachment D

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Procedures for Soil Boring Completion and Sample Collection

Attachment D

Procedures for Soil Boring Completion and Sample Collection

I. Introduction

Soil borings typically will be completed using direct-push techniques (e.g., Geoprobe®) or using the hollow-stem auger drilling method. No oils or grease will be used on equipment introduced into the boring (e.g., drill rod, casing, or sampling tools, etc.). Prior to beginning work, all underground utilities will be delineated by GM or an independent underground utility locator service approved by GM.

II. Equipment Cleaning

Equipment will be cleaned prior to use on the site, between each drilling location, and prior to leaving the site. All drilling equipment and associated tools, including direct-push tooling, augers, drill rods, sampling equipment, wrenches, and other equipment or tools that may have come in contact with soils and/or waste materials, will be cleaned with steam-cleaning equipment using a potable water source. The drilling equipment will be cleaned in an area designated by the supervising engineer or geologist that is approved by GM. More detailed equipment cleaning procedures are provided in Appendix H.

III. Drilling Procedures, Equipment, and Records

All equipment and materials that may be required to advance the soil borings and sample encountered materials, as described, will be available during the boring and sampling operations. Required equipment and materials include drilling machinery in good working order equipped for the season of operation; sample containers and forms; sampling, screening, and cleaning equipment and supplies; and supplies and equipment to comply with all site and Health and Safety procedures.

The drilling contractor will be responsible for obtaining accurate and representative samples, informing the supervising geologist of changes in drilling conditions, and keeping a separate general log of soils encountered, including blow counts (i.e., the number of blows from a soil sampling drive weight [140 pounds] required to drive the split-barrel sampler in 6-inch increments). Records will also be kept of occurrences of premature refusal due to boulders or construction materials which may have been used as fill. Where a boring cannot be driven to the desired depth, equipment will be relocated in order to obtain the required sample. Multiple refusals may lead to a decision by the supervising geologist to abandon that sampling location.

The supervising geologist will be responsible for documenting drilling events using a daily field log (Attachment D-1) to record all relevant information in a clean and concise format. As an alternative, a bound field notebook may be used at the discretion of field personnel to document field activities, provided that the information shown on the Attachment D-1 is concisely presented in the notebook. The record of drilling events will include: 1) start and finish dates of drilling; 2) name and location of project; 3) project number, client, and site location; 4) sample number and depths; 5) blow counts and recovery; 6) depth to water; 7) type of drilling method; 8) auger size;

9) documentation of any elevated organic vapor emissions; 10) names of contractor's drillers, inspectors, or other people on site; and 11) weather conditions.

The direct-push drilling method also may be used to complete soil borings and monitoring wells. Examples of this technique include the Diedrich ESP vibratory probe system or AMS Power Probe™ dual-tube system. Environmental probe systems typically use a hydraulically operated percussion hammer. Depending on the equipment used, the hammer delivers 140 to 350 foot pounds of energy with each blow. The hammer, operated at 1,200 blows per minute, provides the force needed to penetrate very stiff/medium dense soil formations. The hammer simultaneously advances an outer steel casing which contains a dual tube liner for sampling soil. Depending on the system utilized, the outside diameter (OD) of the outer casing ranges from 1.75 to 2.4 inches, and the OD of the inner sampling tube ranges from 1.1 to 1.8 inches. The outer casing isolates shallow layers and permits the unit to continue to probe at depth. The double-rod system provides a borehole that may be tremie grouted from the bottom up. Alternatively, the inside diameter (ID) of the steel casing provides clearance for the installation of small diameter (e.g., 0.75- to 1.5-inch ID) wells. Upon completion of the borehole to the desired depth, the well is installed through the inner drill casing. The wells will consist of approximately 1.5-inch ID PVC slotted screen and blank riser. In areas of suspected DNAPL or highly chlorinated constituents, 2-inch stainless steel monitoring wells will be installed using conventional hollow-stem auger drilling methods.

Following the completion of soil sampling, all borings that are not being converted to monitoring wells will be tremie-grouted using neat cement and 5% bentonite mix. Also, if boring refusal is encountered and the boring location is abandoned, the boring will be tremie-grouted using neat cement and bentonite.

IV. Soil Sampling

Samples of subsurface materials encountered during the drilling of soil borings will be collected continuously with a 2-inch split-barrel (split-spoon) sampler (using ASTM Method D1586) or direct-push methods at select locations, as directed by the supervising geologist. Soil samples will be field screened with a PID.

Representative split-spoon or direct-push samples will be fully described on a soil boring description log (Attachment D-2) or in the field notebook.

Those samples selected for laboratory analysis will be handled, packed, and shipped in accordance with the procedures set forth in Attachment A.

Samples collected for Analysis of volatile organic compounds (VOCs) will be collected from the split-spoon using an EnCore™ Sampler as described in Attachment G. A geologist will be on site during drilling and sampling operations to fully describe each soil sample on the soil boring log including:

- Percent recovery;
- Structure and degree of sample disturbance;
- Soil type;

- Color;
- Moisture condition;
- Density;
- Grain size;
- Consistency; and
- Any other observations, particularly relating to the presence of waste materials or contaminants.

Particular care will be taken to fully describe any sheens observed, oil saturation, evidence of other organic chemicals, or unnatural materials.

V. Disposal Methods

All water generated during cleaning procedures will be collected and contained on site in labeled 55-gallon drums for future analysis and appropriate disposal.

Personal protective equipment, such as gloves, disposable clothing, and other disposable equipment, resulting from personnel cleaning procedures and from soil sampling and handling activities, will be placed in plastic bags. These bags will be transferred into appropriately labeled 55-gallon drums for appropriate disposal.

Soil materials will be placed in labeled sealed 55-gallon steel drums and stored in a secured area. Once full, the material will be analyzed to determine the appropriate disposal method.

Attachment D-1

BLASLAND, BOUCK & LEE, INC.
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Daily Field Report

Date: _____

S	M	T	W	T h	F	S

PROJECT _____

JOB. NO. _____

CLIENT _____

CONTRACTOR _____

PROJECT MANAGER _____

WEATHER _____

TEMP. _____

WIND _____

HUMIDITY _____

FIELD TEAM	
NAME	REMARKS
NAME	REMARKS

VISITORS		
TIME	REPRESENTING	REMARKS

EQUIPMENT AT THE SITE

FIELD ACTIVITIES

BY _____ TITLE _____

6/2/97
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Attachment D-2

BLASLAND, BOUCK & LEE, INC.
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Soil Boring Log

Date Start/Finish: / Drilling Company: Driller's Name: Drilling Method: Bit Size: Auger Size : Rig Type: Spoon Size:	Northing: Easting: Well Casing Elev.: ft. Corehole Depth: ft. Borehole Depth: ft. Ground Surface Elev.: ft. Descriptions by:	Well No. Client: Site:

DEPTH / ELEVATION	Sample Depth / Sample Number	Sample/Int/Type	Blows/6 In.	N	Recovery (ft.)	PID (ppm) Headspace	Geotechnical Test	Geologic Column	Stratigraphic Description	Well Construction
gs elevation ft.									GROUND SURFACE	
5										
10										
15										

Remarks:

Water Levels		
Date / Time	Elevation	Depth

Project:

Script: BBL-wel2
Date: 10/15/98

Attachment H

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Equipment Decontamination Procedures

Attachment H

Equipment Decontamination Procedures

I. Introduction

Decontamination areas for smaller equipment to be washed by hand will generally be set up adjacent to the individual work areas, as described in the Site Health and Safety Plan (HASP). A steam-cleaning station and pad for containing rinse water will be set up within the Site in a peripheral location that will not interfere with sampling activities. The equipment decontamination procedures include pre-field, in the field, and post-field cleaning of sampling equipment. The sampling equipment includes all non-disposable equipment potentially coming in contact with contaminated materials. The nondisposable equipment will be decontaminated after the completion of each sampling event. All rinse water will be contained and appropriately disposed of.

II. Typical Equipment Decontamination Materials List

- Distilled/deionized water
- Non-phosphate soap
- Tap water
- Appropriate cleaning solvent (e.g., hexane, methanol)
- Nitric acid
- Wash basins
- Brushes
- Plastic sheeting
- Aluminum foil
- Large heavy-duty garbage bags
- Spray bottles
- Ziploc®-type bags
- Handiwipes
- Disposable gloves

III. Storage of Equipment

All sampling equipment will be stored in a clean environment and, where appropriate, the equipment will be covered in aluminum foil after cleaning prior to use.

IV. Safety Procedures During Equipment Decontamination

1. Personnel will wear the following safety equipment when cleaning smaller sampling equipment (e.g., split-spoons, trowels);

   - Safety glasses, goggles, and/or a splash shield;
   - Coveralls;
   - Waterproof cover boots; and
   - PVC or nitrile outer gloves.

   Additional personal protective equipment (PPE) may be required based on the results of field screening, as described in the HASP.

2. Personnel will wear the following additional safety equipment when cleaning larger equipment with a high-pressure water/stream cleaning unit (i.e., drilling rig backhoe):

   - Laminated-type Tyvek™ disposable coveralls (e.g., Saranex™); and
   - Chemical-resistant overboots.

3. All solvent rinsing will be conducted in an adequately ventilated area.

4. All solvent transported into the field will be stored and packed in appropriate containers with care taken to avoid extreme heat.

5. Handling of solvents will be conducted in accordance with the manufacturer's Material Safety Data Sheets (MSDSs).

V. Field Decontamination Procedures

1. Decontamination Station

   The steam-cleaning station will be located within the site in a peripheral area. In addition, wash stations for the decontamination of smaller equipment will be established as necessary outside of the individual work zones.

   All equipment, such as drill rigs and other mobile equipment, will receive an initial decontamination prior to use at the site. The frequency of subsequent decontamination while on site will depend on how the equipment is actually used in relation to taking environmental samples. All fluids and residues produced

from the decontamination procedures will be collected and stored on-site until analysis can be conducted and a decision is made regarding final disposition of the material pursuant to state and federal requirements.

2. Decontamination of Sampling Equipment

Sampling equipment (split-spoons, Hydropunch™ sampler, bailers, trowels, etc.) will be cleaned in accordance with the decontamination procedures listed in Attachment H-1. The first step, a soap and water wash, is completed to remove all visible particulate matter and residual oils and grease. (This step may be preceded by steam-cleaning to facilitate removal of residual materials.) When analyzing for organic constituents, this step will be followed by a tap water rinse to remove the detergent and a rinse sequence of solvent (e.g., hexane, methanol) and distilled/deionized water. When analyzing for inorganic constituents, the soap and water wash will be followed by a nitric acid rinse, a tap water rinse, and a distilled/deionized water rinse.

3. Decontamination of Heavy Equipment

Other equipment and materials associated with sampling tasks will be decontaminated prior to use. Items such as drill rigs and auger flights present potential sources of cross-contamination of environmental samples. These items may come into contact with the materials adjacent to the matrix being sampled or may be attached to sampling equipment which has been decontaminated in accordance with procedures set forth in Attachment H-1. Heavy equipment may potentially retain contaminants from other sources such as roadways or storage areas or have soil material from previous job sites that has not been removed. For these reasons, it is most important that these items be decontaminated prior to their use at the site.

Two options are available to accomplish decontamination of heavy equipment: steam-cleaning and manual scrubbing. The use of steam-cleaning can remove visible debris and has several advantages. Steam-cleaners provide high-pressure which is very effective for residuals removal. They are also efficient in terms of ease of handling and generate low volumes of wash solutions.

Steam-cleaning is the preferred method for decontamination of heavy equipment and will be used to decontaminate drill rigs and other heavy equipment whenever possible. Manual scrubbing of equipment will only be used if steam-cleaning fails to remove visible materials.

The drilling equipment will be thoroughly decontaminated by steam-cleaning or manual scrubbing upon initial arrival on site and between drilling locations. Drill rig items such as auger flights, drill rods, and drill bits will be decontaminated between borings.

4. Decontamination of Other Equipment

The water level probe used for water level measurements will be cleaned between each well with a soapy water wash and a distilled/deionized water rinse. The transducer and cable used during the in-situ hydraulic conductivity testing and the gamma ray logging instrument probe used during the borehole logging will be cleaned in the same manner.

Well development equipment will be cleaned with a soapy water wash, followed by a tap water rinse, a solvent rinse, and a distilled/deionized water rinse.

VI. Disposal Methods

All fluids generated during decontamination procedures will be collected and contained on site in 55-gallon drums for future analysis and appropriate disposal. Solids (e.g., disposable gloves, disposable clothing, and other disposable equipment) resulting from personal decontamination procedures will be placed in plastic bags and appropriately disposed of in 55-gallon drums or a covered roll-off container.

Attachment H-1

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Equipment Decontamination Procedure

Attachment H-1

Equipment Decontamination Procedure

The field sampling equipment decontamination procedures when analyzing for organic constituents are as follows:

1. Non-phosphate detergent and water wash;
2. Tap water rinse;
3. Solvent rinse (e.g., hexane, methanol);
4. Distilled water rinse; and
5. Wrap equipment completely with aluminum foil to prevent contact with other materials during storage and/or transport to the field, as appropriate.

The field sampling equipment decontamination procedures when analyzing for inorganic constituents are as follows:

1. Non-phosphate detergent and water wash;
2. Rinse equipment with at least a ten-percent nitric acid solution;
3. Tap water rinse;
4. Distilled water rinse; and
5. Wrap equipment with aluminum foil to prevent contact with other materials during storage and/or transport to the field.