Final Work Plan

RCRA Facility Investigation Former General Latex and Chemical Corporation Facility, Ashland, Ohio

Prepared for

The General Latex and Chemical Company

September 2008

CH2MHILL

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Acronyms and Abbreviations

DPT	direct push technology
GC/MS	gas chromatography/mass spectrometry
GLCC	former General Latex and Chemical Corporation
HHRA	human health risk assessment
Ohio EPA	Ohio Environmental Protection Agency
PID	photoionization detector
QAPP	quality assurance project plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	Resource Conservation and Recovery Act facility investigation
RSL	regional screening level
SLERA	screening level ecological risk assessment
SOP	standard operating procedure
SVOC	semivolatile organic compound
TAL	target analyte list
TCFM	trichlorofluoromethane
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

SECTION 1

Introduction

This Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan was prepared to describe proposed investigation activities associated with the former General Latex and Chemical Corporation (GLCC) facility located in Ashland, Ohio (Ashland site; Figure 1). This RFI work plan was prepared in general accordance with the RCRA Corrective Action Program in anticipation of the site's acceptance into this program. The sampling locations, media, and analytical methods were developed based on the preliminary conceptual site model and understanding of subsurface flow systems developed from investigation activities completed at the site under the oversight of Roffman Associates, Inc. All sampling conducted will be performed pursuant to a quality assurance project plan (QAPP) prepared in accordance with the U.S. Environmental Protection Agency (USEPA) Region 5 Quality Assurance Project Plan Policy (April 1998).

1.1 Purpose

The object of the RFI is to address gaps in existing data so the site can be closed under the most appropriate regulatory program as soon as possible. The recommended approach is to take advantage of the USEPA Region 5 Pilot Portfolio opportunity and to enter the site into the RCRA Corrective Action Program. After reviewing existing information about the site, CH2M HILL identified additional data needs to support anticipated closure activities. This work plan addresses the following tasks:

- Survey the Ashland site to establish a base map with accurate *x*, *y*, and *z* coordinates representing major site features including monitoring wells and topography
- Define the extent of trichlorofluoromethane (TCFM) and other volatile organic compound (VOC) impacts to groundwater
- Conduct a hydrogeological investigation to establish the direction of groundwater flow and contaminate transport
- Verify the presence of source areas and historical soil constituent concentrations, specifically from the former lagoons and TCFM underground storage tank (UST) area
- Determine the nature and extent of contamination within the drainage conveyance ditch
- Determine surface water and sediment characteristics within the unfilled part of the lagoon and the terminus of the drainage conveyance ditch
- Conduct a soil gas survey to evaluate the potential for vapor intrusion into the building
- Evaluate the potential exposure pathways and receptors from site-related constituents
- Determine if site-related contamination poses unacceptable risk to human or ecological receptors

1.2 Site Layout

The 7-acre site is zoned heavy industrial and consists primarily of a building that was constructed in 1954, with expansions to the building in 1967 and 1970, and two former wastewater lagoons in the western part of the property. A former rail spur lies between the western side of the building and the former lagoons (Figure 1).

1.3 Site Background

The facility operated from 1954 to October 2001. Operations consisted of latex and polyurethane plants that included storage tanks, agitators, mixers, and vulcanizers used in the production of liquid latex and polyurethane products. The key raw chemicals were natural latex, neoprene, isoprene GRS 2000-type latex, TCFM, toluene diisocyanate, which was replaced in the mid-1980s with methyl diphenyl diisocyanate and polymeric diphenyl methane diisocyanate. The equipment was removed from the property by February 2002, and the property currently is vacant.

During operations, the lagoons were used for the disposal of facility wastewater. From 1954 to 1975, the lagoons received untreated wastewater, and from 1975 to 1981, they received only treated wastewater. Coagulated solid waste was sent offsite to a sanitary landfill. From February 1981 to 2001, treated wastewater was sent to the City of Ashland sanitary sewer system. After wastewater discharge to the lagoons ceased and over a period of time, the former North Lagoon and part of the former South Lagoon were filled and leveled.

During facility operations, several aboveground storage tanks and USTs were located inside and outside the building. The tanks stored natural latex, neoprene latex, GRS-2000 type latex, isoprene, heating oil, and settled material from wastewater treatment. The tanks were emptied, cleaned, and removed or filled with clean fill or cement.

During operations, seven accidental releases of raw chemicals occurred. The chemicals released were toluene diisocyanate, natural latex, TCFM, ammonia latex, and polymeric methyl diphenyl diisocyanate. Cleanup began immediately, and personnel reported releases to the proper authorities within the Ohio Environmental Protection Agency (Ohio EPA). Accidental discharge reports were prepared and submitted to Ohio EPA, as necessary. The cleanup included cleaning up the remaining chemical on the ground surface and excavating contaminated soil, as needed.

During operations, the facility was a small quantity generator with USEPA Generator No. OHD001008341. Hazardous waste generated included flammable solvents and residues of chemicals added during the compounding of chemical formulation and the mixing processes.

GLCC has been conducting site investigations at the facility since 2001 in accordance with the Ohio Voluntary Action Program. Activities conducted include investigations to support the preparation of a Phase II property investigation report (including a Phase I property investigation report), soil and groundwater fate and transport modeling, soil remedial action planning and remediation, and quarterly groundwater monitoring from December 2004 to December 2006.

Information about the site indicates that soil and groundwater impacts occurred primarily in the western and southwestern area of the site near the former lagoons and TCFM UST. In that area, groundwater has elevated levels of VOCs and TCFM and soil has elevated levels of VOCs, semivolatile organic compounds (SVOCs), and TCFM.

1.4 Site Geology

The site geology is characterized by unconsolidated glacial deposits underlain by bedrock. The site unconsolidated deposits consist predominantly of sandy, gravelly clay, and silt units with intermittent clayey, silty sand, and gravel units. These unconsolidated deposits range from 52 to 60 feet thick. The site bedrock lithology has not been confirmed, but it is reasonable to assume that the site bedrock is consistent with the regional bedrock (Mississippian-age sandstone and shale of the Cuyahoga group).

SECTION 2

Field Investigation

The field investigation will be performed in two phases to support confirmation of residual soil impacts, sediment impacts delineation, groundwater impacts delineation, hydrogeologic evaluation, and abandonment of existing monitoring wells, and installation of new monitoring wells.

The investigation will be performed in two phases to support confirmation of residual soil impacts, sediment impacts delineation, groundwater impacts delineation, hydrogeologic evaluation, and abandonment of existing monitoring wells, and installation of new monitoring wells.

Phase 1

- Survey the site features including the existing monitoring wells, conduct a monitoring well inspection and evaluation, and markout the underground utilities
- Collect 20 groundwater grab samples (nine shallow and 11 deep) to analylze for VOCs and log the lithology from direct push technology (DPT) borings from surface to bedrock in order to delineate horizontal and vertical extents of plume and establish hydrogeologic conditions
- Collect up to 12 soil samples from four borings (two in each former lagoon) biased toward the historical location exhibiting the maximum concentration and analyze samples for VOCs, SVOCs, and target analyte list (TAL) metals by methods that achieve a reporting level at or below the pertinent screening criteria, or best achievable technology
- Collect up to four soil samples from two borings in the area of the former Freon UST biased toward the historical location exhibiting the maximum concentration and analyze samples for VOCs, SVOCs, and TAL metals by methods that achieve a reporting level at or below the pertinent screening criteria, or best achievable technology
- Collect four surface soil samples equally spaced along the conveyance ditch invert to supplement the human health risk assessment (HHRA), and analyze them for VOCs, SVOCs, and TAL metals by methods that achieve a reporting level at or below the pertinent screening criteria, or best achievable technology
- Collect four surface water and four sediment samples (0 to 6 inches): three from locations within the limits of the remaining South Lagoon and one location in the southern terminus of the drainage ditch, and analyze them for VOCs, SVOCs, and TAL metals by methods that achieve a reporting level at or below the pertinent screening criteria, or best achievable technology
- Collect six soil vapor samples (three from the former Freon UST area and three from the MW-6, MW-15, and MW-12 areas), and analyze them for the full TO-15 VOCs list

Phase 2

- Based on the results of the monitoring well inspection and evaluation in Phase 1, abandon an estimated four of the existing monitoring wells
- Based on the results of the well inspection and evaluation and the DPT groundwater grab sampling in Phase 1, install an estimated six new monitoring wells
- Collect an estimated 19 groundwater samples from the existing monitoring wells (13) and proposed monitoring wells (six) and analyze for VOCs to determine horizontal and vertical concentrations of plume

2.1 RFI Phase 1

2.1.1 Site Survey, Monitoring Well Evaluation, and Utility Markout

A site survey will to be performed to map the major site features and topography. The initial site survey will include at least the following elements:

- Site topography (including elevation contour lines at 1-foot intervals)
- Property line and fence
- Site improvements, such as buildings, roads, former rail spur, and parking lot
- Remaining boundary of the former South Lagoon
- Drainage ditch including base elevations
- Ground surface and top of casing (well riser) elevation for the monitoring wells

The project team will inspect the groundwater monitoring wells to evaluate their integrity. Wells suspected of being damaged will be abandoned. Those that are nonrepresentative of site aquifer conditions (that is, wells that show mounding or perched water zones) will be identified for evaluation regarding future sampling. The remaining well network will be evaluated for spatial coverage to determine the need for additional wells or piezometers to confirm groundwater flow direction and to delineate groundwater impacts. This, in conjunction with groundwater grab sample data (Section 2.2.2), will help identify if additional monitoring wells are needed for horizontal or vertical groundwater characterization.

CH2M HILL will coordinate a utility markout (including locations inside the building) to clear the proposed drilling locations prior to beginning any intrusive site activities.

2.1.2 Groundwater Grab Sampling and Lithologic Logging

The objectives of the groundwater delineation borings are as follows:

- Delineate the horizontal and vertical extent of the VOC and TCFM groundwater impacts
- Establish the site hydrogeological conditions

Groundwater Grab Sample and Lithologic Logging Locations

Groundwater grab samples will be collected at 11 locations. Lithology will be logged from DPT borings advanced through the unconsolidated material to bedrock. Figure 2 shows the proposed sampling locations (B-1 through B-9, B-11, and B-12). Shallow groundwater grab samples (5 feet below the observed water table) will be collected from all locations except B-9 and B-5. Deep groundwater grab samples (5 feet above unconsolidated bedrock interface) will be collected from all locations.

Groundwater Sampling Procedures

The following sequence will be followed for collecting samples:

- Advance the DPT boring to 5 feet below the observed groundwater table
- Collect the shallow groundwater sample
- Advance the DPT boring to the overburden-bedrock interface
- Collect the deep unconsolidated-bedrock interface groundwater sample

Field screening of the soil core using a photoionization detector (PID) equipped with a 12-electron volt lamp will be performed from ground surface to bedrock at all boreholes.

Lithological logging of borings will follow the procedures as outlined in Standard Operating Procedure (SOP) 1, *Logging of Soil Borings.* (Appendix A contains all SOPs referenced herein.) The groundwater grab samples will be collected using low flow sampling procedures as described in SOP 2, *Low-Flow Groundwater Sampling*, using a 0.75-inch outer diameter microbladder. Water quality will be monitored according to SOP 3, *Water Quality Field Measurements,* before groundwater samples are collected.

Groundwater Analytical Parameters

The groundwater grab samples will be submitted for laboratory analysis and analyzed for VOCs according to USEPA Method SW8260B, with standard turnaround time.

2.1.3 Surface and Subsurface Soil Investigation

The objectives of the soil investigation are as follows:

- Confirm the impacts to the surface and subsurface soil in the former lagoons and former TCFM UST areas
- Delineate the impacts to surface soil in the drainage conveyance ditch

Soil Sample Locations

Surface and subsurface soil samples will be collected at six locations within the former lagoon and TCFM UST areas. Lithology will be logged from DPT borings advanced through the unconsolidated material from ground surface to the water table. Surface soil samples will be collected from ground surface to 2 feet below ground at four locations within the drainage conveyance ditch.

Figure 2 shows the sampling locations located in the former North Lagoon (B-3 and B-5), in the former South Lagoon (B-11 and B-13), and in the former TCFM UST (B-10 and B-14). Figure 3 shows the four sampling locations within the drainage conveyance ditch.

Former Lagoon Areas Soil Sampling Procedures. Up to three soil samples will be collected from each boring location:

- One surface soil sample will be collected from the 0- to 2-foot depth interval.

- One subsurface soil sample will be collected from the base of the former lagoons.
- One sample will be collected from the 1-foot interval exhibiting the highest PID reading if different than the interval including the base of the lagoon.

Borings will be continuously screened with a PID equipped with a 12-electron volt lamp that can ionize TCFM. (Ionization potential is 11.77 electron volts.) Lithological logging of borings will follow the procedures specified in SOP 1, *Logging of Soil Borings*. Drilling and sample collection with the DPT rig will follow SOP 4, *Drilling and Sampling Using Direct Push Techniques.*

Former TCFM UST Area Soil Sampling Procedures. Two soil samples will be collected at each boring location:

- One surface soil sample will be collected from the 0- to 2-foot depth interval.
- One subsurface soil sample will be collected from the interval exhibiting the highest PID reading. If no PID readings exceed background levels, the subsurface soil sample will be collected from the sample interval from the approximate invert of the former UST.

Borings will be continuously screened with a PID equipped with a 12-electron volt lamp that can ionize TCFM. Lithological logging of borings will follow the procedures specified in SOP 1, *Logging of Soil Borings*. Drilling and sample collection with the DPT rig will follow SOP 4, *Drilling and Sampling Using Direct Push Techniques*.

Drainage Conveyance Ditch. One surface soil sample will be collected from the 0- to 2-foot depth interval at each boring location. Borings will be continuously screened with a PID equipped with a 12-electron volt lamp that can ionize TCFM. Lithological logging of borings will follow the procedures in SOP 1, *Logging of Soil Borings*. Drilling and sample collection with the DPT rig will follow SOP 4, *Drilling and Sampling Using Direct Push Techniques*.

Soil Analytical Parameters

Samples collected for laboratory analysis will be analyzed for VOCs by USEPA Method SW8260B; SVOCs by USEPA Method 8270C; and TAL metals by USEPA Methods SW6010B, SW6020, SW7470A, and SW7471A.

2.1.4 Surface Water and Sediment Investigation

The objective of the surface water and sediment investigation is to characterize impacts to the surface water and sediments of the former South Lagoon and drainage conveyance ditch. The presence of surface water in the South Lagoon varies seasonally. If not present at the time of sampling, another attempt will be made during Phase 2 of the investigation.

Sampling Locations

Surface water and sediment samples will be collected at three sampling locations within the unfilled part of the former South Lagoon. A surface water and a sediment sample will be collected at one location within the southern terminus of the drainage ditch. Figure 3 shows the proposed locations for the surface water and sediment sample locations in the unfilled part of the former South Lagoon (SED-1 and SED-2) and in the southern terminus of the drainage conveyance ditch (SED-3).

Sampling Procedures

The surface water samples will be collected before the sediment samples. Surface water samples will be collected manually from the upper part of the water column using a grab sampling device (Van Dorn, Niskin, or comparable bottle grab sampler) or by using a dip-sampling method (SOP 5, *Surface Water Sampling – General Procedures*). The project team will collect sediment samples using a sediment scoop sampler (SOP 6, *Scoop Sediment Sampling*).

Analytical Parameters

Samples collected for laboratory analysis will be analyzed for VOCs by USEPA Method SW8260B; SVOCs by USEPA Method 8270C; and TAL metals by USEPA Methods SW6010B, SW6020, SW7470A, and SW7471A.

2.1.5 Vapor Intrusion Investigation

This task involves assessing the potential for VOC vapors to enter the building through the subsurface. An evaluation of previous groundwater and soil data indicates there are areas of concern within 100 feet of the building with levels of VOCs—specifically TCFM and trichloroethene—that warrant further investigation for the vapor intrusion pathway. The building survey observations indicate that the condition of the slab might allow soil gas to migrate into the air within the building. The proposed soil gas sampling locations were designed to assess the potential for vapor intrusion at the building. If a building were to be constructed outside the building footprint, additional evaluation would be necessary.

Sampling Locations

Figure 4 shows the location of the soil gas samples to be collected during the investigation. Six borings will be advanced: three in the area of the former TCFM UST area and three northwest of the building. The soil gas samples will be located within 5 to 10 feet of the building. The sample locations may be adjusted in the field to accommodate for surface features and subsurface utilities.

Depending on the depth of the groundwater table, one to two soil gas samples will be collected at each location. If the groundwater table is determined to be within 12 feet of the ground surface, a single soil gas sample will be collected from the boring, 2 feet above the groundwater table. If the groundwater table is more than 12 feet below ground, two soil gas samples will be collected from each boring. One sample will be collected at a depth halfway to the depth of the deeper soil gas sample, located 2 feet above the groundwater table. For example, if the depth to water were 13 feet below ground, one sample would be collected at 5 to 6 feet, the other at 10 to 11 feet.

Sampling Procedures

Permanent soil gas monitoring points will be installed at the six sample locations. The points will consist of an expendable anchor/drive point (tip), a Geoprobe® permanent implant (12-inch-long stainless steel), and Teflon® tubing. Monitoring points will be installed by the post-run method, in accordance with SOP 7, *Installation of Permanent Soil Gas Sampling Implants.*

The project team will collect soil gas samples using evacuated stainless steel (SUMMA™) 1-liter canisters equipped with flow controllers. Samples will be collected at least 24 hours after the monitoring point is installed and over a period of 1 hour at a flow rate of 90 milliliters per minute. Samples will be collected in accordance with SOP 8, *Collection of Soil Gas Samples from Soil Gas Probes (GeoProbe System – PRT) Using Summa Canisters and a Helium Leak Check.*

Analytical Parameters

The air samples will be analyzed in accordance with USEPA Method TO-15, *Determination of Volatile Organic Compounds in Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry* (GC/MS). A certified laboratory will perform the analyses for the appropriate analyte and environmental matrix combinations. The laboratory will provide data of comparable quality and documentation that are consistent with the Uniform Federal Policy for QAPPs (USEPA 2005). The QAPP describes the measurement quality objectives for analyses using Method TO-15 GC/MS and GC/MS–selective ion monitoring analysis.

The laboratory will supply individually certified clean SUMMA canisters with individual tracking numbers and certified clean and calibrated flow regulators. Turnaround time for the soil gas samples will be 21 days.

2.2 RFI Phase 2

The second RFI mobilization will include new well installation/development, compromised well abandonment, and a complete round of groundwater well sampling.

2.2.1 Monitoring Well Installation

Permanent wells will serve as monitoring points that define the horizontal and vertical extent of the groundwater plumes based on historical groundwater data and the analysis of groundwater samples from the delineation of groundwater impacts conducted in Phase 1. The actual number of wells and construction details will be determined following a review of analytical data. CH2M HILL will prepare an amendment to this work plan to provide the basis for the monitoring well locations and their construction details. The amendment will include SOPs for the installation and development of the monitoring wells.

2.2.2 Monitoring Well Abandonment

Wells identified as compromised based on field inspection will be abandoned in accordance with an SOP to be included in the amendment to this work plan.

2.2.3 Monitoring Well Sampling

Groundwater Sampling Locations

The groundwater sampling locations will include the remaining permanent monitoring wells and the new permanent monitoring wells.

Groundwater Sampling Procedures

Groundwater samples will be collected following SOP 2, *Low-Flow Groundwater Sampling,* and the requirements of the QAPP. Before groundwater sample are collected, water quality will be monitored according to SOP 3, *Water Quality Field Measurements*.

2.3 Sample Identification

Before samples are collected, sample containers will be labeled with the project name, sample number, analysis to be performed, date and time of collection, and the processor's initials. Primary sample labels will use the format *LocationMediaDepth-Date* for sample identification, where:

Location = well ID (for groundwater) or location identifier (for all other sample types) as shown on figures
Media = GW (groundwater); SB (soil); SD (sediment); SG (soil gas)
Depth = four digit depth, 1 to 2 feet = 0102
Date = mmddyy

For example, a groundwater sample collected from Monitoring Well 10 with a screened interval 10 to 20 feet below ground, on September 1, 2008, is identified as MW10GW1020-090108.

Quality control (QC) sample labels will use the format *QCTypenumber-date* for sample identification, where:

QCtype = FD (field duplicate); EB (equipment blank); TB (trip blank); MS (matrix spike); MSD (matrix spike duplicate)
Number = unique numerical identifier
Date = mmddyy

Note that QC sample identification will not be tied to a media or location. Locations and media will be noted in the field logbook. For example, a duplicate surface soil sample collected from location 6 on September 1, 2008, is identified as FD01-090108.

The sample identification numbers will be affixed to each sample container before sample collection and then recorded on the chain-of-custody. Field team members will maintain a listing of the sample identification numbers in the field logbook. The procedures used for proper packaging, shipping, and documentation of samples being transported from the field to the laboratory for analysis are given in SOP 9, *Sample Management*.

2.4 Equipment Decontamination

Sampling equipment that is reused in the field must be decontaminated in accordance with the SOP 10, *Field Decontamination Procedures*.

2.5 Waste Management

Investigative-derived wastes will be managed and disposed in accordance with SOP 11, *IDW Handling and Disposal*. Plastic sheeting will be used around the drill rig to contain soil cuttings and water generated during drilling and to prevent contact of subsurface materials with the ground surface. A berm will be established (using 4-by-4s, sand bags, or other materials) beneath the plastic sheeting perimeter so that materials do not run off the sheeting. Soil and rock cuttings will be stored in 55-gallon drums or in a rolloff box within the exclusion zone. Water generated from decontamination, well development, and purging the monitoring wells will be stored in 55-gallon drums. Investigation-derived waste will be properly characterized and disposed of at a GLCC-approved facility.

SECTION 3
Data Evaluation and Reporting

3.1 Data Evaluation

Data collected as part of the investigation will be evaluated to refine and update the preliminary conceptual site model and to provide a preliminary understanding of the potential for human health or environmental risk posed by residual contamination in environmental media.

3.1.1 Conceptual Site Model Refinement

Data collected during Phases 1 and 2 of this investigation will support refinement of the preliminary conceptual site model by filling gaps in understanding. The mapping data and lithological information obtained in Phase 1 will support the evaluation and reporting efforts.

Groundwater samples collected from DPT borings (Phase 1) will be used to delineate groundwater impacts (vertical and horizontal). The data will be used in conjunction with the well inspection findings to refine and enhance the monitoring well network. Groundwater sampling (Phase 2) will help to establish the extent of groundwater impacts to support remedial decision making. Measured groundwater elevations will support refinement of the localized groundwater flow characteristics, both vertically and horizontally. Groundwater, soil, soil gas, sediment, and surface water data will be compared and used for screening level risk evaluation purposes as defined below. Data on subsurface soils will be used to characterize residual concentrations and, in conjunction with the updated groundwater quality data, to determine if residual source areas remain. Data collected under the RFI will support establishing a “baseline” of environmental conditions for the site before it is reused.

3.1.2 Human Health Screening

A screening level human health evaluation will be prepared. It will consist of screening analytical data collected in 2008 with risk-based concentrations and preparing a human health conceptual exposure model, depicting potential exposure pathways at the site consistent with realistic current and future site uses. Groundwater, surface and subsurface soil, sediment, and surface water data collected under the investigation will be compared to USEPA’s risk-based regional screening levels (RSLs; USEPA 2008) to identify constituents that may be present at concentrations posing unacceptable health risk. The likely future use of the site is for commerce or industry; therefore, soil and sediment will be compared to soil RSLs that assume future commercial/industrial land use.

For the purpose of the human health evaluation, groundwater and surface water data will be conservatively compared to RSLs for residential use of tap water. The RSLs will be based on a cumulative target excess lifetime cancer risk of 1×10^{-5} and a cumulative target noncancer hazard index of 1 in accordance with the Ohio EPA Division of Emergency and

Remedial Response's definition of unacceptable risk for all receptors and land uses. The RSLs will be used to assess if measured concentrations could pose a human health concern. Areas with concentrations exceeding the RSLs may require further data evaluation (such as calculation of site-specific screening levels or completion of a baseline risk assessment) or additional site characterization (such as collection of additional soil or groundwater samples).

Soil gas data will be compared to screening levels derived by applying a soil gas-to-indoor air attenuation factor to the tabulated indoor air RSLs assuming an industrial exposure scenario (USEPA 2008). A soil gas-to-indoor air attenuation factor of 0.1 will be for shallow soil gas samples (roughly 5 to 6 feet below ground). An attenuation factor of 0.01 will be used for deep soil gas (more than 6 feet below ground). The soil gas RSLs will be based on a cumulative target excess lifetime cancer risk of 1×10^{-5} and a cumulative target noncancer hazard index of 1. The soil gas screening levels will be used to assess whether measured soil gas concentrations could pose a concern for vapor intrusion. Areas with soil gas concentrations exceeding the soil gas screening levels may require additional sampling of the soil gas monitoring points in the area of the exceedance, further data evaluation (for example, calculation of site-specific screening levels or a completion of baseline risk assessment) or additional assessment by subslab gas sampling or direct indoor air sampling.

A decision on the next action (resampling the soil gas implants, additional soil or groundwater sampling, further data evaluation, subslab vapor sampling, indoor air sampling) will be based on the conceptual exposure model and an evaluation of the results of screening the data against the RSLs.

3.1.3 Ecological Risk Assessment

A screening level ecological risk assessment (SLERA) will be completed consistent with the following USEPA guidance:

- *Framework for Ecological Risk Assessment.* EPA/630/R-92/001. 1992.
- *Guidelines for Ecological Risk Assessment.* EPA/630/R-95/002F. 1998.
- *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments.* 1997. Interim Final. EPA/540/R-97/006.

The proposed approach for assessing ecological risk at Ashland site will use a SLERA to evaluate the potential for unacceptable ecological risks based on very conservative assumptions. Step 1 of the SLERA process is intended to answer two main questions:

- Do complete exposure pathways exist?
- Are sufficient data available to conduct the SLERA?

The preliminary conceptual site model will be updated with the new information to determine if any exposure pathways are complete and if they may require further assessment. If no complete exposure pathways exist, the SLERA process terminates at Step 1 with a conclusion of negligible (acceptable) risk. If one or more complete exposure pathways are known or are likely to exist, the SLERA process will continue to Step 2 but only evaluate those pathways that have been determined critical.

The second step of the SLERA process involves conducting a screening exposure assessment, a screening effects assessment, and a screening risk calculation (risk characterization). The surface soil, sediment, and surface water data obtained will be compared to standard ecological screening values for each media.

3.2 Reporting

At the conclusion of the RFI site work, CH2M HILL will prepare an RFI report to document the nature and extent of contamination. If CH2M HILL determines that additional RFI or risk assessment work is needed, the RFI report will not be submitted until such work is performed and the site is ready to advance to a remedy evaluation/selection process.

SECTION 4

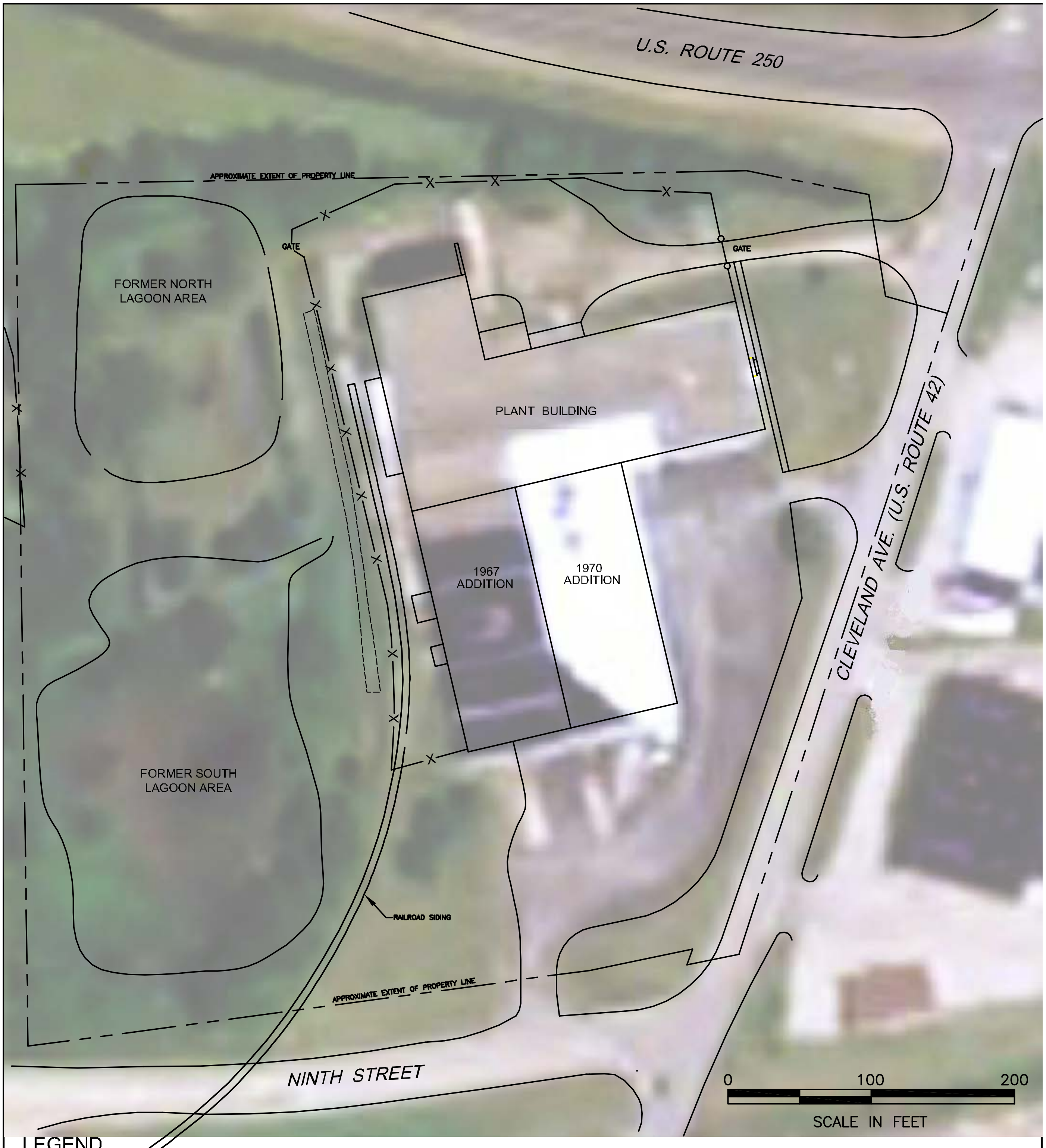
References

U.S. Environmental Protection Agency (USEPA), Region 5. 1998. USEPA Region 5 Quality Assurance Project Plan Policy. April.

U.S. Environmental Protection Agency (USEPA). 2005. Uniform Federal Policy for Quality Assurance Project Plans. Available online at http://www.epa.gov/fedfac/documents/qualityassurance.htm. June.

U.S. Environmental Protection Agency (USEPA). 2008. Regional Screening Levels. Available online at http://epa-prgs.ornl.gov/chemicals/download.shtml. July.

Figures



LEGEND

——X—— FENCELINE

-------- APPROXIMATE EXTENT OF DRAINAGE DITCH

LOCATION MAP

SOURCE:
FIGURE 2 – FACILITY LAYOUT FROM THE PHASE II PROPERTY INVESTIGATION.
THE FORMER GENERAL LATEX AND CHEMICAL CORPORATION, ASHLAND, OHIO,
AS PROPOSED BY ROFFMAN ASSOCIATES, INC, PITTSBURGH, PA

Figure 1
SITE LOCATION
AND LAYOUT MAP
FORMER GENERAL LATEX
AND CHEMICAL CORPORATION
ASHLAND, OHIO

CH2MHILL

FILE NAME: Fig1_363963.dwg DATE: 07/15/2008

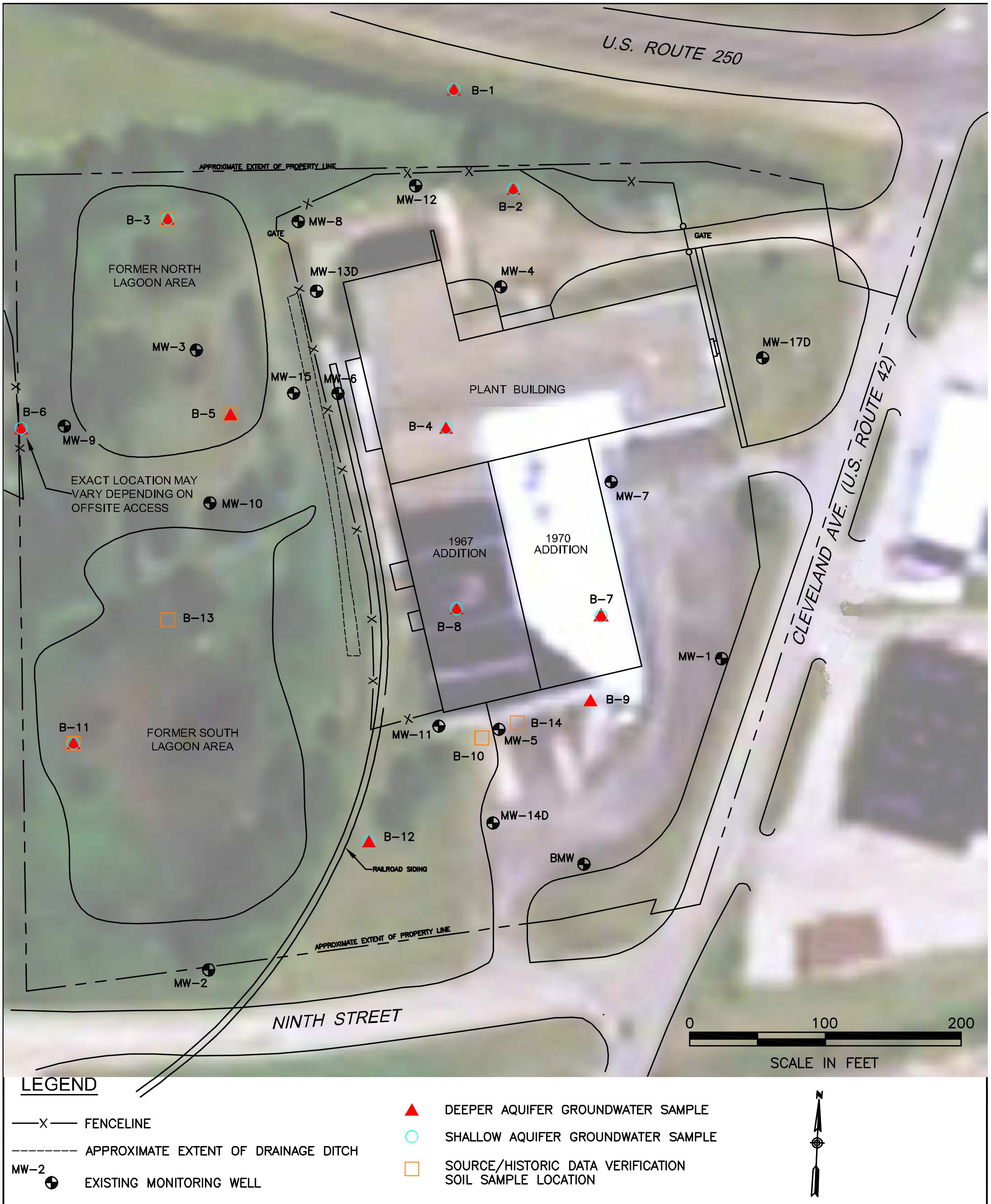


Figure 2

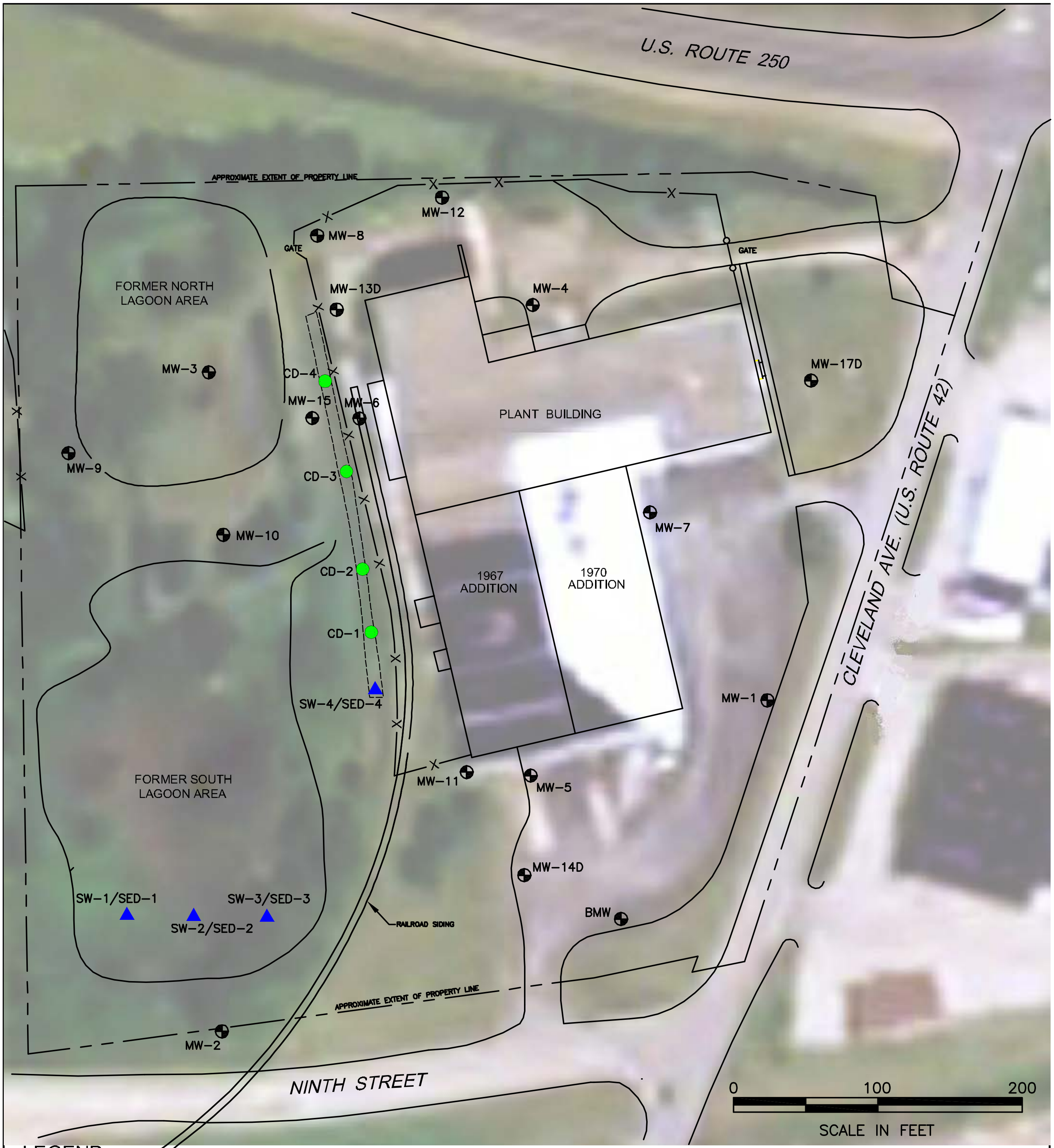
PROPOSED SOIL AND GROUNDWATER SAMPLE LOCATIONS

FORMER GENERAL LATEX
AND CHEMICAL CORPORATION
ASHLAND, OHIO

SOURCE:
FIGURE 2 – FACILITY LAYOUT FROM THE PHASE II PROPERTY INVESTIGATION.
THE FORMER GENERAL LATEX AND CHEMICAL CORPORATION, ASHLAND, OHIO,
AS PROPOSED BY ROFFMAN ASSOCIATES, INC, PITTSBURGH, PA

CH2MHILL

FILE NAME: Fig2_363963.dwg DATE: 07/15/2008



LEGEND

——X—— FENCELINE

-------- APPROXIMATE EXTENT OF DRAINAGE DITCH

MW-2 ⊕ EXISTING MONITORING WELL

▲ SURFACE WATER/SEDIMENT SAMPLE

● DRAINAGE CONVEYANCE DITCH SOIL SAMPLE

N

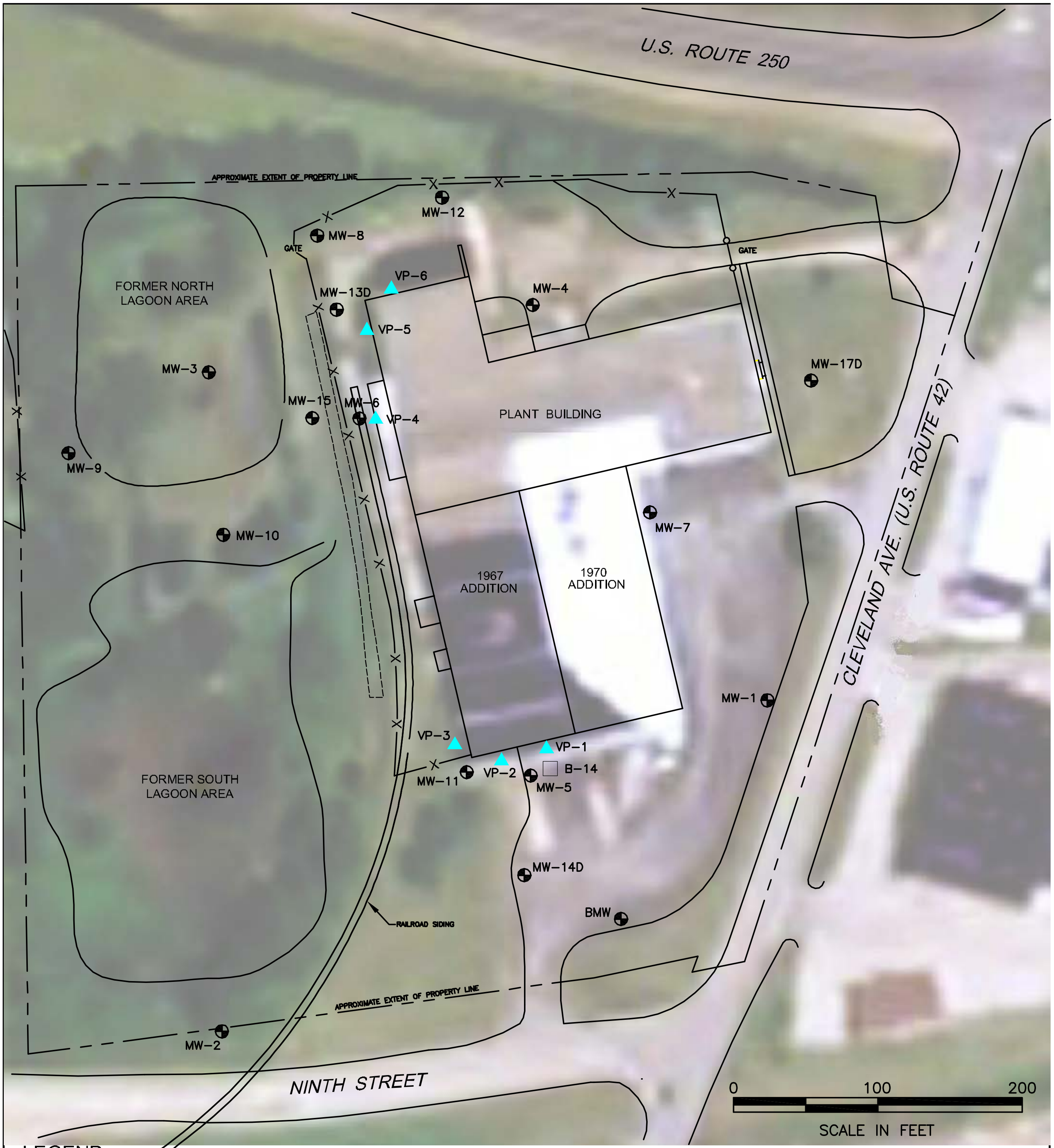
Figure 3
PROPOSED DRAINAGE
CONVEYANCE DITCH AND SURFACE
WATER SAMPLING LOCATIONS

FORMER GENERAL LATEX
AND CHEMICAL CORPORATION
ASHLAND, OHIO

CH2MHILL

SOURCE:
FIGURE 2 – FACILITY LAYOUT FROM THE PHASE II PROPERTY INVESTIGATION.
THE FORMER GENERAL LATEX AND CHEMICAL CORPORATION, ASHLAND, OHIO,
AS PROPOSED BY ROFFMAN ASSOCIATES, INC, PITTSBURGH, PA

FILE NAME: Fig3_363963.dwg DATE: 07/15/2008



LEGEND

—X— FENCELINE

-------- APPROXIMATE EXTENT OF DRAINAGE DITCH

MW-2 ● EXISTING MONITORING WELL

▲ SOIL GAS SAMPLE

N

Figure 4
PROPOSED SOIL GAS
SAMPLING LOCATIONS
FORMER GENERAL LATEX
AND CHEMICAL CORPORATION
ASHLAND, OHIO

CH2MHILL

SOURCE:
FIGURE 2 – FACILITY LAYOUT FROM THE PHASE II PROPERTY INVESTIGATION.
THE FORMER GENERAL LATEX AND CHEMICAL CORPORATION, ASHLAND, OHIO,
AS PROPOSED BY ROFFMAN ASSOCIATES, INC, PITTSBURGH, PA

FILE NAME: Fig4_363963.dwg DATE: 07/15/2008

Appendix A

Standard Operating Procedures

FIELD SOP - 1

Logging of Soil Borings

Purpose and Scope

The purpose of this document is to assist CH2M HILL staff in accurately logging soil borings.

Equipment and Materials

- Soil Boring Log Forms
- Pens
- Other materials are listed with appropriate logging technique.

Policy, Guidelines, and Procedures

Policy

These soil boring procedures should be used for CH2M HILL projects in which soil boring techniques are used during field exploration. These procedures establish the types of information that should be recorded in the field to adequately characterize recovered soil samples. Because each project is unique and because job requirements can vary widely, the standards presented may need to be modified or supplemented with alternate methods, additional technical descriptions, or field test results. These modifications will be made on a case-by-case basis.

CH2M HILL Standard Form D1586, the Soil Boring Log Form, should be used on CH2M HILL projects for field logging (see Figure 3-1 at the end of this section). Heading information should be completely filled out on each log sheet, and technical items in each column should be addressed in the field. The boring log should be completed in the field according to the instructions that follow. Forms should be filled out neatly and completely. Laboratory testing, if required, should be initiated as soon after completion of the field work as practical. Field classifications of samples should be checked against the laboratory test results, and corrections should be noted on the field log.

Guidelines for Completing Soil Boring Log

The following are guidelines for completing log forms in the field. To the extent needed or reasonable, these guidelines should be followed. Field personnel should review completed logs for accuracy, clarity, and thoroughness of detail. Samples should also be checked to see that information is correctly recorded on both jar lids and labels, and on the log sheets.

Heading Information

Project Number

Use standard region code, contract ID (5-digit), and appropriate point number.

Boring Number

Enter the boring number. A numbering system should be chosen that does not conflict with information recorded for previous exploratory work done at the site. Number the sheets consecutively for each boring. If rock core log sheets are also used, continue the consecutive numbering.

Project

Fill in the name of the project or client.

Location

If stationing, coordinates, mileposts, or similar project layout information is available, indicate the position of the boring to that system using modifiers such as approximate or estimated as appropriate. If this information is not available, identify the client facility (e.g., Richland STP, center of Clarifier No. 2 site), or the town and state.

Elevation

Enter the elevation. If it is estimated from a topographic map, or if it is roughly determined using a hand level, use the modifier approximate. It is important to tie the boring elevation to a recoverable reference point (e.g., fire hydrant, floor slab) if no other elevation data are available. Such points can be picked up later in a site survey and boring elevations can be determined. Or, if no survey is done, at least the relative boring elevation with respect to pertinent project facilities will be known.

Drilling Contractor

Enter the name of the drilling company and the city and state where the company is based.

Drilling Method and Equipment

Identify the bit size and type, drilling fluid (if used), and method of drilling (e.g., rotary, hollow-stem auger, air track). Information on the drilling equipment (e.g., CME 55, Mobile B61) is also entered.

Water Levels

Enter the depth below ground surface to the static water level in the borehole. Frequent water measurements are recommended. The information should be recorded in the Comments column. If free water is not encountered during drilling, or cannot be detected because of the drilling method, this information should be noted. Generally, water levels should be measured each morning before resuming drilling and at the completion of each boring. Record date and time of day (for tides, river stage) of each water level measurement.

Start and Finish

Enter the dates the boring was begun and completed. Time of day may be added if several borings are performed on the same day.

Logger

Enter the first initial and full last name.

Technical Data

Depth Below Surface

Use a depth scale that is appropriate for the sample spacing and for the complexity of subsurface conditions.

Sample Interval

Draw horizontal lines at the top and bottom depth of each sample interval. These lines should extend to the soil description column. For a very short sample interval, the bottom line can be lowered after the interval column to provide room for writing the information. Enter the depth at the top and bottom of the sample interval.

Sample Number and Type

Enter the sample number and type. For instance, 1-S = first sample, split spoon. Number samples consecutively regardless of type. Enter a sample number even if no material was recovered in the sampler.

Sample Recovery

Enter the length to the nearest 0.1 foot of soil sample recovered from the sampler. Often, there will be some wash or caved material above the sample; do not include the wash material in the measurement.

Standard Penetration Test Results

In this column enter the number of blows required for each 6 inches of sampler penetration and the "N" value, which is the sum of the blows in the last two 6-inch penetration intervals. A typical standard penetration test involving successive blow counts of 2, 3, and 4 is recorded as 2-3-4 and (7). The standard penetration test is terminated if the sampler encounters refusal. Refusal is a penetration of more than 6 inches but less than 12 inches with a blow count of 100, or a penetration of less than 6 inches with a blow count of 50. A partial penetration of 50 blows for 4 inches is recorded as 50/4". See the Standard Penetration Test Procedures subsection for additional discussion.

Soil Description

The soil classification should follow the format described in the Field Classification of Soil subsection.

Comments

Include pertinent observations (e.g., changes in drilling fluid color, rod drops, drilling chatter, rod bounce as in driving on a cobble, damaged Shelby tubes, and equipment malfunctions). Also note if casing was used, the sizes and depths installed, and if drilling fluid was added or changed. You should instruct the driller to alert you to any significant changes in drilling (e.g., changes in material, occurrence of boulders, and loss of drilling fluid). Such information should be attributed to the driller and recorded in this column.

Specific information might include the following:

- The date and the time drilling began and ended each day
- The depth and size of casing and the method of installation
- The date, time, and depth of water level measurements
- Depth of rod chatter
- Depth and percentage of drilling fluid loss
- Depth of hole caving or heaving
- Depth of change in material
- Drilling interval through a boulder
- The results of pocket penetrometer or torvane test reported as: “PP = _____ TSF” or “TV = ____TSF,” respectively

The depth of piezometers and the results of in situ tests should be noted in the Comments column.

Field Classification of Soil

This section presents the format for the field classification of soil. In general, the approach and format for classifying soils should conform to the latest revision of ASTM D 2488, Visual-Manual Procedure for Description and Identification of Soils.

The Unified Soil Classification System is based on numerical values of certain soil properties that are measured by laboratory tests (ASTM D 2487). It is possible, however, to estimate these values in the field with reasonable accuracy using visual-manual procedures (ASTM D 2488). Also, some elements of a complete soil description, such as the presence of cobbles or boulders, changes in strata, and the relative proportions of soil types in a bedded deposit, can be obtained only in the field. Corrections and additions to the field classification can be provided, when necessary, by laboratory testing of the soil samples.

Soil descriptions should be precise and comprehensive without being verbose. The correct overall impression of the soil should not be distorted by excessive emphasis on insignificant details.

Soil descriptions should be recorded in the Soil Description column for every soil sample collected. The format and order for soil descriptions should usually be as follows:

1. Soil name (synonymous with ASTM D 2488 Group Name) with appropriate modifiers
2. Group symbol
3. Color
4. Moisture content
5. Relative density or consistency
6. Soil structure, mineralogy, or other descriptors

This order follows, in general, the format described in ASTM D 2488. Examples of soil descriptions are provided in Table 3-1.

TABLE 3-1
Example Soil Descriptions

Term	Description
Poorly Graded Sand (SP)	light brown, moist, loose, fine sand size
Fat Clay (CH)	dark gray, moist, stiff
Silt (ML)	light greenish gray, wet, very loose, some mica, lacustrine
Well-Graded Sand With Gravel (SM)	reddish brown, moist, dense, subangular gravel to 0.6 inches maximum
Poorly Graded Sand With Silt (SP-SM)	white, wet, medium dense
Organic Soil With Sand (OH)	dark brown to black, wet, firm to stiff but spongy undisturbed, becomes soft and sticky when remolded, many fine roots, trace of mica
Silty Gravel With Sand (GM)	brownish red, moist, very dense, subrounded gravel to 1.2 inches maximum
Interlayered Silt (60 Percent) And Clay (40 Percent): Silt With Sand (ML)	medium greenish gray, nonplastic, layers mostly 1.5 to 8.3 inches thick
Lean Clay (CL)	dark gray, firm and brittle, layers 0.2 to 1.2 inches thick
Silty Sand With Gravel (SM)	light yellowish brown, moist, medium dense, gravel to 1.0 inches maximum, very few small particles of coal, fill
Sandy Elastic Silt (MH)	very light gray to white, wet, stiff, calcareous cementation
Lean Clay With Sand (CL/MH)	dark brownish gray, moist, stiff
Well-Graded Gravel With Silt (GW-GM)	brown, moist, very dense, rounded gravel to 1.0 inches maximum

Soil Name

The basic name of a soil should be generally consistent with the ASTM D 2488 Group Name based on visual estimates of gradation and plasticity. The soil name should be capitalized. The recommended soil names are those listed in ASTM D 2488.

The following are example descriptions for two different cases:

- A soil sample is visually estimated to contain 15 percent gravel, 55 percent sand, 30 percent fines (passing No. 200 sieve). The fines are estimated as either low or highly plastic silt. This visual classification is SILTY SAND WITH GRAVEL, with a Group Symbol of (SM).

- Another soil sample has the following visual estimate: 10 percent gravel, 30 percent sand, and 60 percent fines (passing the No. 200 sieve). The fines are estimated as low plastic silt. This visual classification is SANDY SILT. The gravel portion is not included in the soil name because the gravel portion was estimated as less than 15 percent. The Group Symbol is (ML).

The gradation of coarse-grained soil (i.e., more than 50 percent retained on No. 200 sieve) is included in the specific soil name in accordance with ASTM D 2488. There is no need to further document the gradation. However, the maximum size and angularity or roundedness of gravel and sand-sized particles should be recorded. For fine-grained soil (i.e., 50 percent or more passing the No. 200 sieve), the name is modified by the appropriate plasticity/elasticity term in accordance with ASTM D 2488.

Interlayered soil should each be described starting with the predominant type. An introductory name, such as Interlayered Sand and Silt, should be used. Also, the relative proportion of each soil type should be indicated (see Table 3-1 for example).

Where helpful, the evaluation of plasticity/elasticity can be justified by describing results from any of the visual-manual procedures for identifying fine-grained soils, such as reaction to shaking, toughness of a soil thread, or dry strength as described in ASTM D 2488.

Group Symbol

The appropriate group symbol from ASTM D 2488 should be given after each soil name. The group symbol should be placed in parentheses to indicate that the classification has been estimated.

In accordance with ASTM D 2488, dual symbols (e.g., GP-GM or SW-SC) can be used to indicate that a soil is estimated to have about 10 percent fines. Borderline symbols (e.g., GM/SM or SW/SP) can be used to indicate that a soil sample has been identified as having properties that do not distinctly place the soil into a specific group. Generally, the group name assigned to a soil with a borderline symbol should be the group name for the first symbol. The use of a borderline symbol should not be used indiscriminately. Every effort should be made to first place the soil into a single group.

Color

The basic color of a soil, such as brown, gray, or red, should be given. The color term can be modified, if necessary, by adjectives such as light, dark, or mottled. Especially note staining, iron staining, or mottling. This information may be useful to establish water table fluctuations or contamination. As an alternative, consider using the Munsel rock color chart designation.

Moisture Content

The degree of moisture present in a soil sample should be defined as dry, moist, or wet. Moisture content can be estimated from the criteria listed in Table 3-2.

TABLE 3-2
Criteria for Describing Moisture Conditions

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp, but no visible water
Wet	Visible free water, usually soil is below water table

Soil Structure, Mineralogy, and Other Descriptors

Discontinuities and inclusions are important and should be described. Such features include joints or fissures, slickensides, bedding or laminations, veins, root holes, and wood debris.

Significant mineralogical information should be noted. Cementation, abundant mica, or unusual mineralogy should be described, as well as other information such as organic debris or odor.

Other descriptors can be included if important for the project or for describing the sample. These include particle size, range and percentages, particular angularity, particle shape, maximum particle size, hardness of large particles, plasticity of fines, dry strength, dilatancy, toughness, reaction to HCl, and cementation.

Residual soils have characteristics of both rock and soil and can be difficult to classify. Relict rock structure should be described and the parent rock identified if possible.

FIELD SOP 2

Low-Flow Groundwater Sampling

Purpose and Scope

This procedure presents general guidelines for the collection of groundwater samples from monitoring wells using low-flow purging and sampling procedures. Operations manuals should be consulted for specific calibration and operating procedures.

Equipment and Materials

- Flow-through cell with inlet/outlet ports for purged groundwater and watertight ports for each probe
- Meters to monitor water quality parameters (e.g., pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature) (e.g., Horiba® U-22 or similar)
- Water-level indicator
- In-line disposable 0.45µ filters (QED® FF8100 or equivalent)
- Adjustable-rate, positive-displacement pump, submersible, or peristaltic pump
- Generator
- Disposable polyethylene tubing
- Plastic sheeting
- Well-construction information
- Calibrated bucket or other container and watch with second indicator to determine flow rate
- Sample containers
- Shipping supplies (labels, coolers, and ice)
- Field logbook

Procedures and Guidelines

A. Setup and Purging

1. For the well to be sampled, information is obtained on well location, diameter(s), depth, and screened interval(s), and the method for disposal of purged water.

2. Instruments are calibrated according to manufacturer's instructions and information such as make/model and calibration and use specifications are recorded in the field logbook.
3. The well number, site, date, and condition are recorded in the field logbook.
4. Plastic sheeting is placed on the ground, and the well is unlocked and opened. All decontaminated equipment to be used in sampling will be placed only on the plastic sheeting until after the sampling has been completed. To avoid cross-contamination, do not let any downhole equipment touch the ground.
5. All sampling equipment and any other equipment to be placed in the well is cleaned and decontaminated before sampling in accordance with Field SOP, *Field Decontamination Procedures*.
6. Water level measurements are collected in accordance with Field SOP, *Water Level Measurements*. **Do not measure the depth to the bottom of the well at this time**; this reduces the possibility that any accumulated sediment in the well will be disturbed. Obtain depth to bottom information from well installation log.
7. Attach and secure the polyethylene tubing to the low-flow pump. Lower the pump slowly into the well such that the pump intake is at least 2 feet above the bottom of the well to avoid mobilization of any sediment present in the bottom. Preferably, the pump intake should be set in the middle of the screen.
8. Insert the measurement probes into the flow-through cell. The purged groundwater is directed through the cell, allowing measurements to be collected before the water contacts the atmosphere.
9. Start purging the well at approximately 100 mL per minute. Avoid surging. Record the initial water quality parameters in the field logbook.
10. The water level should be monitored during purging, and, ideally, the purge rate should equal the well recharge rate so that there is little or no drawdown in the well (i.e., less than 0.5 feet). The water level should stabilize for the specific purge rate. There should be at least 1 foot of water over the pump intake so there is no risk of the pump suction being broken, or entrainment of air in the sample. Record adjustments in the purge rate and changes in depth to water in the logbook. Purge rates should, if needed, be decreased to the minimum capabilities of the pump (typically 100 mL per minute) to avoid affecting well drawdown.
11. During purging, the water quality parameters are measured frequently (every 3 to 5 minutes) until the parameters have stabilized. Water quality parameters are considered stabilized when measurements meet the following criteria:
    - pH: within 10 percent
    - Specific conductance: within 3 percent
    - Dissolved oxygen: within 10 percent

- Turbidity: within 10 percent or as low as practicable given sampling conditions
- ORP: within 10 mV

B. Sample Collection

Once purging has been completed, the well is ready to be sampled. The elapsed time between completion of purging and collection of the groundwater sample from the well should be minimized. Typically, the sample is collected immediately after the well has been purged, but this is also dependent on well recovery.

Samples will be placed in bottles that are appropriate to the respective analysis and that have been cleaned to laboratory standards. Each bottle typically will have been previously prepared with the appropriate preservative, if any.

The following information, at a minimum, will be recorded in the logbook:

1. Sample identification (site name, location, and project number; sample name/ number and location; sample type and matrix; whether the sample is filtered or not; time and date; sampler's identity)
2. Sample source and source description
3. Field observations and measurements (appearance, volatile screening, field chemistry, sampling method), volume of water purged prior to sampling, number of well volumes purged, and field parameter measurements
4. Sample disposition (preservatives added; laboratory sent to, date and time sent; laboratory sample number, chain-of-custody number, sample bottle lot number)

The steps to be followed for sample collection are as follows:

1. The cap is removed from the sample bottle, and the bottle is tilted slightly.
2. The sample is slowly discharged from the pump so that it runs down the inside of the sample bottle with a minimum of splashing. The pumping rate should be reduced to approximately 100 ml per minute when sampling VOCs.
3. Samples collected for metals analysis will be field filtered before transfer to the sample bottle. Filtration must occur in the field immediately upon collection. The recommended method is through the use of a disposable in-line filtration module (0.45-micron filter) using the pressure provided by the pumping device for its operation.
4. Samples for analysis for volatile organic compounds should be collected first, if such samples are required.
5. Adequate space is left in the bottle to allow for expansion, except for VOC vials, which are filled to overflowing and capped.
6. The bottle is capped and then labeled clearly and carefully.
7. Samples are placed in appropriate containers and packed with ice in coolers in accordance with Field SOP, *Sample Management*.

C. Additional remarks

1. If the well goes dry during purging, wait until it recovers sufficiently to remove the required volumes to sample all parameters. It may be necessary to return periodically to the well but a particular sample (e.g., large amber bottles for semivolatile analysis) should be filled at one time rather than over the course of two or more visits to the well.

2. It may not be possible to prevent drawdown in the well if the water-bearing unit has sufficiently low permeability. If the water level was in the screen to start with, there was no stagnant water in the riser above the screen to begin with.

   If the water level in the well is in the riser above the screen at the beginning of purging, then be sure you pump out sufficient volume from the well to remove the volume of water in the riser above the screen. For a 2-inch diameter well, each foot of riser contains 0.163 gallons; for a 4-inch riser, each foot of riser contains 0.653 gallons; for a 6-inch riser, each foot of riser contains 1.47 gallons.

   Alternatively, the water in the riser above the screen can be removed by lowering the pump into the well until the pump intake is just below the water level, starting the pump, running it at a low rate, and slowly lowering the pump as the water level in the riser declines. This approach can be terminated when the water level reaches the top of the screen, at which time the stagnant water in the riser has been removed. This may not be a practical approach for dedicated sampling equipment. As with typical low-flow sampling, the flow rate should be kept as low as practicable.

3. There may be circumstances where a positive-displacement or submersible pump cannot be used. An example is at isolated, hard-to-reach locations where the required power supply cannot be brought. In this case, a peristaltic pump may be used. Samples can be collected by the procedures described above for all but those for VOC analysis. The water to be placed in the vials for VOC analysis should not be run through the peristaltic pump but instead should be collected by the following:

   - Stop the pump when it is time to collect the VOC sample.
   - Disconnect the tubing upstream from the pump (a connector must be installed in the line to do this).
   - Holding a finger over the end of the tubing to keep the water in the tubing, remove the tubing from the well. Be sure that the tubing does not contact other than clean surfaces.
   - Place the end of the tubing that was in the well into each VOC vial and fill the vial by removing the finger from the other end of the tube.
   - Once the vials are filled, return the tubing to the well and collect any other samples required.

4. Non-dedicated sampling equipment is removed from the well, cleaned, and decontaminated in accordance with Field SOP, *Field Decontamination Procedures*. Disposable polyethylene tubing is disposed of with contaminated PPE.

Attachments

None.

Key Checks and Preventative Maintenance

- The drawdown in the well should be minimized as much as possible (preferably no more than 0.5 to 1 foot) so that natural groundwater-flow conditions are maintained as closely as possible.
- Stirring up of sediment in the well should be avoided so that turbidity containing adsorbed chemicals is not suspended in the well and taken in by the pump.
- Overheating of the pump should be avoided to minimize the potential for losing VOCs through volatilization.
- Keep the working space clean with plastic sheeting and good housekeeping.
- Maintain field equipment in accordance with the manufacturer's recommendations. This will include, but is not limited to:
  - Inspect sampling pump regularly and replace as warranted
  - Inspect quick-connects regularly and replace as warranted
  - Verify battery charge, calibration, and proper working order of field measurement equipment prior to initial mobilization and daily during field efforts

FIELD SOP 3

Water Quality Field Measurements

Purpose

This technical practice provides a general guideline for the following field measurements:

- pH
- Specific Conductance
- Dissolved Oxygen (DO)
- Oxidation Reduction Potential (ORP)
- Temperature
- Turbidity

Scope and Applicability

This standard operating procedure provides standard field measurement techniques for use on groundwater and surface water samples. Refer to the specific requirements of the project in the Work Plan/Sampling Plan (WP/SP) when using this SOP during field activities.

Example Equipment / Materials

- Horiba U-22 or equivalent
- Separate Hach meter or equivalent may be needed for turbidity
- Distilled water in squirt bottle
- Appropriate calibration solutions for each type of field measurement

Guidelines

General

1. Check instrument calibration before initial daily use and at least once every 4 hours or every 5 samples which ever is less. Check instrument with standard solution. Deviations should be noted in the field logbook.

2. Check units of measurement on LCD are correct per project instructions.

3. Check power levels on equipment.

4. Record instrument information in logbook, including device model and serial numbers, KCl standard solution lot number, and instrument settings.

For pH

General

Measurement of pH is temperature dependent. Therefore, temperatures of buffers and samples should be within about 2°C. For refrigerated or cool samples, use refrigerated buffers to calibrate pH meter. Some meters have temperature compensation features built in. Check the manufacturer's instruction to determine if the meter has this function.

Weak organic and inorganic salts, oil, and grease interfere with pH measurements. If oil or grease is visible, note it on the data sheet. Clean electrode with Alconox Soap (or comparable soap) and water, rinse with a 10 percent solution of HCl, and then rinse with distilled water. Then recalibrate the meter.

Following field measurements:

- Record any problems.
- Compare with previous data and note any large variances.
- Clean all dirt from the meter and from inside the case.
- Store electrode in pH 4 buffer solution.

Accuracy and precision are dependent on the instrument used. Refer to manufacturer's manual. Expected accuracy and precision are ± 0.1 pH unit.

Note if pH paper is used. Results from a pH meter and pH paper can vary. Record the results in the logbook along with the brand and range of the pH paper.

Calibration

Calibrate the unit before the initial daily use and at least once every 4 hours or every 5 samples, whichever is less. Calibrate with at least two pH standard solutions. Clean probe according to manufacturer's recommendations. Run duplicate samples once every 10 samples or every 4 hours.

When calibrating meter, use pH buffers 4 and 7 for samples with pH < 8, and buffers 7 and 10 for samples with pH > 8. If meter will not read pH 4 or 10, something may be wrong with electrode.

Note that the calibration procedure may vary depending on the manufacturer's instructions. The following procedure is standard for most pH meters, although some meters have an autocalibration feature.

1. Note source of pH buffers, date of preparation, expiration date, and the manufacturer or the person who prepared the solutions.

2. Note the pH instrument number, model number, and manufacturer.

3. Rinse electrode with distilled water.

4. Place electrode in pH 7 buffer solution.

5. Allow meter to stabilize and then press the "yes" key to accept reading.
6. Rinse electrode with distilled water and place it in a pH 4 or pH 10 buffer solution. The decision of which buffer solution is dependent upon what the expected range of pH values will to be found in the samples. The buffer solutions should bracket the anticipated range of sample readings.
7. Allow meter to stabilize again and then press the "yes" key to accept reading. Record the slope reading (for example, "SLP 98.5").
8. Rinse electrode with distilled water, and place in pH 7 buffer. If meter reading is not 7.0, repeat sequence. Most probes are sealed but some older probes need to have the internal solution topped off. If the probe is not reading correctly, check the fluid level in the probe and add solution per the manufacturer's instructions if the fluid level is low.

Procedure of pH Measurement for Water

1. Before going into the field:
   - Check batteries.
   - Do a quick calibration in pH 7 and 4 or 10 buffer solutions to check electrode.
   - Obtain fresh buffer solutions.
2. Calibrate meter using calibration procedure.
3. Pour the collected water sample into a clean beaker.
4. Rinse electrode with distilled water.
5. Immerse electrode in solution. Record pH reading once the meter has stabilized.
6. Recheck calibration with pH 7 buffer solution after every five samples.
7. Decontaminate probe and the beaker and then cover to protect them from contamination.

For Specific Conductance

General

Follow manufacturer's instructions for setting up and using instrument. If meter has temperature correction capability, set it to this mode (some units always operate in this mode). If not, manual calculation may be required.

Calibration

Calibrate the unit before the initial daily use and at least once every 4 hours or every 5 samples, whichever is less. Clean probe according to manufacturer's recommendations. Run duplicate samples once every 10 samples or every 4 hours.

Record instrument information in logbook, including device model and serial numbers, KCl standard solution lot number, and instrument settings.

Follow manufacturer's instructions for setting up and using instrument. If meter has temperature correction capability, set it to this mode (some units always operate in this mode). If not, manual calculation may be required.

After rinsing probe with distilled water, insert it into standard solution and note results. Since standard conductance solutions are to be used to measure specific conductance (temperature corrected to 25°C), record temperature-corrected reading. If manual correction must be calculated, use the formula:

$$G_{25} = Gt / [1 + 0.02 (t - 25)]$$

Where:

G_{25} = conductivity at 25°C, µmho/cm

t = temperature of sample, °C

G_t = conductivity of sample at temperature t, µmho/cm

Procedure

1. Rinse probe with distilled water.
2. Run sample and record results.
3. Rinse probe with distilled water.

For Temperature

General

Use the same probe or thermometer for all measurements.

Calibration

Calibrate the unit before the initial daily use and at least once every 4 hours or every 5 samples, whichever is less. Clean probe according to manufacturer's recommendations.

Procedure

1. Place probe into fluid to be measured. It is best to place the probe in the fluid without drawing a sample. If a sample must be taken from the source, measure the temperature immediately after the sample is taken. Move the probe slightly while it is in the fluid.
2. Record minimum or maximum reading (as applicable) in the logbook or on a field data form.
3. Decontaminate the probe.

For Dissolved Oxygen (DO)

General

Clean all dirt off of meter and from inside the case before calibrating. Store probe in calibration container with wet towel/sponge when not in use to keep membrane from drying out or causing damage to membrane. Accuracy and precision are dependent on the instrument used. Refer to manufacturer's manual. Expected accuracy and precision are ± 0.1 mg/L.

Calibration

Calibration and equipment checks are the responsibility of the field team after the initial calibration done by the laboratory. Calibrate unit before initial daily use and at least once every 4 hours. Run duplicate samples once every 10 samples.

1. Ensure that there is a damp towel or sponge in the bottom of the calibration container.
2. Place the probe into the calibration container so that the membrane is not touching the container or wet sponge/towel.
3. Set the meter to read temperature.
4. Adjust temperature correction setting.
5. Set meter to air calibration mode.
6. Adjust meter to correct reading. Record calibration information in logbook.
7. Set meter to reading mode.
8. Rinse electrode with distilled water before use.
9. Check the membrane for tears or cloudiness, and check the O-ring and make sure it is properly seated. The membrane needs to be changed at least weekly.

When the probe membrane needs to be changed, use the following procedure.

1. Remove old membrane and O-ring.
2. Fill probe well with KCl solution.
3. Lay a new membrane across the top of the probe well, ensuring that the membrane is not folded.
4. Place to O-ring over new membrane and fit it into the lip just below the end of the probe. Check membrane for tears and folds, making sure that membrane is stretched tightly across the top of the probe well.

Procedure

1. Before going into the field:
    - Check batteries.
    - Perform calibration.

   - Check probe membrane.
2. Record instrument make, model, and serial number in the logbook or data form.
3. Calibrate meter using calibration procedure every 4 hours and a duplicate reading every 10 samples.
4. Pour the collected water sample into a clean beaker.
5. Rinse probe with distilled water.
6. Immerse probe in sample. Record dissolved oxygen reading in the log book or data form, and record the results once the readings have stabilized.
7. Decontaminate the probe and the beaker and then cover to protect them from contamination.

For Oxidation Reduction Potential (ORP)

General

1. Following field measurements:
   - Record any problems.
   - Compare with previous data and note any large variances.
   - Clean all dirt from meter and from inside case.
   - Accuracy and precision are dependent on the instrument used. Refer to manufacturer's manual.

Calibration

The field team is responsible for calibration after the initial calibration. Calibrate unit before initial daily use and at least once every 4 hours during the day. Run duplicate samples once every 10 samples, rinsing with distilled water between duplicate samples.

1. Record make, model, and serial number of redox meter in logbook or on field data form.
2. Rinse probe with distilled water.
3. Note standard information on Zobell solution in the field logbook (date opened, lot number, expiration date).
4. Place clean, dry probe in Zobell solution.
5. Note meter reading of the Zobell solution in logbook along with expected solution reading and time of measurement.
6. Rinse probe with distilled water.

Procedure

1. Check batteries before going into the field and perform the initial daily calibration.
2. Calibrate meter using calibration procedure every 4 hours and a duplicate reading every 10 samples.
3. Rinse probe with distilled water.
4. Immerse probe in sample. Record the oxygen reduction potential reading on the field form or in logbook.
5. Decontaminate probe and beaker, and then cover to protect them from contamination.

For Turbidity

Calibration

Most meters have an auto calibration function. Follow the manufacturer's instructions to calibrate instrument. Calibrate unit before initial daily use and at least once every 4 hours during the day. Run duplicate samples once every 10 samples, rinsing with distilled water between duplicate samples.

Most turbidity meters take measurements by sending a beam of light through the sample in a small tube in the meter and measuring the refracted light to determine turbidity. The most common cause for a meter not to calibrate is that the glass in the turbidity meter tube becomes dirty and generates false readings. Use a cotton swab or similar and soap to clean the inside of the meter tube, and then rinse with distilled water.

Record make, model, and serial number of turbidity meter in logbook or on a field data form.

Procedure

1. Decontaminate and clean turbidity probe.
2. Check batteries before going into the field, and perform the initial daily calibration.
3. Calibrate meter using manufacturer's guideline every 4 hours, and take a duplicate reading every 10 samples.
4. Collect a representative sample of liquid, and place it in a clean beaker.
5. Place probe into sample as soon as it is collected. Move probe slightly, stirring sample to prevent settling. Record reading after reading has stabilized.
6. Decontaminate probe and beaker.

Key Checks / Items

1. Check battery.
2. Check calibration.

3. Clean probe with distilled water when done.
4. When reading results, note sensitivity settings.

FIELD SOP 4

Drilling and Sampling Using Direct Push Techniques

Purpose

The purpose of this statement of procedure (SOP) is to provide a general guideline for soil sampling using the direct-push drilling technique.

Scope and Applicability

This SOP covers how to obtain soil samples using the direct-push sampling system for geotechnical exploration. It applies to all environmental contractors and specific projects conducted to support this program.

Refer to the specific requirements of the project in the Work Plan/Sampling Plan (WP/SP) when using this SOP during field activities.

General Description

A direct push soil sampling system consists of a sample collection tool (sample barrel) with a removable inner butyl liner, hollow extension rods for advancement, retrieval, and transmission of energy to the sampler, and an energy source (usually the Rig or hammer) to force sampler penetration. To advance the sample barrel, a driving force is applied to the above ground portion of the sampling assemblage until it has been advanced to the desired depth.

Example Equipment / Materials

- Appropriate PPE
- Clean plastic liner
- Nitrile gloves
- Duct tape
- Sampling jars
- Carpet knife
- Field notebook
- Garbage bags
- Decontamination solution and equipment.

Procedures / Guidelines

Preparation

1. Wear appropriate personal protective equipment (PPE), as required by the health and safety plan.
2. Confirm the drill location with either a map or GPS instrument.
3. Locate and document all pre-surveyed buried and above ground utilities.
4. Evaluate site for any potential hazards concerning the work area, the drill rig, maneuverability of the drill rig mast, the drilling location and associated activities. Contact the field team lead if a potential hazard is identified.
5. Stabilize the drill rig over the location to be drilled.
6. Ensure that the drill rig mast has clearance to be raised into position. Raise the drill rig mast.
7. Identify and set up sample processing area

Soil Sampling

1. Advance the extension rods with a sampler attached for the length of the capacity of the sampler. A new sample barrel is inserted for each increment of depth. Additional extension rod sections may be necessary to advance the sampler to the desired depth.
2. Once the sampler has been completed through the sampling interval, remove the sampler.
3. Log soil sample:
   a. **If no analytical sample is to be taken:** If the sample interval is not going to be analyzed at a laboratory, take a utility knife with a hook-edge attachment and split the butyl liner (if a butyl liner is used). Log the soil sample in accordance with *SOP Soil Classification and Logging* and collect a representative sample of the split spoon for headspace analysis if samples are to be analyzed for volatile organics (see Step 4 below).

   b. **If an analytical sample is to be taken:** Take a small portion of soil from the open end of an uncut liner decontaminated spoon, and put the sample into a headspace container (see Step 4 below). If there is not enough soil for the laboratory and a headspace sample, then omit the headspace sample and make a note on the field book. Log soil sample in accordance with *SOP Logging of Soil Borings*.
4. Prepare the analytical sample:
   a. **Prepare the analytical sample when sampling with a butyl liner:** While in the

field, cut the liner into two 2-foot lengths. Seal the open ends of the liner with a Teflon® cap and use Teflon tape to seal the cap to the liner. Apply the sample labels to each length of liner. Put each pair of capped liners in a zip-lock bag and seal the bag. Immediately place the samples in a cooler with ice. Do not leave the sample exposed to the sun or extreme temperatures.

   b. **Prepare the analytical sample when not sampling with a butyl liner:** Use a decontaminated spoon and place a representative portion of the entire sample length in each sample container. Tightly pack the sample and screw on the container lid. Immediately place the samples in a cooler with ice. Do not leave the sample exposed to the sun or extreme temperatures.

5. Perform headspace analysis on a representative sample in accordance with the WP/SP. Taking a PID or FID reading from soil that has been placed in a separate container (either a glass jar or zip-lock bag) will do headspace screening. When filling the container make sure to leave room at the top for the headspace reading. Use a consistent amount of soil volume in each container. Do not compact the soil.

   a. **Option 1 (glass jar):** After filling, immediately replace the jar cap to prevent the loss of volatiles and wait 5 minutes. If the ambient temperature is less than 50°F, move the sample into a warm place (>50°F) and let the sample equilibrate for 5 minutes. After 5 minutes, unscrew the cap and lift one end off the jar just high enough to allow the probe of the FID or PID to enter the opening. Watch the instrument's response, and record the highest reading in the field notebook or field form. Discard the sample.

   b. **Option 2 (glass jar):** <u>This option is recommended if headspace readings are being done in a windy environment</u>. Follow the steps outlined in Option 1, except after filling the jar, and cover the jar top with a single layer of aluminum foil before screwing the cap on. When taking the headspace reading, unscrew the cop while leaving the foil in place, insert the PID/FID probe end through the foil into the headspace of the jar, and take the reading. Discard the sample.

   c. **Option 3 (zip-lock bag, recommended method):** <u>This option is recommended to minimize the volume of investigation-derived waste and reduce bottle costs. It is also effective in windy environments</u>. Follow the steps outlined for Options 1 or 2, but place the soil in a zip-lock bag and seal. Take the reading by breaking the zip-lock bag seal just enough to insert the probe of the PID/FID, inserting the probe, and recording the result. Discard the soil and bag.

6. Decontaminate all sampling equipment and media transfer tools before using them to collect another sample.

7. Decontaminate the sample barrel and other sampling assemblage that came in contact with the soil during sample collection before collecting another sample.

8. Record sample description, depth, percent recovery, sample ID, and time and date of sampling in field notebook.

Investigation Derived Waste (IDW)

All IDW should be contained in accordance with approved Work Plan and applicable regulations. Refer to *SOP Handling and Disposal of Investigation-Derived Waste*.

Drill Hole Abandonment

All drilled holes should be abandoned in accordance with approved Work Plan and applicable regulations.

Key Checks / Items

- Wear appropriate personal protective equipment.
- Screen headspace around the DPT hole for volatile organic vapors and other gases through out the duration of sampling
- Prepare, seal, and label all sample jars and containers and put on ice immediately after sampling.
- Make sure the drillers properly decontaminate the sampling assemblage between sample collections.

References

American Society for Testing and Materials (ASTM) Standard D6282-98, *Standard Practice for Direct Push Soil Sampling for Environmental Site Characterizations*.

FIELD SOP 5

Surface Water Sampling – General Procedures

Purpose

This technical practice provides general guidelines for surface water sampling.

Scope and Applicability

This technical practice covers the general surface water sampling technique, including standard surface water sampling procedures and equipment. Surface water sampling procedures are provided in other technical practices for trace metals (*Clean Sampling for Trace Metals)*, field filtering (*Field Filtering*), and volatile organic compounds (*Surface Water Sampling - VOC*). Site-specific details are discussed in related sections of each field-sampling plan. Refer to the specific requirements of the project in the Work Plan/Sampling Plan (WP/SP) when using this SOP during field activities. The depth for collecting surface samples will be described in the WP/SP.

Surface water samples will be collected from the upper part of the water column using a grab-sampling device (Van Dorn, Niskin, or comparable bottle grab sampler) or by using a dip-sampling method.

Example Equipment / Materials

- Decontaminated polyethylene or glass sample containers to be used for field parameter measurements
- Sample bottles, sample labels, and chain-of-custody forms
- Appropriate field instruments (typically thermometer, pH meter, and conductivity meter—refer to the specific field sampling plan for details)
- Paper towels or Kimwipes
- Cooler with ice
- Field notebook and waterproof and permanent markers
- Appropriate sampling equipment and sample bottle decontamination equipment

Procedures / Guidelines

Refer to the WP/SP for specifics (e.g., sampling depth) of sample collection. Sampling procedures are as follows:

1. Order of Station Sampling:

   - When river sampling, field personnel should always start downstream and work upstream to avoid contaminating unsampled areas with the river sediment suspended as a result of working in the river. When using a mechanized vehicle, additional care must be taken not to disturb sediments before sampling.

   - If sampling is to occur in a standing water body without a current (such as a water impoundment), the field team must take care to minimize the amount of sediment that is disturbed.

2. Decontaminate all field sampling equipment, sampling containers, and field instruments before use (see *Field Equipment Decontamination - Procedures*).

3. Calibrate all field measurement equipment before use. (See the technical practice for the instruments to be used.)

4. Sample collection will be done by either using a grab-sampling device (Van Dorn, Niskin, or comparable sampler) or by using a dip-sampling method. The procedures for the equipment operations for these two methods are described below.

   - Grab sampling devices, such as Van Dorn or Niskin, are fairly similar in general operation. The Van Dorn can be deployed in either the horizontal or vertical configuration. The advantage of the horizontal configuration is that a very narrow depth sample is collected, whereas the vertical configuration ensures that the water within the open bottle has been flushed during deployment.

     Before lowering the sampler into the water, the rope should be marked along its length so that the field crew will know the sampler's depth. These markings can be done with Sharpies, tape, or flagging. The length interval between marking depends upon the depth of deployment. A weight should be tied to the bottom of the rope to ensure that the sample remains in the correct configuration. The rope is then clamped to the sampler at least 3 feet above the weight, and the drain valve on the sampler is closed. The two end seals are then cocked in the open position. The trigger configuration of the open-end seals should be tested before deployment. The loose end of the rope should be tied to ensure that the sampler is not lost during deployment.

     Deployment consists of lowering the sampler by rope to the desired depth and sending a trigger mechanism, called a messenger, down the rope to close the end seals on the sampler. Successful closure can be felt as a vibration through the rope. Slowly pull the sampler back to the surface and place it in a secure stand to prevent it from tipping. The top end seal should be propped open, and the water sample allowed to run through the drain valve to purge it. Samples can then be taken through the drain valve by pushing the valve open and pulling it closed.

   - A dip sampler usually consists of a sample container attached to the end of a pole using an adjustable clamp. The length of the pole depends on the required sampling depth. A telescoping pole can be used.

Dip sampling can be done by hand if conditions (i.e., sample depth, health and safety concerns) are appropriate. Gently sweep the surface of the water with an oar or similar device to remove the surface microlayer from the area to be sampled. Submerge the dip sampler to the desired sample depth. Submerge the sampler very slowly to minimize surface disturbance. Allow the sample container to fill slowly. Retrieve the sampler with minimal surface water disturbance. Transfer the water sample into the appropriate sample collection bottle. Fill the bottle slowly to minimize turbulence. Repeat the sample collection steps until all sample collection bottles are filled and field measurements have been completed. The sample container used to collect the water can be one of the sample collection bottles for that station. Ensure that the sample container used for collection has not been pre-preserved.

5. When collecting the sample, immerse a clean sampling apparatus with the opening facing upstream (as applicable) to collect sample volume. Immerse the apparatus gently into the water to avoid turbulence while filling it. Confirm sampling depth for surface water samples with specific requirements listed in the WP/SP. Typically, the sampling apparatus should be in the top 3 feet of the water column but below the surface when the sample is collected in flowing water bodies and at the one-third point in the water column in a non-flowing water body. Avoid collecting floating surface debris or disturbed bottom sediment in water sample.

6. Pour the sample into properly labeled sample vials and bottles taking care not to wash out the sample preservatives. For VOC samples, gently transfer water from sampling apparatus into sample vials, avoiding turbulence and formation of bubbles in sample vial. After filling to top with a visible convex meniscus, immediately cap vial taking care not to entrap air bubbles in vial. If vial has air trapped inside (visible as bubbles), discard vial and restart the filling procedure with a new vial. See the Field SOP Volatile Organic Sampling for further detail.

7. Collect the appropriate QC samples, as specified in the WP/SP.

8. Perform field analyses for the location as specified in the Quality Assurance Project Plan or WP/SP. Field analyses might include temperature, pH, specific conductance, salinity, turbidity, and dissolved oxygen.

9. Decontaminate all equipment between locations following Field SOP Field Equipment Decontamination.

10. Note in the field logbook any characteristics of the sample such as color or odor, and also note any observations of the station conditions such as weather and water conditions (e.g., "choppy"), amount and type of debris, odor, color, station offset, boat activity, and current.

Key Checks / Items

- Avoid suspending sediment when sampling by moving from downstream to upstream. Avoid sampling areas with observed suspended sediment.

FIELD SOP 6

Scoop Sediment Sampling

Purpose

This technical practice describes collecting and handling sediment samples during field operations using sediment scoop samplers.

Scope and Applicability

This sediment sampling procedure is applicable to collecting representative surficial sediment samples using a sediment scoop sampler. Refer to the specific requirements of the project and sample handling procedures described in the Work Plan/Sampling Plan (WP/SP) and Quality Assurance Project Plan (QAPP) when using this SOP during field activities.

Example Equipment / Materials

- Scoop sediment sampler
- Stainless steel spoon or spatula for sediment sample transfer
- Stainless steel bowls or pans
- Measuring tape
- Logbook and waterproof and permanent marker
- Personal protection equipment (rubber or latex gloves, boots, hip waders, etc.)
- Samples bottles
- Cooler with ice
- Paper towel or Kimwipes

Scoop Sediment Sampler

A scoop sampler consists of a glass jar, an HHPE wide-mouth jar, or a stainless steel scoop, typically clamped to a pole. The pole may be made of wood or plastic and be either fixed length or telescoping. If the water body can be sampled from the shore or if it can be waded into, the easiest and "cleanest" way to collect a sample is to use the scoop sampler because it reduces the potential for cross-contamination. This method is performed by reaching over or wading into the water body and, while facing upstream into the current, gently lowering the scoop into the water until it is resting on the substrate. Ensure that the area upstream, which is to be sampled, is undisturbed. In a single, smooth action, sweep the scoop sampler along the bottom, moving it upstream and then out of the water column. Do not return the scoop to the to collect additional sample volume from the same location until the collected sample is removed from the scoop.

When performing replicate sampling for additional volume, avoid sampling areas previously sampled.

The scoop sampler method is very effective in shallow water environments (less the 1-foot deep) and when collecting for small volumes of sample. The scoop sampler method is also very effective in areas that have small pockets of sample material, such as pockets of sand on a cobble beach. It is very difficult not to disturb fine-grained materials at the sediment/water interface. It is usually effective in fine grain substrates and only samples the top 3 to 5 centimeters.

Typical Procedures / Guidelines

1. Make a sketch of the sample area, showing nearby features and permanent structures that can be used to locate the sample points on a map. Whenever possible, include measured distances from such identifying features. Include depth and width of waterway, rate of flow, type and consistency of sediment, and point and depth of sample removal (e.g., along shore, mid-channel).
2. Start downstream and work upstream to prevent contamination of unsampled areas.
3. Collect the sediment sample using the appropriate sampling method as described in the WP/SP.
4. Ensure that all field observations are recorded completely and correctly. After the sample is judged acceptable, the following observations should be recorded:
    - Station location indicated on the GPS instrument
    - Station depth
    - Gross characteristics of the sediment
        - Texture
        - Color
        - Biological structures (e.g., shells, tubes, macrophytes)
        - Presence of debris (e.g., wood chips, wood fibers, human artifacts)
        - Presence of oily sheen
        - Odor (e.g., hydrogen sulfide, oil, creosote)
5. Before sub-samples of the surficial sediments are taken, the overlying water must be removed. The preferred method of removing this water is by slowly siphoning it off near one side of the sampler. This can be done using a peristaltic pump, or in a similar siphoning-type device. Methods such as decanting the water or slightly cracking the grab to let the water run out are not recommended, as they may result in unacceptable disturbance or loss of fine-grained surficial sediment and organic matter.
6. Once the overlying water has been removed, the surficial sediment can be sub-sampled.

When sub-sampling surficial sediments, unrepresentative material should be removed in the field and noted on the field log sheet.

7. Transfer sample into sample jars as specified in the WP/SP and QAPP using a stainless steel spoon or utensil. Never touch the sediment sample because gloves may introduce organic contamination into the sample.
8. Fill out necessary chain-of-custody forms.
9. Decontaminate all sampling implements and protective clothing according to prescribed procedures.

Key Checks / Items

- Start downstream, work upstream.
- Log exact locations using permanent features.
- Work safely. Beware of hidden hazards under the water.

FIELD SOP 7

Installation of Permanent Soil Gas Sampling Implants

This procedure is recommended as a practical approach for installation of permanent soil gas implants where the intent is to collect shallow soil vapor samples. This SOP should be used where its application is consistent with the project's data quality objectives and in conjunction with CH2M HILL's SOP *Standard Operating Procedure for the Collection of Soil Gas Samples from Soil Gas Probes Using Summa™ Canisters.* Only persons trained in the collection of soil gas samples should attempt this procedure.

1. Implant/Probe System Set-up

1.1 Obtain soil gas sampling probes, such as those manufactured by GeoProbe Systems®, in sufficient quantity to carry out the assessment without delay to the sampling effort. Note: these systems and their installation can be obtained from geo-technical firms that provide direct push installation. See Figure 1.

1.2 Manufactured soil gas probes, such as GeoProbe Systems® post-run tubing (PRT) system, which are specifically manufactured for soil gas collection facilitate installation, improve sampling, are easily decontaminated between each use, and offer ease of use.

1.3 This technique can only be used in the vadose zone, not below the water table.

1.4 Several screen lengths are available (6″, 14″, 21″) but for discrete intervals required in Vapor Intrusion investigations, a 6″ screen is recommended.

1.5 It is necessary to coordinate the hardware (i.e. size of tubing, fittings, sampling interface assembly, etc.) that mates the soil gas probe sampling line to the sampling system (i.e. Tedlar bags, Summa canisters, etc.). This step is critical to achieve a leak free system. All connections should be inert gas tight compression fittings (i.e Swagelok® or equal) and all sample transfer lines should be made of Teflon® tubing.

1.6 Prior to installation of gas probes at a given location a utility survey must be completed, the necessary permits acquired, and in the case of private property - permission granted.

1.7 The soil gas probes must be decontaminated prior to use. Steam cleaning is the preferred method of decontamination. Once decontaminated, the probes must be shown to be free of contaminates. As a minimum, a suitably sensitive organic vapor meter should be used for this purpose. Any probe that does not pass decontamination should not be used.

1.8 Handle and store decontaminated soil gas probes in a manner that prevents contamination.

1.9 Inspect each gas probe assembly for ware and faulty parts. Replace probe tips, o-rings, adapters, and probe rods as needed.

2. Implant Installation

2.1 Assemble the drive point holder, implant anchor/drive point, and drive rod. Drive the rod to the desired depth. Be sure that the final depth of the drive point includes extra depth to include length of the screen. (i.e. for 5′ BGS with a 6″ screen, push the probe to 5′6″). Do not disengage the drive point at this time.

2.2 Attach the ¼″ Teflon tubing to the implant. Use enough tubing so that at least 2′ will be left above ground. Plug the exposed end of the tubing with a cap.

2.3 Remove the drive head and thread the implant and tubing down the inside of the drive rod. Once the implant reaches the drive point, turn the tubing counterclockwise with a gentle downward force to thread the implant into the drive point/anchor. Test that the implant is seated by gently pulling up on the tubing. It is very important to be sure that the implant is seated before moving on to the next step.

2.4 Retract the drive rod 12″ while pushing down on the Teflon tubing. This is to be sure that as the rod is being removed, the anchor/drive point and implant stay at depth.

2.5 Thread the tubing through a funnel and place the funnel on top of the drive rod. Determine the volume of glass beads needed to fill the space around the implant plus an additional 6″ space above the implant. Remove the cap placed over the end of the tubing. Pour the beads into the funnel and down the inside diameter of the drive rod. Use the Teflon tubing to stir the glass beads and ensure they make it all the way down to the bottom. Do not pull on the tubing. Note: Failure the remove cap over end of tubing can result in bridging of glass beads (due to air displacement issue) and therefore an insufficient filter pack around screen. See Figure 2.

2.6 Lift the drive rod up an additional 18″ to 24″ and pour in the bentonite seal mixture. The mixture is 25% glass beads and 75% powdered bentonite clay (hi-yield type). It takes approximately 154 mls of this mixture per foot. At least 2 feet of the mixture are recommended to adequately seal the hole and prevent contribution from ambient air during sampling. Pour 50 mls of water down the drive rod to initiate the bentonite seal.

2.7 Replace cap over end of tubing. Pull the drive rod the rest of the way out of the ground and fill the remaining hole to about 1′ from the ground surface with either bentonite or cement.

2.8 Enlarge the hole and install the flushmount so that it is flush with the ground surface. Coil the extra tubing inside the enclosure and cover.

2.9 Wait at least 24 hours before sampling.

2.10 When calculating dead volume, use the internal volume of the Teflon tubing, the internal volume of the implant, and the volume of the glass bead pack (assume 30% porosity).

2.11 The ground surface shall be replaced and repaired to original condition.

Figure 1 – Installed GeoProbe Implant

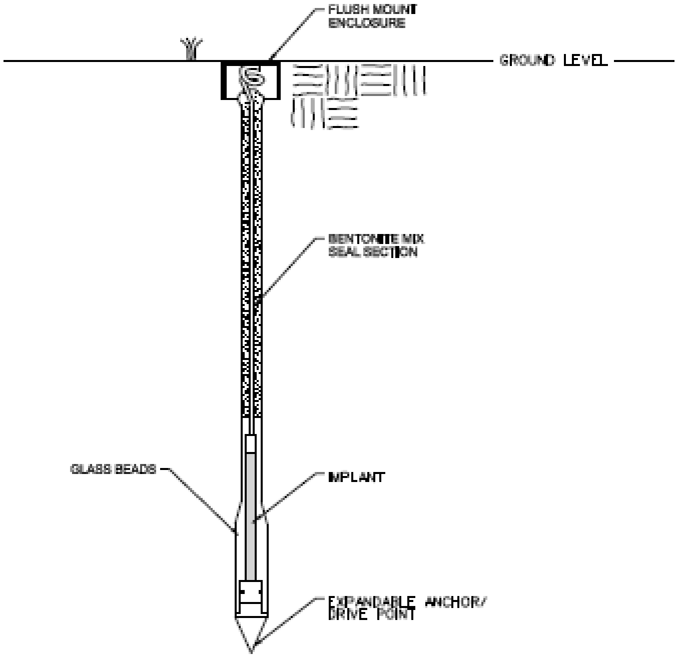
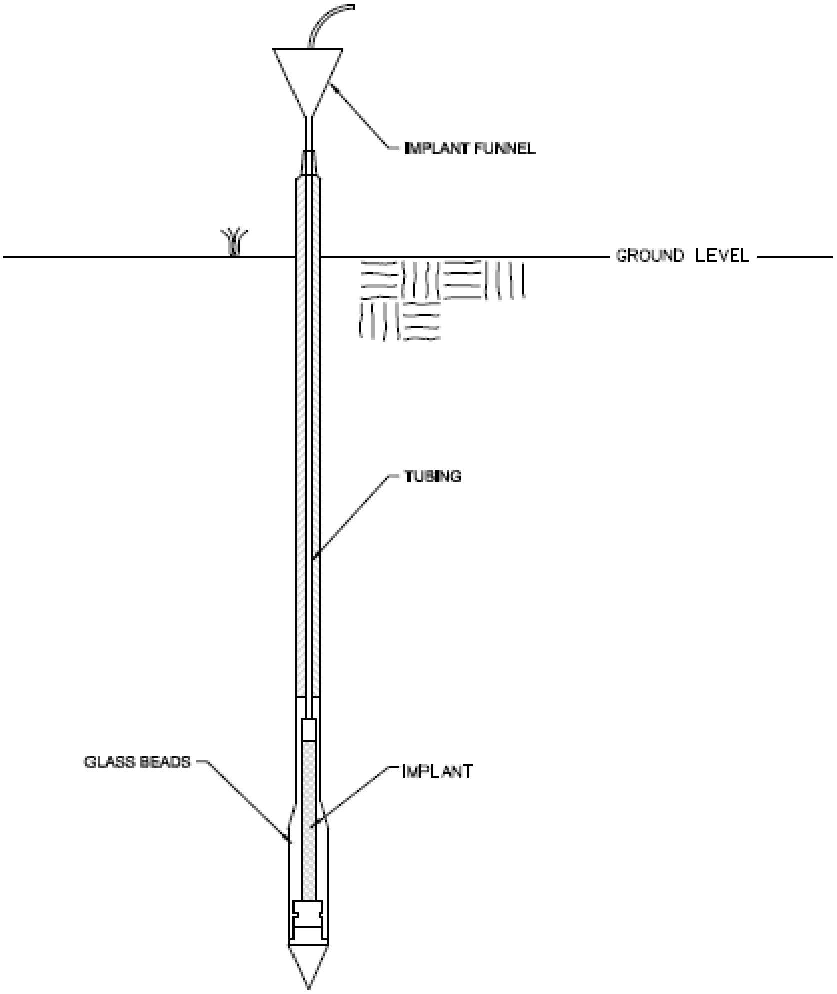


Figure 2 – Adding glass beads to the GeoProbe Implant



FIELD SOP 8

Collection of Soil Gas Samples from Soil Gas Probes (GeoProbe System - PRT) using SummaTM Canisters and a Helium Leak Check

This procedure offers a practical approach for the collection of soil vapor samples from GeoProbe Systems (or equal) direct push soil gas probes (with PRT adapters) into Summa canisters. Soil gas sample integrity is verified by using a real time helium leak checking procedure. This SOP should be used in conjunction with CH2M HILL's SOP: "Standard Operating Procedure for the Installation of Shallow Soil Gas Sampling Probes" and when its application is consistent with the projects data quality objectives. It is the responsibility of the project team to make sure this procedure meets all applicable regulatory standards and receives approval/concurrence from the leading regulatory agency for the project. Only persons trained in the collection of soil gas samples should attempt this procedure.

1. System Set-up

1.1 Acquire all the necessary hardware and sampling equipment shown in Figure 1.

1.2 Assemble or obtain the necessary fittings and vacuum gauge to create a soil gas probe and sampling manifold shown in Figure 1. This manifold must be clean, free of oils, and flushed free of VOCs prior to use. Note: use only gas tight fittings such as Swagelok or equivalent. Be sure to place the helium leak check enclosure over the probe, and push the sample tubing through the hole in the cap before attaching the sampling manifold.

1.3 Adjust the purge system evacuation pump sampling rate to achieve the desired flow rate of 150 milliliters /min. This should be performed at the outlet of the vacuum pump prior to purging, either by use of a suitable flowmeter or determining the amount of time required to fill a 1 liter Tedlar bag.

1.4 Summa canisters are pre-evacuated by the laboratory. In some cases (i.e. project specific QA) the vacuum will need to be verified in the field prior to use. This is accomplished with a vacuum gauge and instructions supplied by the laboratory.

1.5 Flow controllers (if used) should come pre-set by the laboratory to sample at a pre-determined rate based on specific project requirements (see Table 1 for the most common options). Verify the flow controller flowrate setting (indicated on the tag). In some cases (i.e. project specific QA) the flowrate will need to be verified in the field prior to use. This is accomplished with a bubble meter, vacuum source, and instructions supplied by the laboratory.

2. System Leak Checking & Purging

2.1 Make sure the sampling system is assembled (as shown in Figure 1). The leak check enclosure is placed over the sample probe prior to connection of the sample line to the sampling manifold and the purge system. ***Do not connect the canister at this time***.

2.2 ***Physical Leak Check*** - Perform a leak check of the sample manifold system by:

- 2.2.1 Making sure the gas probe valve (valve #1) is closed and the sample valve (valve #2) is open.
- 2.2.2 Open the purge valve (valve #3) and start the purge pump. Verify that the flow is set to 150 ml/min.

2.2.3 Close the sample valve (valve #2) and achieve a vacuum gauge reading of 10 inches of Hg or to a vacuum that will be encountered during sampling, which ever is greater.

2.2.4 A leak free system will be evident by closing off the purge valve (valve #3), turning of the purge pump, and observing no loss of vacuum within the sampling manifold system for a period of 30 seconds. Repair any leaks prior to use.

2.2.5 Record the leak check date and time on the field sampling log.

2.3 ***System Purge and Helium Leak Check*** -A purge of the soil gas probe and sampling manifold system is required. The helium leak check procedure is also performed during this step. This is accomplished by:

2.3.1 Where the ground surface is soft, the helium leak check enclosure is pressed down slightly into the ground surface. In situations where the ground surface is hard (e.g. asphalt), apply a slight downward pressure to achieve a build up of helium in the leak check enclosure.

2.3.2 Start the flow of helium into the side of the leak check enclosure at 200 ml/min. Let the helium fill the enclosure for a couple of minutes.

2.3.3 Turn the helium leak detector on and make sure that the detector is not giving a helium reading before starting the purge. Place the probe of the helium detector in the exhaust port of the flow meter.

2.3.4 Purging is carried out by pulling soil gas through the system at a rate of between 150 milliliters /min for a time period sufficient to achieve a purge volume that equals at least 3 dead volumes (internal volume of the in ground annular space, sample line, and sampling manifold system).

2.3.5 Open the sample valve (valve #2) and the purge valve (valve #3) and start the purge pump. Verify that the flow rate is still 150 ml/min.

2.3.6 To start the soil gas probe purge, open the gas probe valve (valve #1) and close the sample valve (valve #2) at the same time, and start timing.

2.3.7 During the purge, observe the helium detector for indication of soil gas probe leakage (e.g. infiltration of ambient air into the probe). If a helium reading of >1% is observed, then the probe leak check has failed and corrective action should be taken. This includes first checking the fittings and connections and trying another purge and leak check. It may also result in removing the soil gas probe and re-installing it in a nearby location.

2.3.8 If the vacuum gauge reads >15" during the purge, then close the purge valve (valve #3) and monitor the vacuum in the manifold and probe. If there is no significant change after a minute, then there is the lack of a significant amount of soil gas and the vacuum is too great to take a soil gas sample. Several things can cause this. Consult with the project manager and take corrective action.

2.3.8.1 The soil formation is too 'tight' (i.e. high clay or moisture content). Try a different depth or location

2.3.8.2 With a GeoProbe style probe system, the expendable tip may not have released when the probe was retracted. Try retracting the probe a little further, or using a long thin rod to poke the tip loose.

2.3.8.3 If water is visible in the flexible soil gas tubing, stop the purging immediately. It is not possible to take a soil gas sample at that depth or location.

2.3.9 At the end of the pre-determined purge time (usually around a couple minutes) and after the system is verified to be leak free, close the purge valve (valve #3).

Do not open it again. Doing so will result in loss of the purge integrity and requires re-purging. Turn off the helium leak detector.

2.3.10 Record the purge date, time, purge rate, leak check result, and purge volume on the field sampling log.

2.3.11 Immediately move on to the sampling phase. Little to no delay should occur between purging and sampling.

3 Sampling

3.1 The Summa canisters are certified clean and evacuated by the laboratory to near absolute zero pressure. Care should be used at all times to prevent inadvertent loss of canister vacuum. ***Never open the canister's valve unless the intent is to collect sample.***

3.2 Attach the canister to the flow controller and then connect the flow controller to the sample valve (valve #2) on the sampling manifold.

3.3 Before taking the sample, confirm that the sampling system valves are set as follows: 1) the purge valve (valve #3) is confirmed to be closed, gas probe valve (valve #1) is open, and 2) the sample valve is (valve #2) is open.

3.4 Slowly open the canister's valve approximately one full turn.

3.5 After sampling for the appropriate amount of time (determined from project instructions, see Table 1), close the sample valve (valve #2) and the canister's valve. Remove the canister from the sampling manifold.

3.6 Record the sampling date, time, canister ID, flow controller ID, and any other observation pertinent to the sampling event on the field sampling log.

3.7 Fill out all appropriate documentation (sampling forms, sample labels, chain of custody, sample tags, etc.).

3.8 Disassemble the sampling system.

4 Sample Handling and Shipping

4.1 If shipping is required, pack the sample canisters in a rigid wall shipping container such as a cooler or heavy duty cardboard box (ice is not required). Never pack the cans with other objects or materials that could cause them to be punctured or damaged.

4.2 Place a custody seal over the openings to the shipping container.

4.3 Ship immediately to the laboratory for analysis.

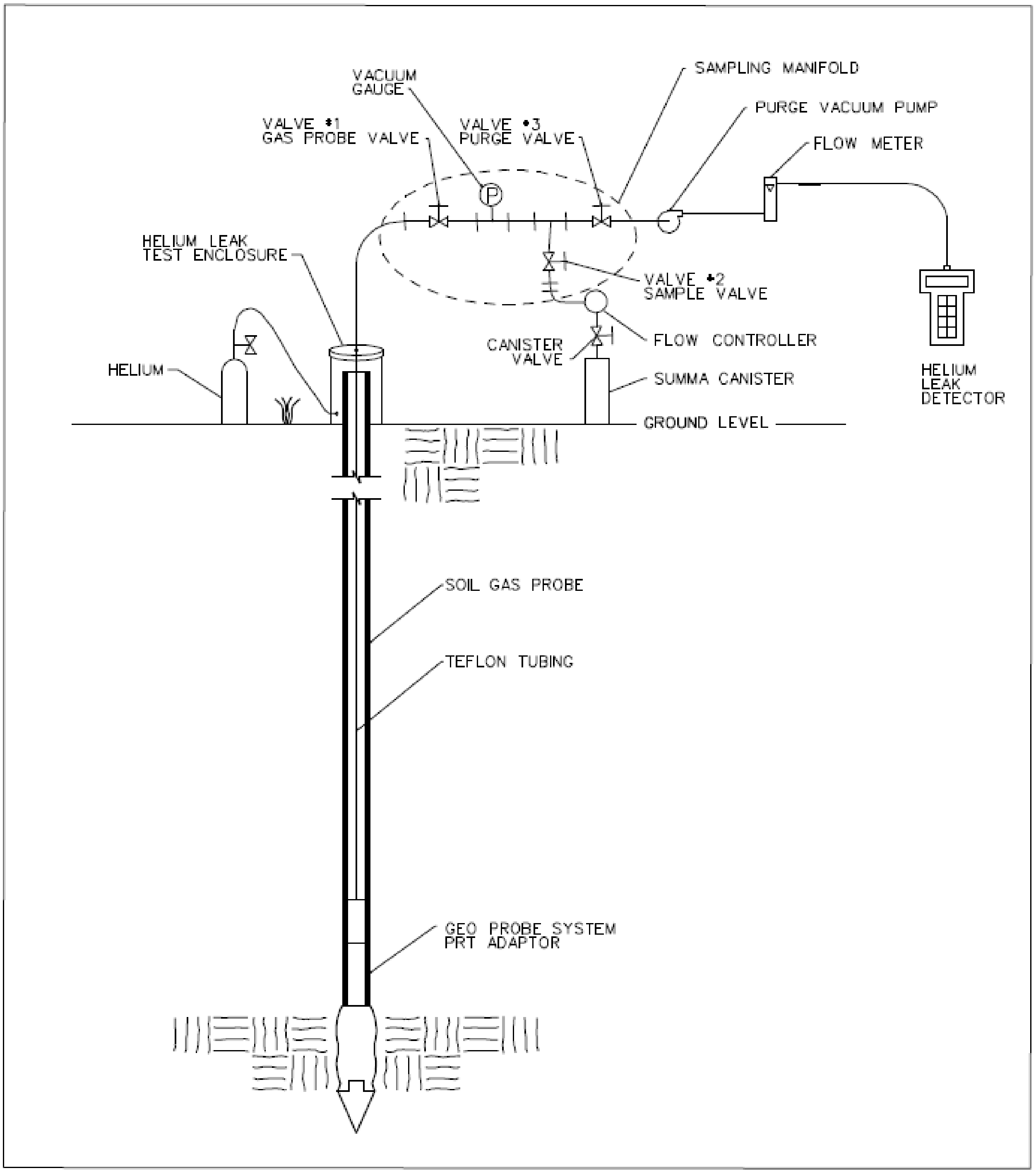
Table 1 – Common Sampling Rates for Soil Gas Sampling

Can Size	Length of sampling time	Sampling Flow Rate (ml/min)
6 Liter	1 hour	90
6 Liter	8 hours	11.25
6 Liter	24 hours	3.75

1 Liter	5 minutes	180
1 Liter	1 hour	15
850 ml	5 minutes	150
850 ml	1 hour	12

Figure 1

Soil Gas Sampling System


VACUUM GAUGE
SAMPLING MANIFOLD
PURGE VACUUM PUMP
VALVE #1 GAS PROBE VALVE
VALVE #3 PURGE VALVE
FLOW METER
P
HELIUM LEAK TEST ENCLOSURE
VALVE #2 SAMPLE VALVE
FLOW CONTROLLER
CANISTER VALVE
HELIUM
SUMMA CANISTER
HELIUM LEAK DETECTOR
GROUND LEVEL
SOIL GAS PROBE
TEFLON TUBING
GEO PROBE SYSTEM PRT ADAPTOR

CH2MHILL *Applied Sciences Laboratory*

Indoor Vapor Intrusion Assessment
Soil Gas Sampling Field Log

Sheet _ of _

Project Info

Project Name:
Project # :
By:
Date:

Structure

Identification:
Address:
Sample Location type:

☐ concrete slab on grade
☐ concrete footing w/crawl space
☐ basement
☐ Yard or Driveway
☐ other (describe)

Soil Gas Sampling System

Probe type (describe):

Probe to sample interface system (describe):

Sample collection type: ☐ Syringe ☐ Tedlar bag ☐ Summa canister

Other info (describe other aspects)

Soil Gas Probe Purging & Sampling Log

Sample location (show in diagram)	1	2	3	4
Sample Identification (field ID)				
Time Installed				
Depth of installed probe (feet bgs)				
Leak check (probe/sampling interface)				
Calculated dead volume (1 purge volume), cc				
Purge rate, cc/min.				
Purge duration, min.				
Purge vacuum, " Hg				
Max PID Reading, ppmv (optional)				
Purge completed (time of day)				
Sampling period started (time of day)				
Sampling rate, cc/min				
Sampling vacuum, " Hg				
Sampling period ended (time of day)				

Observations and Comments:

FIELD SOP 9

Sample Management

Purpose

The purpose of this standard operating procedure is to describe the daily sample management procedures.

Scope and Applicability

This technical practice describes the procedures for producing and carrying out the following activities:

- Label printing
- Chain of custody
- Bottle tracking
- Shipping
- Sample tracking
- Management of electronic field instrument
- Field note management

Refer to the specific requirements of the project in the Work Plan/Sampling Plan (WP/SP) when using this SOP during field activities.

Example Equipment / Materials

- Labels
- Copier
- Computer/printer
- Bottles/coolers
- Federal Express shipping forms
- Copies of field notebooks
- Binders

General Procedures/Guidelines

Each day the Field Team Lead shall perform the following functions:

- Check the sample list against the number of bottles available.

- Track the number of sample bottles available. If the bottle supply is low, notify the Project Chemist to place a new bottle order.

- Provide labels to the sampling teams.
- Provide Baggies, ice, sample bottles, and coolers to the sampling teams.
- Pack and ship all samples, with help from the other field team members if needed.
- Print a chain-of-custody form for each cooler (grouped by shipment) and verify the form's accuracy.
- Place each Federal Express Airbill in a binder in a folder in a secure location.
- Print a schedule of sample activities for the next sampling day.
- Enter all samples collected during the day into the Sample Tracking Spreadsheet.
- Notify the labs of deliveries, either by phone or e-mail.

Sample Packing and Shipping

Procedures / Guidelines

Samples shall be under COC protocols at all times. COC protocols shall include restricted access to all sample containers, and samples before, during, and after sample collection. Sampling materials that are not in the direct possession of a project team member shall be locked or sealed in a secure area to prevent tampering. After the samples have been collected, proceed with sample shipment preparations. Samples with analyses that have short holding times shall be shipped with in time to meet hold time requirements identified in the WP/SAP. The steps for shipping samples are as follows:

1. If the shipping cooler is equipped with drain holes, tape holes shut with duct tape, inside and out.
2. Place mailing label on lid of cooler, and cover with clear protective tape.
3. Fill bottom of cooler with preformed poly foam wrap, bubble wrap, or other temperature and shock insulating material.
4. Examine each sample bottle. Each sample container should be decontaminated according to Field SOP, *Field Decontamination Procedures*. Make sure that each bottle is appropriately labeled with the sample date and time, analysis, and sampler's initials and that the bottle caps are securely fastened. Cover the label with clear protective tape, completely encircling the bottle.
5. Place each bottle or group of bottles inside plastic zip-lock bags and seal bags.
6. Arrange bottles inside the cooler so they do not touch.
7. List all samples packaged inside cooler on the COC, and record sample numbers and COC number on a field sample log.

8. If ice is required to preserve the samples at 4.0° C, ice should be packaged in double zip-lock bags and placed on and around the sample containers (especially on volatile organic compound vials).

9. Fill remaining spaces with packing material to prevent contents from shifting during shipping.

10. Make sure all pertinent fields on the COC are filled out. Sign the COC and record the time and date.

11. Complete the shipping airbill. If appropriate, record the airbill tracking number on the COC form. Attach airbill or airbill receipt to the top of the sample cooler.

12. Separate the copies of the COC. Seal laboratory's copy in a zip-lock bag and tape zip-lock bag to the inside of the cooler lid.

13. Close and secure cooler lid.

14. Carefully peel custody seals from backings and place intact over lid openings, one in front and one in back. Cover seals with clear protection tape.

15. Tape cooler shut on both ends, making several complete revolutions with strapping tape. Do not cover custody seals, mailing label, or air bill with strapping tape.

16. Cooler is ready to be relinquished to the shipping carrier. Keep data user's copies of COC and shipper's copy of the airbill together. Put receipts in a binder for storage.

17. The sample data manager shall call or fax COC information to the laboratory each day that samples are shipped. The laboratory shall be provided with the airbill numbers, number of coolers, and number of samples.

Key Checks / Items

- Labels printed and verified.
- Chain-of-custody forms printed and verified.
- Samples entered into sample tracking system daily.
- Seal cooler drain holes.
- Package bottles in such a way to protect from breakage.
- Add sufficient ice (double bagged) to keep samples cool during shipment.
- Sign and date the completed COC form, and place laboratory's copies inside the cooler.
- Tape the lid shut and custody seal the cooler.
- Shipping label and airbill must be on cooler.

- Keep the user's copy of the COC and airbill together. Each day's paperwork is to be filed in a secure location.

FIELD SOP 10

Field Decontamination Procedures

Purpose

This technical practice provides guidelines for decontamination groundwater investigation equipment, sampling equipment, and monitoring equipment used in potentially contaminated environments.

Scope and Applicability

This technical practice provides a description of decontamination procedures. Refer to the specific requirements of the project in the Work Plan/Sampling Plan (WP/SP) and the Quality Assurance Project Plan when using this SOP during field activities.

Equipment / Materials

- Emergency eyewash.
- Distilled water.
- Alconox (or other detergent) and potable water solution.
- Large plastic pails, totes, or tubs for detergent and water; scrub brushes; squirt bottles for detergent and water; and plastic bags and sheets.
- DOT approved 55-gallon drum or poly tank for collection of any decontamination solvents that are used.

Procedures / Guidelines

Sampling Equipment Decontamination

Personnel wearing proper safety protection shall decontaminate all sampling equipment.

The following procedures will be utilized:

1. Wash all equipment surfaces that contacted the potentially contaminated soil or water with detergent solution, using a brush as needed to remove particulate matter and surface films.
2. Rinse with potable tap water.
3. Rinse with distilled water and air dry.
4. Wrap equipment with aluminum foil, if appropriate, to reduce the need for subsequent cleaning if equipment is to be stored or transported.

5. Collect any decontamination fluids used in a DOT-approved 55-gallon drum or other approved temporary storage container and disposal. Review Work Plan/Sampling Plan (WP/SP) for information regarding disposal of rinse waters. Follow disposal practices specified in the WP/SP.

Monitoring Equipment Decontamination

Monitoring equipment shall be decontaminated as follows:

1. Wipe all surfaces that had possible contact with contaminated materials with a paper towel wet with detergent solution. Then wipe three times with a towel wet with distilled water.
2. Dispose of all used paper towels in a DOT-approved 55-gallon drum or other approved temporary storage container.

Sample Container Decontamination

The outer surface of sample containers filled in the field must be decontaminated before being either packed for shipment or handled by personnel without dermal hand protection.

1. Wipe container with a paper towel dampened with detergent solution after containers have been sealed.
2. Then wipe container with a paper towel dampened with potable water.
3. Dispose of all used paper towels in a DOT-approved 55-gallon drum or other approved temporary storage container.

Key Checks / Items

- Clean sampling equipment, with solutions of detergent and distilled water.
- Clean monitoring equipment with solutions of detergent and distilled water.
- Clean sample containers with solutions of detergent and potable water before relinquishing them to anyone.
- Document any deviations from above procedure.

FIELD SOP 11

Investigative-Derived Waste (IDW) Handling and Disposal

Purpose

The purpose of this technical practice is to provide general guidelines for the handling and disposal of investigation-derived waste (IDW).

Scope and Applicability

This technical practice covers the handling and disposal of IDW, which are the waste materials generated during a field investigation. Some of the waste materials may be classified as hazardous waste. All investigative-derived wastes must be disposed of in accordance with local, state, and federal regulations.

Materials that may become IDW requiring proper treatment, storage and disposal include:

- Personal protective equipment, such as disposable coveralls, gloves, booties, and respirator canisters.
- Disposable equipment, such as plastic ground and equipment covers, aluminum foil, Teflon® tubing, broken or unused sample containers, sample container boxes, and tape.
- Groundwater obtained through well development, purging or sampling.
- Decontamination fluids such as spent solvent and wash water.

Procedures/Guidelines

All IDW will be handled in accordance with Federal and State Regulations, as well as any site-specific requirements. If IDW is identified as potentially hazardous waste based on analytical data, it must be segregated from IDW that will be treated as non-hazardous for further characterization.

The following IDW will be containerized in DOT approved 55-gallon drums:

- Purge water, development water, and decontamination fluids.

All IDW <u>not identified as potentially hazardous waste</u> will be managed as follows:

- Used PPE will be placed in containers or trash bags and disposed of as a solid waste in an appropriate licensed landfill.

Labeling

All IDW containers will be labeled to identify their waste status. Labels shall be obtained from the Field Team Leader. Containers being used to store/accumulate waste shall include one of the following labels:

- "Non-Hazardous Waste"
- "Analysis Pending" or "Waste Material"
- "Hazardous Waste"

Prior to affixing the label, prepare containers by wiping any residue from outer surfaces that may prevent legible and permanent labeling. Labels will include the following information:

- Type of waste
- Location from which the waste was generated
- Accumulation start date, and
- Any other information required (i.e., point of contact with phone number).

Waste Accumulation Area Management

All IDW identified as potentially hazardous will be transferred as soon as practical to a temporary storage area identified by FTL. The following requirements apply to the waste storage areas:

- Hazardous wastes and waste awaiting designation will be stored separately in the waste accumulation area.
- All containers will be stored on wooden pallets.
- Store containers in rows based on the waste stream designators.

Offsite Disposal

Off-site IDW disposal will be coordinated by CH2M HILL following applicable state and federal regulations. Arrangements will be made immediately upon completion of drilling and sampling activities to have the contracted waste handling firm remove the waste from the site. The need for waste disposal analysis (i.e., RCRA characteristics testing) will be determined as discussed with the contract waste handler prior to the onset of field events.