Daniel Eaton - 80987-Friedrichsohn Cooperage Site-RD/RA Work Plan OU-1 & Upland Source Soils in OU-3 ~COR-080987~

From: "Hurl, Brandon" <bhurl@craworld.com>
To: "djeaton@gw.dec.state.ny.us" <djeaton@gw.dec.state.ny.us>
Date: 7/10/2013 9:39 AM
Subject: 80987-Friedrichsohn Cooperage Site-RD/RA Work Plan OU-1 & Upland Source Soils in OU-3 ~COR-080987~
CC: "Cowan, Keith" <KCowan@chacompanies.com>, "Puskas, Jamie" <jpuskas@crawo...
Attachments: 080987-RPT-3-Remedial Design-Remedial Action-July9-2013.pdf

Please find attached the Remedial Design/Remedial Action Work Plan for the OU-1 and Upland Source Soils in OU-3 for the Friedrichsohn Cooperage Site in Waterford, New York for review and approval. Note that an electronic copy in CD format, two bound hard copies and an unbound hard copy will be sent via Fed Ex today.

If you have any questions or concerns regarding the attached, please do not hesitate to contact us.

RD/RA Work Plan OU-1 & Upland Source Soils in OU-3

Regards,

Brandon

Brandon Hurl, B.A.Sc. Eng..
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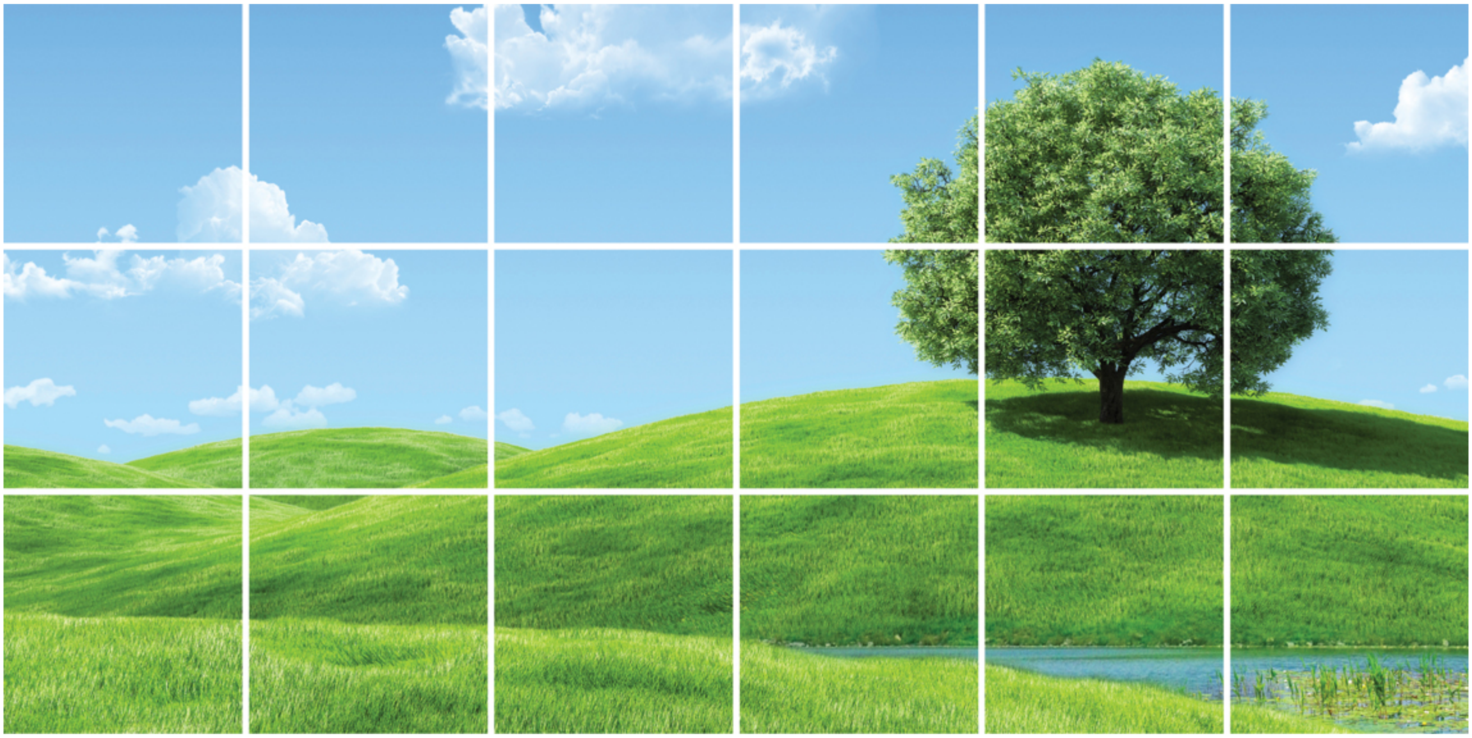

Remedial Design/Remedial Action (RD/RA) Work Plan OU-1 and Upland Source Soils in OU-3

Friedrichsohn Cooperage Site 153-155 Saratoga Avenue Town of Waterford, New York

Prepared for: General Electric Company and SI Group, Inc.

Conestoga-Rovers & Associates
651 Colby Drive
Waterloo, Ontario N2V 1C2

July 2013 • #080987
Report Number:3

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July 9, 2013 Reference No. 080987-98

Daniel J. Eaton,
New York State Department of Environmental Conservation
625 Broadway
Albany, NY 12233-7015

Dear Sir:

Re: Remedial Design/Remedial Action (RD/RA) Work Plan,
OU-1 and Upland Source Soils in OU-3,
Friedrichsohn Cooperage Site, 153-155 Saratoga Avenue, Waterford, New York

On behalf of SI Group Inc. and the General Electric Company (Companies), we have enclosed the OU-1 and Upland Source Soils in OU-3 Remedial Design/Remedial Action (RD/RA) Work Plan for New York State Department of Environmental Conservation (NYSDEC) review and approval. RD/RA Work Plan has been prepared by Conestoga-Rovers & Associates (CRA) in accordance with an Order on Consent (Consent Order) between NYSDEC and the Companies, which came effective February 7, 2013 (Index No. A5-0784-1202). The Consent Order requires the Respondents to prepare a RD/RA Work Plan for OU-1 and for the upland source soils in OU-3 at the Friedrichsohn Cooperage Site in Waterford, New York.

The Work Plan is being submitted in electronic (PDF) format and hard copies.

Please note the RD/RA Work Plan for the OU-3 Sediments is under development and will be completed in the near term for submittal to the NYSDEC. The Companies and CRA are planning to conduct the Upland Soil and Sediment pre-design activities and designs concurrently, which would require coordinated approvals of both work plans. Please advise, if the NYSDEC, would like to discuss this possibility.

Should you have any questions or require additional information or clarification, please do not hesitate to contact the undersigned.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Brandon Hurl, B.A.Sc

RJ/lp/1
Encl.

Cc: Jamie Puskas, CRA
Keith Cowan, CHA
Krista Anders, New York State Department of Health
Dolores A. Tuohy, New York State Department of Environmental Conservation
Roger Florio, GE Corporate Environmental Programs
John Uruskyj, GE Corporate Environmental Programs
Thomas Masterson, SI Group, Inc.
Dean S. Sommer, Young Sommer LLC
Michael G. Sterthous, Whileman, Osterman & Hanna LLP

CERTIFICATION

I certify that I am currently a NYS registered professional engineer and that this Remedial Design/Remedial Action (RD/RA) Work Plan for the Friedrichsohn Cooperage Site was prepared in accordance with applicable statues and regulations and in substantial conformance with the New York State Department of Environmental Conservation (NYSDEC) DER Technical Guidance for Site Investigation and Remediation (DER-10).

Robert G. Adams, P.E.
CRA Infrastructure & Engineering, Inc.
Registration No. 064918

July 9, 2013
Date

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LIST OF APPENDICES

1.0 INTRODUCTION

This Remedial Design/Remedial Action Work Plan (RD/RA Work Plan) provides for the development and implementation of final plans and specifications for implementing the remedial alternative for Operable Unit 1 (OU-1) and the upland source soils in OU-3 at the Friedrichsohn Cooperage inactive hazardous waste site (the Site) located at 153-155 Saratoga Avenue in the Town of Waterford, New York (see Figure 1.1 for the Site location). OU-1 is comprised of the on-Site and off-Site contaminated soils associated with the former cooperage operation. OU-3 is comprised primarily of the sediments in the Old Champlain Canal between O'Connor Drive and Burton Avenue, and also includes on-Site source area soils.

This RD/RA Work Plan has been prepared by Conestoga-Rovers & Associates (CRA) in accordance with an Order on Consent (Consent Order) between the New York State Department of Environmental Conservation (NYSDEC) and the Respondents, General Electric Company and SI Group, Inc. (the Companies), which came effective February 7, 2013 (Index No. A5-0784-1202). The Consent Order requires the Respondents to prepare a RD/RA Work Plan for OU-1 and for the upland source soils in OU-3.

This RD/RA Work Plan has been prepared in general accordance with the following guidance, directives, and other publications, where appropriate:

- Consent Order, Index No. A5-0784-1202, January 2013
- Record of Decision for OU-1, Site No. 546045, December 2012
- Record of Decision for OU-3, Site No. 546045, March 2011
- NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, May 2010
- Applicable provisions of the New York State Environmental Conservation Law (ECL) and associated regulations, including Title 6 of the New York Code of Rules and Regulations (6 NYCRR) Part 375
- United States Environmental Protection Agency (USEPA) guidance document entitled "Guidance for Conducting Remedial Investigations and Feasibility Studies Under the Comprehensive Environmental Response, Compensation and Liability Act" (CERCLA), Interim Final (USEPA, 1988)
- Applicable provisions of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) regulations contained in Title 40 of the Code of Federal Regulations (CFR) Part 300

This RD/RA Work Plan was prepared to fulfill the Companies' requirement for a RD/RA Work Plan under the Consent Order.

The RD/RA Work Plan is organized as follows:

Section 1.0 – Introduction

Section 2.0 – Background Information

Section 3.0 – Remedial Action Objectives

Section 4.0 - Remedial Action Components

Section 5.0 – Pre-Design Data Collection

Section 6.0 – Remedial Action Project Plans

Section 7.0 – Remedial Design Activities

Section 8.0 – Schedule

Section 9.0 – Progress Reports

2.0 BACKGROUND INFORMATION

2.1 SITE LOCATION AND DESCRIPTION

The Site is located at 153-155 Saratoga Avenue, Waterford, Saratoga County, New York. A Site location map is presented as Figure 1.1. The Site is approximately 0.45 acres in size and has approximately 315 feet of frontage on Saratoga Avenue (Route 32). The Old Champlain Canal borders the Site on the side opposite the road. Residential properties are adjacent to the Site on Saratoga Avenue; residential and commercial properties are also located across from the Site on Saratoga Avenue. The Site is currently a vacant lot. The approximate boundaries of the Site are shown on Figure 2.1.

Access to the Site is limited by an 8-foot tall, lockable, chain-link fence that has been installed around the former Friedrichsohn Cooperage property. Warning signs have been installed on the fencing.

The Site is currently zoned as residential (R-75) and is served by the public water supply system and the public storm water and sanitary systems. The commercial properties across from the Site are located on property formerly known as the Friedrichsohn Cooperage Lot, which was used to store drums.

2.2 SITE HISTORY

A cooperage operated at this location from 1817 to 1991. During the early operations the cooperage made and refurbished wooden kegs and barrels. When the cooperage closed in 1991 the primary business had been cleaning and refurbishing metal drums. Industrial facilities in the area used materials shipped in drums in their industrial processes. Drums would be sent to the cooperage to be cleaned, repainted, and resold. The drum cleaning and refurbishing operations are alleged to be the source of the contamination that was identified at the Site.

During its most recent history, the cooperage operated out of five buildings at the Site. Three of the five buildings were constructed as slab-on-grade. Two of the buildings contained structures below grade. One of the buildings had a basement area, below grade, where the sumps were located. One of the buildings on the southwest end of the Site is labeled as a garage on historical drawings, and had an automobile service trench associated with it. The service trench is below grade and provided access to the undercarriage of vehicles.

Inspection and examination of the abandoned business in 1994 revealed many metal drums, and the buildings to be unstable and in poor condition. The USEPA conducted an emergency removal action between 1994 and 1996. The cooperage buildings were demolished, and clean fill was imported to replace contaminated soil that was removed. In the spring of 2008, NYSDEC collected samples of soil, groundwater, and surface water and sediment in the canal. The analytical results formed the basis for the listing of the Site in December 2008 as a Class 2 on the NYS Registry of Inactive Hazardous Waste Disposal Sites. The Site is currently divided into three OUs:

- OU-1 is comprised of the on-Site and off-Site soil at the former cooperage site, excluding the soil in the on-Site source area adjacent to the Canal that is part of OU-3
- OU-2 is comprised of on-Site and off-Site groundwater
- OU-3 is comprised of the sediments in the Old Champlain Canal between O'Connor Drive and Burton Avenue, as well as the adjacent on-Site source area and canal bank soil

The contaminants of concern (COCs) at the Site include polychlorinated biphenyls (PCBs), chlorinated volatile organic compounds (VOCs) (tetrachloroethane, trichloroethane, dichloroethene, vinyl chloride, and chlorobenzene), benzene, toluene, ethylbenzene, xylenes (BTEX), phenolic compounds (phenol and dimethylphenol), hexachlorobenzene, and metals (arsenic, barium, chrome, and lead).

NYSDEC issued a ROD for OU-1 in December 2012 and a ROD for OU-3 in March 2011. In the OU-1 ROD, NYSDEC selected the Site Cover remedy to achieve restricted residential soil cleanup objective (SCOs). In addition to the Site cover component, the remedy also included Institutional Controls. In the OU-3 ROD, the remedy pertinent to the on-Site source area included excavating the source soil down to bedrock and transporting it off-Site for disposal. The areas identified for remediation are shown on Figure 2.2. The components of the remedy as specified in the RODs are as follows:

- A remedial design program to provide the details necessary to implement the remedial program
- Construction of a Site cover to allow for restricted residential use of the Site, including any soil excavation to make room for the full thickness of the Site cover
- Excavation of on-Site source soils down to bedrock
- Off-Site transport and disposal of excavated soils to a permitted disposal facility
- Development of a Site management plan to address residual contamination and any use restrictions

- Imposition of an environmental easement
- Annual certification of the institutional and engineering controls.

In January 2013, the Companies and NYSDEC entered into a Consent Order to conduct and implement a RD/RA Work Plan. The objective of the RD/RA Work Plan is to provide for the development and implementation of final plans and specifications for implementing the remedial alternative set forth in the NYSDEC RODs, dated March 2011 and December 2012.

2.3 ON-SITE AND GROUNDWATER CHEMISTRY

The available historic soil and groundwater data for OU-1 and OU-3 areas were reviewed as a part of the preparation of this Work Plan. Soil and groundwater data is included in the following reports that were available during the preparation of this Work Plan:

- Focused Remedial Investigation Feasibility Study (RI/FS), Malcolm Pirnie, April 2010
- Record of Decision – Operable Unit Number 01 Remedial Program, On-Site and Off-Site Soil (OU-1 ROD), December 2012
- Record of Decision – Operable Unit Number 03 Remedial Program (OU-3 ROD), March 2011
- Proposed Remedial Action Plan Operable Unit 01 Remedial Program – Onsite and Offsite Soil (OU-1 PRAP), October 2012
- Proposed Remedial Action Plan Operable Unit 03 Remedial Program (OU-3 PRAP) February 2011

Of the five documents listed above, only the RI/FS includes tabulated data for subsurface and surface soil samples. The remaining documents include summary statistics for the data but not the parent data. The parent data for the soil data summaries presented in the OU-1 and OU-3 RODs and PRAPs were provided by the NYSDEC in electronic Equis file format.

The RI/FS was the only source for tabulated groundwater data at the time of the preparation of this Work Plan.

2.3.1 SOIL DATA

The OU-1 and OU-3 RODs and OU-1 and OU-3 PRAPs provide general information regarding the number of analyses, concentration ranges for the various chemical parameters detected and frequency of exceedances at the Site. A summary of the number of subsurface soil analyses within the OU-1 soil area and the OU-3 upland source area are as follows:

OU-1 Soil Area

- VOCs – 52 samples
- SVOCs – 52 samples
- Inorganics – 41 samples
- Pesticides – 22 samples
- PCBs – 124 samples

OU-3 Upland Source Area

- VOCs – 76 samples
- SVOCs – 76 samples
- Inorganics – 56 samples
- Pesticides – (Not Provided in OU-3 ROD)
- PCBs – 173 samples

The above soil sampling completed by NYSDEC was conducted in phases as follows:

- 2009 – A biased surface and subsurface sampling program (SB-01 to SB-30) was completed in 2009 that included both on-Site and off-Site soil sample collection. Samples were collected in both the OU-1 and OU-3 upland soil source areas
- 2010 – A grid-based subsurface soil sampling program (SB-31 to SB-91) was completed in 2010. The grid-based sampling was conducted in the eastern portion of the Site and included sample collection in both the OU-1 and OU-3 upland source areas. A limited amount surface soil sample collection was completed during the 2010 grid-based sampling that appears to be related to localized surface soil removals
- 2011 – Off-site subsurface soil sampling (SB-91 to SB-104) was completed in 2011 outside the boundaries of the OU-1 and OU-3 upland soils areas. A limited amount

of surface soil sample collection was completed in 2011 in the eastern portion of the OU-1 upland soils area

Soil boring locations are identified on Figure 5.1. A summary of the available soil data is as follows:

OU-1

The OU-1 ROD presents summary surface and subsurface soil data for on-Site sample locations. The soil data for the OU-1 and OU-3 upland source areas are shown in Table 2.1 and Table 2.2, respectively. The surface soil samples were collected from 0 to 2 inches below ground surface (bgs) and the subsurface samples were collected from 2 to 20 feet bgs. It is to be noted that the on-Site subsurface soil data is for samples collected outside the source areas.

Surface soil results showed an elevated frequency of exceeding the unrestricted SCOs for PCBs, several metals (chromium, lead, mercury), and some SVOCs, particularly phenol. Frequencies of surface soil samples exceeding the restricted SCOs, however, were lower.

Subsurface soil results showed an elevated frequency of exceeding the unrestricted SCOs for PCBs, lead, mercury, and phenol. Frequencies of subsurface soil samples exceeding the restricted SCOs, however, were lower. PCBs were detected exceeding both unrestricted and restricted SCOs. The highest PCB concentration reported in the OU-1 Area was 12 parts per million (ppm) reported at a depth of 9 to 12 feet bgs at soil boring location SB-42. The OU-1 RA would result in PCB concentrations up to 12 ppm remaining in subsurface soil on Site in the OU-1 area.

OU-3

The OU-3 ROD presents summary surface and subsurface soil data for on-Site sample locations in OU-3 and vicinity, and are shown in Table 2.3 and Table 2.4, respectively. These soil samples were collected across the property where the cooperage buildings stood and were used to delineate the on-Site source area. One of the cooperage buildings, Building #3, stood in the on-Site source area. Surface soil samples were collected from 0 to 2 inches bgs, and subsurface soil samples were collected from 0 to 18 feet bgs.

Surface soil results showed an elevated frequency of exceeding the unrestricted SCOs for PCBs, several metals (chromium, lead, mercury), and phenol. The only parameter with a significant frequency of exceeding the restricted SCOs was chromium.

Subsurface soil results showed an elevated frequency of exceeding the unrestricted SCOs for PCBs, metals (particularly lead, arsenic), ethylbenzene, toluene, xylenes, hexachlorobenzene, and phenol. Parameters that exceeded the restricted SCOs, were metals and PCBs, but at lower frequencies. The main parameter exceeding both unrestricted and restricted SCOs was PCBs. There are two soil boring locations in the OU-3 Area SB-74 and SB-76 that report PCB concentrations above 50 ppm. The Toxic Substance Control Act (TSCA) requires disposal of soil containing PCBS at concentrations greater than 50 ppm in a hazardous waste landfill permitted under section 3004 of the Resource Conservation and Recovery Act (RCRA), or by a State authorized under section 3006 of RCRA or a PCB disposal facility approved under TSCA.

VOCs, SVOCs, pesticides, metals, and PCBs exceeded SCOs at various frequencies. In general, higher concentrations of PCBs and SVOCs were detected at depths of approximately 10 feet bgs and deeper within the limits of the OU-3 upland source area.

2.3.3 OU-3 GROUNDWATER DATA

As described in Section 2.2, the OU-3 remediation activities will involve excavation of soils below the water table. As a result, a discussion of groundwater quality in relation to the anticipated excavation activities is relevant. There are two groundwater monitoring wells MW-09 (bedrock) and MW-10 (overburden) located in the OU-3 Area. There is also a piezometer located in the OU-3 Area. Both the monitoring wells and the piezometer are installed in or downgradient to the area that has the highest PCB concentrations in soils (greater than 50 ppm) on Site. These monitoring points are representative of the worst-case groundwater quality that is likely to be observed on the Site. A summary of OU-3 groundwater quality is presented in Table 1 of the OU-3 ROD.

The groundwater data presented in the FS indicates that exceedances of the NYDEC Class GA Standard or Guidance Values (Groundwater Criteria) for SVOCs, VOCs, and Pesticides/PCBs are present within the overburden wells located in the OU-1 and OU-3 upland source areas. There are three monitoring locations on-Site that monitor overburden groundwater quality (MW-10 and PES-1 in the OU-3 soil area and MW-8 in the OU-1 soil area). The exceedances identified in the monitoring locations within the OU-1 and OU-3 areas include:

- VOCs – chlorinated solvents, Acetone, and benzene, toluene, ethylbenzene, and xylene (BTEX)
- SVOCs – phenols, bis(2-ethylhexyl)phthalate, polynuclear aromatic hydrocarbons (PAHs)
- Metals
- PCBs

3.0 REMEDIAL ACTION OBJECTIVES

As stated in the RODs, the remediation goals for the soil at the Site are to:

- Prevent ingestion/direct contact with contaminated soil
- Prevent inhalation of or exposure from contaminants volatilizing from the soil
- Prevent migration of contaminants that would result in groundwater or surface water contamination or recontamination of the sediments in the canal
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain

4.0 REMEDIAL ACTION COMPONENTS

The primary components of the selected remedial action are as follows:

- Pre-design investigation
- Excavation of contaminated soil in OU-1 as necessary to install a soil cover
- Installation of soil cover in OU-1
- Excavation of contaminated soil and backfilling with clean fill in OU-3 upland source area
- Transportation and off-Site disposal of excavated soil
- Site Management Plan
- Imposition of an environmental easement
- Annual certification of the institutional and engineering controls

A description of each of the remedial action components is presented in the following subsections.

4.1 PRE-DESIGN ACTIVITIES

As described in Section 2.2, the OU-1 Area remediation activities involve shallow soils excavation ranging in depth from 0 to 2 feet bgs for the purpose of installing a soil cover. PCB concentrations within the OU-1 Area are all below 50 ppm PCBs. As a result, no additional sampling to characterize the presence of PCBs according to TSCA Subpart N is required for the removal of soil in the OU-1 Area. Additionally, shallow excavations are standard remediation activities. No additional data is necessary to complete the OU-1 Area remedial design.

The OU-3 upland soil source area remediation activities will involve deeper excavation below the water table. PCBs with concentrations above 50 ppm are present in the OU-3 upland source area. The purpose the pre-design data collection activities are as follows:

- Collect geotechnical data for the overburden and bedrock to allow for the design of a shoring plan for the OU-3 excavation activities
- Complete the characterization of PCBs between the existing OU-3 upland source area sampling and the top of bank

- Estimate groundwater flow from the overburden and bedrock aquifer to develop estimates of the amount of water that will require management during excavation activities below the water table
- Obtain representative groundwater samples from the OU-3 upland source area to evaluate the quality of groundwater that will require management during dewatering activities
- Characterize soil for disposal purposes

A description of the proposed pre-design data collection activities is presented in Section 5.0. The NYSDEC will be notified at least seven business days prior to the initiation of pre-design field activities.

4.2 INSTALLATION OF SOIL COVER IN OU-1

A Site cover will be established to allow for restricted residential use of the Site. The cover will consist either of the structures such as buildings, pavement, sidewalks or a soil cover. Where the soil cover is required it will be a minimum of 2 feet thick, meeting the SCOs for cover material as set forth in 6 NYCRR Part 375-6.7(d) for restricted residential use. The soil cover will be placed over a demarcation layer, with the upper six inches of the soil of sufficient quality to maintain a vegetation layer. In areas where the SCOs for restricted residential use for the contaminants of concern are exceeded, and the intended final grade will not permit 2 feet of cover, the soil will be excavated to a depth of 2 feet to achieve the SCOs for restricted residential use. Relatively low levels of residually impacted soils below a depth of 2 feet will be left in place. Excavated soil will be disposed of at an approved facility. It is estimated that approximately 285 cubic yards of soil will be removed. The final grade for the Site will be consistent with the current grade or the future anticipated use. Any fill material brought to the Site will meet the requirements for the identified Site use as set forth in 6 NYCRR Part 375-6.7(d).

4.3 EXCAVATION OF UPLAND SOURCE SOIL IN OU-3

Soil within the OU-3 upland source area will be excavated down to bedrock. The depth to bedrock in this area is approximately 16 feet, and will involve the excavation of approximately 2,800 cubic yards.

As the depth to water is approximately 7 feet, dewatering will be necessary as the excavation extends down below 7 feet bgs. In order to estimate the rate of groundwater that would flow into the excavation, the hydraulic conductivity of the overburden soil and underlying bedrock will be investigated. During the pre-design activities, in-situ hydraulic conductivity tests will be conducted in several overburden monitoring wells, and packer-pumping or packer-injection tests will be conducted in bedrock well MW-09, located in the OU-3 upland source area. Two additional overburden monitoring wells will be installed within the OU-3 upland source area and used for the in-situ hydraulic conductivity testing of the overburden soil. Also, a sample of the water generated during the development of the new overburden wells in OU-3 will be submitted for chemical analysis in order to design a temporary on-Site groundwater treatment system. This treatment system will manage the water generated during the excavation in OU-3. The treated water will be discharged under a SPDES permit into the adjacent canal.

The northern edge of the upland OU-3 upland source area is in close proximity to Saratoga Avenue and the sidewalk. As the depth of excavation is anticipated to be approximately 16 feet, the excavation must be shored to prevent damage to the road and sidewalk. Two geotechnical boreholes will be installed during the pre-design activities in order to collect bedrock core samples for geotechnical testing (point load testing and unconfined compression testing). This information will aid the geotechnical subcontractor to design the shoring structure.

Excavated soil will be transported off-Site to a permitted facility for treatment or disposal in accordance with State and Federal regulations.

Once sections of the OU-3 upland source area have been fully excavated, clean fill that meets the Restricted Residential use SCOs will be backfilled into the excavation and compacted. The imported fill will be brought up to 6 inches below final grade. Topsoil will be backfilled into the upper 6 inches and then seeded.

4.4 SITE MANAGEMENT PLAN

Upon completion of the Site remediation, a Site Management Plan will be prepared to address any residual contaminants remaining and covered at the Site and identify any Site use restrictions. The Site Management Plan will: (a) require soil characterization in the event of future subsurface excavation and, where applicable, disposal/re-use in accordance with NYSDEC regulations; (b) evaluate the potential for vapor intrusion to any potential future buildings developed on the Site, including provision for mitigation of any impacts identified; and (c) identify any Site use restrictions.

4.5 IMPLEMENTATION OF ENVIRONMENTAL EASEMENT

Imposition of an institutional control, likely in the form of an environmental easement or deed notice that will: (a) require compliance with the approved Site Management Plan; (b) limit the use and development of the property to commercial or industrial uses only; (c) restrict use of groundwater as a source of potable or process water, without necessary water quality treatment; and (d) require complete and submit an annual certification to the NYSDEC.

4.6 ANNUAL CERTIFICATION OF THE INSTITUTIONAL AND ENGINEERING CONTROLS

An annual certification will be prepared and submitted by a professional engineer or environmental professional acceptable to the NYSDEC, which will certify that the institutional controls and engineering controls in place are unchanged from the previous certification and that nothing has occurred that would impair the ability of the controls to protect public health or the environment or constitute a violation or failure to comply with any operation and maintenance or Site management. The operation of the components of the remedy will continue until the remedial objectives have been achieved, or until the NYSDEC determines that continued operation is technically impracticable or not feasible, or that the significant threat to the environment or human health that gave rise to the property being placed on the DEC registry of inactive hazardous waste disposal sites has been eliminated.

5.0 PREDESIGN DATA COLLECTION ACTIVITIES

Pre-design activities will be conducted to collect additional data necessary to complete the RD. The Pre-design activities are described in the following sections.

5.1 OU-3 UPLAND SOURCE AREA 50 PPM SOIL DELINEATION

There are two locations within the OU-3 Area that have PCBs above 50 ppm, which will require disposal at a hazardous waste landfill permitted under section 3004 of the RCRA, or by a State authorized facility under section 3006 of RCRA or a PCB disposal facility approved under TSCA consistent with 40 CFR 761.61 of TSCA. The two locations with PCB concentrations above the 50 ppm are:

- SB-74 sample depth 7 to 8 feet bgs – 1,000 ppm PCBs
- SB-76 sample depth 4 to 5 feet bgs – 72 ppm PCBs

Soil borings SB-80, SB-77, SB-71, SB-72, SB-67, SB-66, SB-58, SB-73, SB-75, SB-82, SB-81 report PCB concentrations below 50 ppm. These soil borings define the boundary of PCBs above 50 ppm at soil borings SB-74 and SB-76. Table 5.1 presents a summary of the PCB sampling that has been completed as of the date of this Work Plan for the soil borings that currently define the limits of the OU-3 Area soil that exceeds 50 ppm PCBs at SB-74 and SB-76. TSCA requires sampling consistent with Subpart O following removal of greater than 50 ppm PCB material. Once sampling, consistent with Subpart O, demonstrates PCB concentrations are below 50 ppm the hazardous waste/TSCA approved PCB disposal requirements no longer apply. Due to the small dimensions of the Site, direct loading of greater than 50 ppm material is anticipated. Additional sampling is described below to evaluate the potential for disposing the soil overlying the greater than 50 ppm PCB concentrations at SB-74 and SB-76 as less than 50 ppm material by conducting soil sampling consistent with TSCA to further refine the vertical and horizontal definition of greater than 50 ppm PCB material. In order to further define the limits of the area with greater than 50 ppm PCBs, the following additional soil sampling will be completed:

- SB-76 – install one soil boring: sample 2 to 3 feet, 3 to 4 feet, and 7 to 8 feet intervals for PCBs to define vertical extent of greater than 50 ppm PCB material at this location.
- SB-80, SB-81, SB-82, SB-71, SB-72, SB-73, SB-75, SB-77 – install one soil boring at each location: sample 2 to 3 feet and 3 to 4 feet intervals for PCBs. The samples will be

placed on hold pending review of the SB-76 2 to 3 and 3 to 4 feet interval results. If the SB-76 results are below 50 ppm the samples on hold will be analyzed from the deepest interval at SB-76 that did that did not exceed 50 ppm PCBs. Provided the results of the on hold samples are below 50 ppm, the overlying soil will be disposed of as less than 50 ppm PCB material.

- SB-74 – install one soil boring: sample 5 to 6 feet, 7 to 8 feet, and 8 to 9 feet intervals for PCBs (8 to 9 feet sample placed on hold pending review of shallower 7 to 8 feet sample PCB results) to define vertical depth of greater than 50 ppm PCB material.
- SB-58, SB-66, SB-67, SB-72, SB-73 – install one soil boring sample 4 to 5 feet and 5 to 6 feet intervals for PCBs. The samples will be placed on hold pending review of the SB-74 5 to 6 feet interval result. If the SB-74 result is below 50 ppm the 5 to 6 feet bgs samples on hold will be analyzed. If the SB-74 result is above 50 ppm the shallower 4 to 5 feet bgs sample will be analyzed. Provided the results of the on hold samples are below 50 ppm, the overlying soil will be disposed of as less than 50 ppm PCB material.

The 50 ppm PCB Delineation location sample locations are presented on Figure 5.1

5.2 PCB CHARACTERIZATION SAMPLING

There is a 25-foot wide gap between the southernmost PCB sampling identified on Figure 5.2 and the sediment sampling completed at the northern bank of the canal. 40 CFR 761.61 of the Toxic Substance Control Act (TSCA) Subpart N requires characterization sampling prior to conducting PCB removals. The spacing of the existing grid sampling in the OU-3 area is consistent with Subpart N. However, there is a gap between the southernmost grid based soil samples and the northern canal bank sediment samples. As a result, an additional 8 boring locations will be installed between the existing soil sample locations and the top of the canal bank. In addition, within the OU-3 area, no PCB analysis for soil boring locations SB-31, SB-32, SB-33, SB-36, SB-37, and SB-38 was provided in the available data. As a result, an additional six soil borings are proposed for these locations, unless the NYSDEC provides additional PCB data for these locations. The proposed sample locations are identified on Figure 5.2.

Each soil boring will be advanced to bedrock. Stratigraphic information will be recorded by a qualified geologist. A surface soil sample will be collected at each soil boring location consistent with the procedures described in the Field Sampling Plan (FSP). Soil sampling will be collected at 5-foot intervals for the entire depth of each soil boring. The samples will be submitted for PCB analysis consistent with the procedures defined in the QAPP.

5.3 GEOTECHNICAL SOIL BORINGS

Two geotechnical borings will be installed at the locations identified on Figure 5.3. The purpose of the geotechnical testing is to generate the necessary data for the overburden and bedrock to allow for the design of a shoring plan for the OU-3 excavation activities. Based on the site survey, the northern extent of the proposed OU-3 upland source area excavation is approximately 12 feet from the adjacent sidewalk and roadway and the depth to bedrock is approximately 16 to 20 feet below grade in this area. As a result, shoring of the OU-3 excavation will be necessary to accommodate the excavation to bedrock.

The geotechnical borings will be advanced 15 feet into bedrock using an HQ size core barrel. A total of six overburden samples (three from above the water table and three saturated samples from below the water table) will be collected and submitted for geotechnical testing. Each geotechnical sample will be analyzed for the parameters:

Grain size distribution - hydrometer (ASTM422)
Water Content (ASTM D2216)
Unit weight determination (ASTM D653)
Specific Gravity (ASTM D584)

Four bedrock samples will be collected for the geotechnical borings and submitted for point load testing and unconfined compression testing.

5.4 MONITORING WELL INSTALLATION/GROUNDWATER SAMPLING

There are two groundwater monitoring wells; MW-09 (bedrock) and MW-10 (overburden) located in the OU-3 Area. There is also a piezometer located in the OU-3 Area. Both the monitoring wells and the piezometer are installed in or downgradient to the area that has the highest PCB concentrations (greater than 50 ppm) in soils on Site. These monitoring points are representative of the worst-case groundwater quality that is likely to be observed on the Site. In order to further evaluate groundwater quality in the OU-3 Area, two additional groundwater monitoring wells will be installed. The proposed monitoring well locations are presented on Figure 5.4. The purpose of the additional monitoring well installations is to obtain representative groundwater samples from the OU-3 Area to evaluate the groundwater quality that will require management during dewatering activities and evaluate the effect of the OU-3 area soil on groundwater quality.

At each monitoring well location a soil boring will be advanced to bedrock using a hollow stem auger rig. Stratigraphic information will be recorded by a qualified geologist. The well screen will be installed to evaluate groundwater quality in the overburden/bedrock interface at a depth consistent with well MW-10.

Following installation the monitoring wells will be developed until a turbidity reading below 50 NTU is achieved or 10 well volumes are removed, which ever occurs first. A bulk sample of the initial three well volumes of well development water will be collected and submitted for analysis of waste characterization parameters.

Following well development, both monitoring wells will be sampled consistent with the procedures presented in the FSP. One groundwater sample will be collected from each monitoring well. The samples will be submitted for TCL VOCs, TCL SVOCs, TAL metals, and PCB analysis consistent with the procedures defined in the QAPP.

In addition to the newly installed monitoring wells, MW-09 and MW-10 will be re-developed, as described above, and one round of groundwater sampling will be completed for TCL VOCs, TCL SVOCs, TAL metals, and PCB analysis consistent with the procedures defined in the QAPP to evaluate groundwater quality at these locations.

5.5 IN-SITU HYDRAULIC CONDUCTIVITY TESTING

In-situ hydraulic conductivity test data for the overburden aquifer and the bedrock aquifer will be collected. The purpose of the hydraulic conductivity testing is to allow for an order-of-magnitude estimate to be calculated of the volume of water that will require management during the excavation activities.

Following the installation of the overburden monitoring wells discussed above, there will be a total of three overburden monitoring wells in the OU-3 excavation area. A slug test will be performed on each of the three monitoring wells. Initial groundwater elevations, drawdown and recharge at all three locations will be recorded with in-Situ Level TROLL 700's (a data logging pressure transducer) equipped with vented cables. The vented cables enable the transducer to cancel the effects of atmospheric pressure changes, eliminating the need to collect background atmospheric pressures.

The bedrock will also contribute water to the OU-3 excavation. There is one bedrock monitoring well (MW-09) in the OU-3 upland source area. The stratigraphic borehole log and the well installation details for MW-09 are included in Appendix A. A Packer injection test or a Packer pumping test will be performed to estimate the hydraulic properties of the bedrock.

6.0 REMEDIAL ACTION PROJECT PLANS

This section provides an overview of the following Project Plans that are presented as appendices to this RD/RA Work Plan:

- Appendix B – Health and Safety Plan
- Appendix C – Quality Assurance Project Plan
- Appendix D – Field Sampling Plan
- Appendix E – Waste Management Plan

The aforementioned Project Plans are designed to provide the procedures and protocols that are necessary to support the remedial activities. All work will be conducted in accordance with the Project Plans.

6.1 HEALTH AND SAFETY PLAN

A Site-specific Health and Safety Plan (HASP) is required to ensure that all remedial activities are performed safely and in accordance with applicable regulatory requirements, and that all persons, the general public, and the environment are protected from exposure to Site-related contaminants. The health and safety requirements for the remedial activities were developed in accordance with 29 CFR 1910 and are provided in the HASP presented in Appendix B. The HASP includes:

- General requirements
- Personnel
- Levels of protection
- Safe work practices and safeguards
- Medical surveillance
- Personal and environmental air monitoring
- Personal protective equipment
- Personal hygiene
- Decontamination of personnel and equipment
- Site work zones
- Contaminant control
- Contingency and emergency planning

- Logs, reports, and recordkeeping
- Community Air Monitoring Plan

6.2 QUALITY ASSURANCE PROJECT PLAN

The field and laboratory quality assurance objectives, protocols, and procedures supporting the waste characterization and pre-design sampling activities are provided in the Quality Assurance Project Plan (QAPP) presented in Appendix C. The QAPP includes:

- Project description
- Project organization
- Project responsibilities
- Sampling and custody procedures
- Calibration procedures
- Quality assurance (QA) objectives
- Analytical procedures
- Data analysis and reporting
- Internal quality control (QC) checks
- Performance and system audits
- Preventative maintenance
- Method-specific procedures for assessing data precision, accuracy, and completeness
- Laboratory corrective actions
- Quality assurance (QA) reports.

6.3 FIELD SAMPLING PLAN

A Site-specific Field Sampling Plan (FSP) is required to ensure that sampling and analyses are performed to established and accepted protocols. All sampling and analyses will be conducted as part of a quality assurance program to ensure that accurate and precise analytical results are obtained. All sampling and analysis activities will be completed in accordance with the FSP presented in Appendix D. The FSP includes:

- Number of samples to be collected
- Sampling protocols
- Sample collection locations
- Special sample collection equipment and techniques (if required)
- Analytical method to be used

7.0 REMEDIAL DESIGN

7.1 PRELIMINARY DESIGN

At the Preliminary Design stage, all pre-design data collection would be complete and technical requirements of the remediation are addressed and outlined in sufficient detail in order that they may be reviewed to determine if the Final Design will provide an effective remedy for the Site. NYSDEC comments on the Preliminary Design will be addressed as the design proceeds to the Pre-Final Design.

The Preliminary Design will consist of the following components:

- Draft Design Report including summary of Pre-Design Investigations and the Design narrative
- Draft Design drawings and list of project specifications including restoration details
- Major Design Calculations
- Draft Construction Quality Assurance Plan
- Draft Risk Management Plan
- Discussion of permits and approvals
- Updated Project Schedule
- Preliminary Construction Cost Estimate.

7.1.1 PRELIMINARY DESIGN REPORT

The Preliminary Design Report will present all of the pre-design data and a detailed description of all preliminary design assumptions and parameters, the basis and rationale for all technical aspects of the design including supporting calculations, and the interaction of the various design components. Calculations will be included for the hydraulic conductivity of the overburden soils and bedrock, dewatering requirements during OU-3 upland source area excavation, excavation shoring design for OU-3 upland source area, volume of soil to excavate, and soil cover design. The Preliminary Design Report will, at a minimum, address the following:

OU-1

- Final grades of OU-1 soils area to facilitate drainage and consistency with grades of adjacent properties

- Protection of existing OU-1 soils area monitoring wells
- Define existing conditions for excavation to areas to 2 feet bgs
- Specification for fill quality and gradation
- Runoff/silt controls
- Site logistics including lay down area, decon area, street access, equipment placement, material stockpiling, material handling, truck staging
- Sequence of operations

OU-3

- Hydraulic properties of the overburden and bedrock aquifers and their effect on shoring for the OU-3 excavation
- Results for additional soil sampling
- Groundwater management
- Dewatering of soil excavated from below the water table
- Treatment of water/discharge
- Specification for fill quality and gradation
- Runoff/silt controls
- Isolation of the south end of the OU-3 excavation area from the adjacent canal (excavation may occur deeper than the water level of the canal)
- Site logistics including water treatment area, lay down area, decon area, street access, equipment placement, material stockpiling, material handling, truck staging
- Sequence of operations
- Procedures for Verification sampling to confirm Restricted Residential Soil Cleanup Objectives (SCOs) have been achieved (if excavation not to bedrock).

7.1.2 PRELIMINARY PLANS AND SPECIFICATIONS

The preliminary plans and specifications will include an outline of required drawings, specifications, and performance standards. Drawings will be prepared to present the conceptual aspects of the design. The drawings will be of sufficient detail to provide the reviewer with a clear understanding of the major components of the remediation and the interaction of the key components.

Appropriate project specifications will be selected during the Preliminary Design phase of the work. An outline of the required specifications will be prepared and submitted with the Preliminary Design.

7.2 PRE-FINAL/FINAL DESIGN

The Pre-Final Design will address comments generated from NYSDEC, and permitting authorities on the Preliminary Design review, and clearly show any modification of the design as a result of incorporation of the comments. The Pre-Final Design will essentially function as the draft version of the Final Design. The package will represent a complete peer-reviewed design, subject to final review by the NYSDEC.

Following NYSDEC review and comment on the Pre-Final Design, the Final Design will be prepared along with a memorandum indicating how the Pre-Final Design comments were incorporated into the Final Design. All Final Design documents will be certified by a Professional Engineer registered in the State of New York. The Pre-Final/Final Design will consist of the following components:

- Design Report
- Plans and Specifications
- Waste Management Plan
- Construction Quality Assurance Project Plan
- Construction Health and Safety Plan
- Construction Schedule

7.2.1 DESIGN REPORT

The Design Report will present a detailed description of all design assumptions and parameters, the basis and rationale for all technical aspects of the design including supporting calculations, and the interaction of the various design components. The selected design will be presented along with an analysis supporting the design approach.

7.2.2 PLANS AND TECHNICAL SPECIFICATIONS

A complete set of construction drawings and technical specifications will be submitted, which describe the selected design. This will include detailed design and specifications for all excavations, fill material, soil cover, excavation shoring, excavation dewatering and water treatment, and soil erosion and sediment control.

It is anticipated that the drawing package will include the following drawings:

- Overall Site Plan and General Notes
- Excavation areas and excavation depths
- Excavation shoring for OU-3 upland source area
- OU-1 areas to be capped
- Soil cover design
- Soil erosion and sediment control plan and details
- Proposed final grade contours
- Site security details

7.2.3 WASTE MANAGEMENT PLAN

The Waste Management Plan will describe procedures and protocols for the handling of materials generated during the remediation, which includes construction, and dewatering and excavation activities. The Waste Management Plan is presented in Appendix E and will be updated as necessary for the final design. Potential types of wastes that may be generated include, but may not be limited to the following:

- Aqueous waste
- Solid waste (e.g., drill cuttings, personal protective equipment)
- Impacted soil.

The overall objectives of the Waste Management Plan are to:

- Minimize the quantity of waste generated and requiring off-Site disposal
- Prevent commingling of different waste streams
- Ensure wastes are properly managed on Site to prevent releases to the environment or contamination of otherwise clean areas of the Site
- Manage all wastes in accordance with applicable regulations

The procedures and protocols outlined in the Waste Management Plan will include proper management, characterization testing/sampling, treatment, and transportation and/or disposal of wastes generated during the remediation. These procedures will be performed in conjunction with those presented in the Construction Health and Safety Plan.

The Waste Management Plan may be revised/expanded as appropriate as the remediation work progresses to include information, methodologies, and procedures associated with any changes in work scope and/or Site conditions.

7.2.4 CONSTRUCTION HEALTH AND SAFETY PLAN

A project-specific HASP will be prepared to describe the health and safety procedures and emergency response guidelines to be implemented during the construction phase of the project. CRA is very cognizant of the importance of health and safety for all aspects of all projects.

During construction activities, personnel will be working with heavy equipment and may come into contact with soils, groundwater, and waste materials, which potentially contain hazardous substances. The HASP will be developed to ensure the following:

- That Site personnel are appropriately trained and aware of potential hazards at the Site.
- That Site personnel are not adversely exposed to the compounds of concern.
- Compliance with applicable governmental and non-governmental (American Conference of Governmental Industrial Hygienists [ACGIH]) regulations and guidelines. In particular, the amended rules of the Occupational Safety and Health Administration (OSHA) for Subpart D of Part 1926 (Title 29 Code of Federal Regulations [CFR] Part 1926.65) will be implemented for Site work where there is a potential to come in contact with hazardous substances.
- Initiation of proper emergency response procedures to minimize the potential for any adverse impact to Site workers, the general public, or the environment.

All on-Site workers will have completed the 40-hour HAZWOPER training and annual refresher training pursuant to OSHA regulations.

7.2.5 CONSTRUCTION SCHEDULE

The Pre-Final/Final Design will include a final construction schedule.

8.0 SCHEDULE

A schedule for completing the RD is presented on Figure 8.1. The RD will include a schedule for implementing the RA.

9.0 PROGRESS REPORTS

Progress reports will be submitted to NYSDEC and NYSDOH by the tenth day of each month commencing with the month subsequent to the approval of the first Work Plan and ending with the termination date. The progress reports will include at a minimum:

- All actions taken pursuant to the Order during the reporting period and those anticipated for the upcoming reporting period
- All approved modifications to work plans and/or schedules
- All results of sampling and tests, and all other data received or generated by or on behalf of the Companies in connection with the Site during the reporting period, including quality assurance/quality control information
- Information regarding percentage of completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays

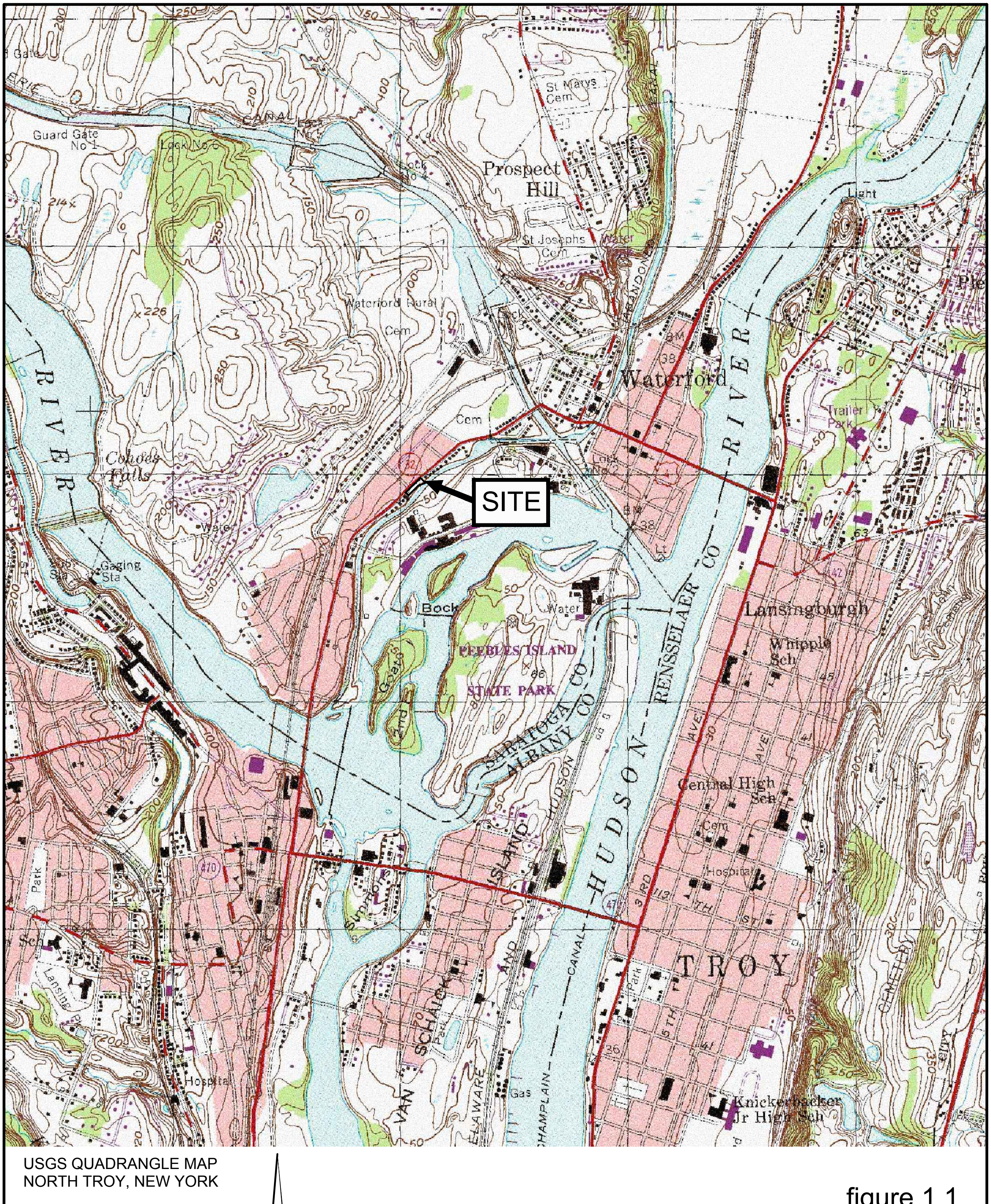


figure 1.1

SITE LOCATION
RD /RA WORK PLAN
FRIEDRICHSOHN COOPERAGE SITE
153-155 Saratoga Ave., Waterford, N.Y.

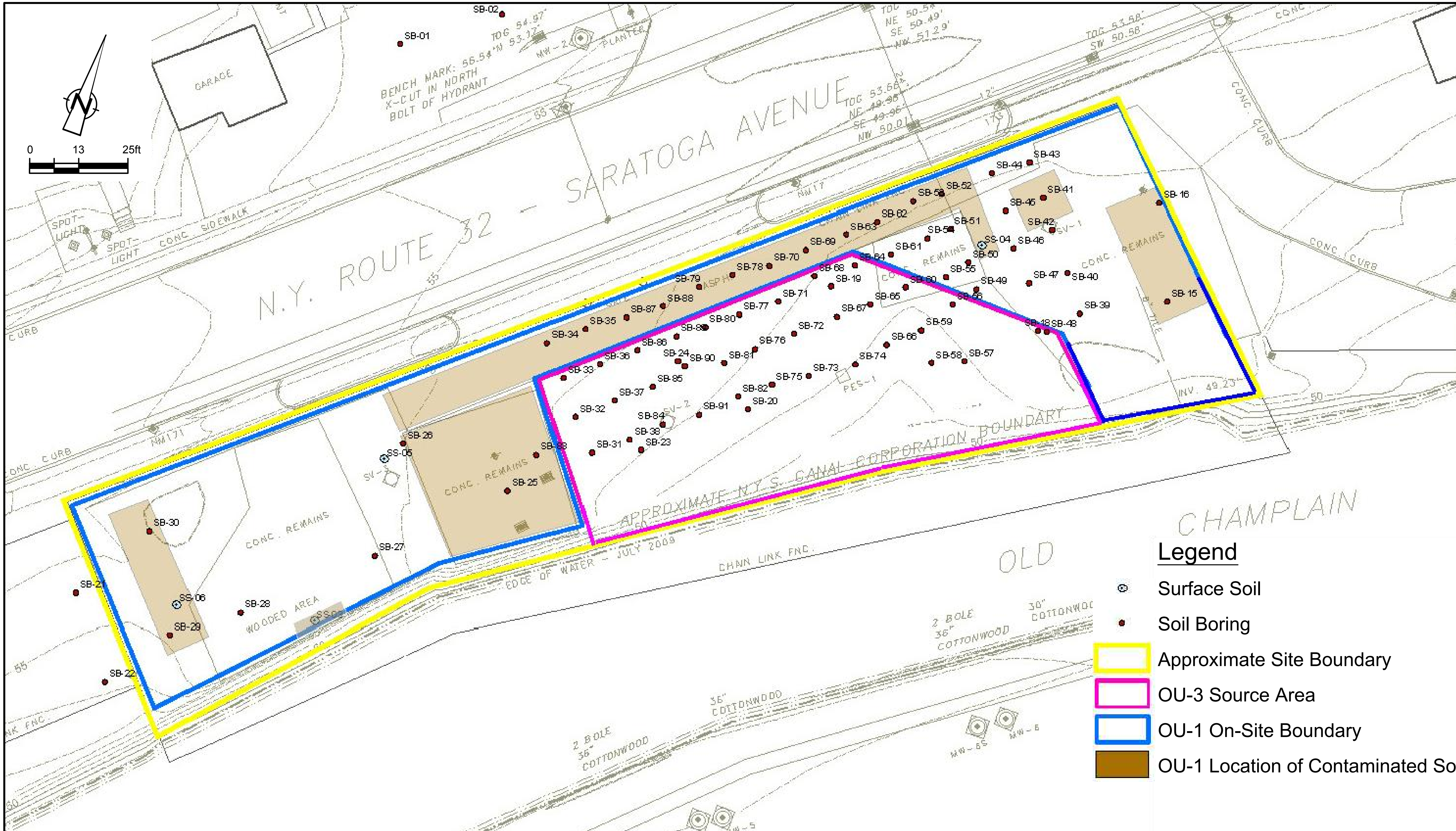
80987-98(003)GN-WA001 JUL 4/2013

SOURCE: FOCUSED REMEDIAL INVESTIGATION FEASIBILITY STUDY, MALCOLM PIRNIE, INC., FIGURE 2, APRIL 2010

figure 2.1

SITE PLAN
RD / RA WORK PLAN
FRIEDRICHSOHN COOPERAGE SITE
153-155 Saratoga Ave., Waterford, N.Y.

80987-98(003)GN-WA002 JUL 4/2013



NOTE: OU-1 SOURCE AREA - EXCAVATION DEPTHS 0-2 FEET BELOW GROUND SURFACE TO ALLOW FOR COVER SYSTEM.
OU-3 SOURCE AREA - EXCAVATION BELOW WATER TABLE.

SOURCE: TOPOGRAPHIC SURVEY, POPLI DESIGN GROUP, AUGUST 2009,
TOPOGRAPHIC SURVEY OF CANAL, MJ ENGINEERING AND LAND SURVEYING, P.C., APRIL 2011
BASE DRAWING INFORMATION FROM .PDF FILES OF MALCOLM PIRNIE FIGURES PROVIDED AS PART OF THE RFP PACKAGE.

figure 2.2

PREVIOUS SOIL SAMPLING LOCATIONS
FRIEDRICHSOHN COOPERAGE SITE
153-155 Saratoga Ave, Waterford, NY

80987-98(001)GN-WA007 MAR 22/2013

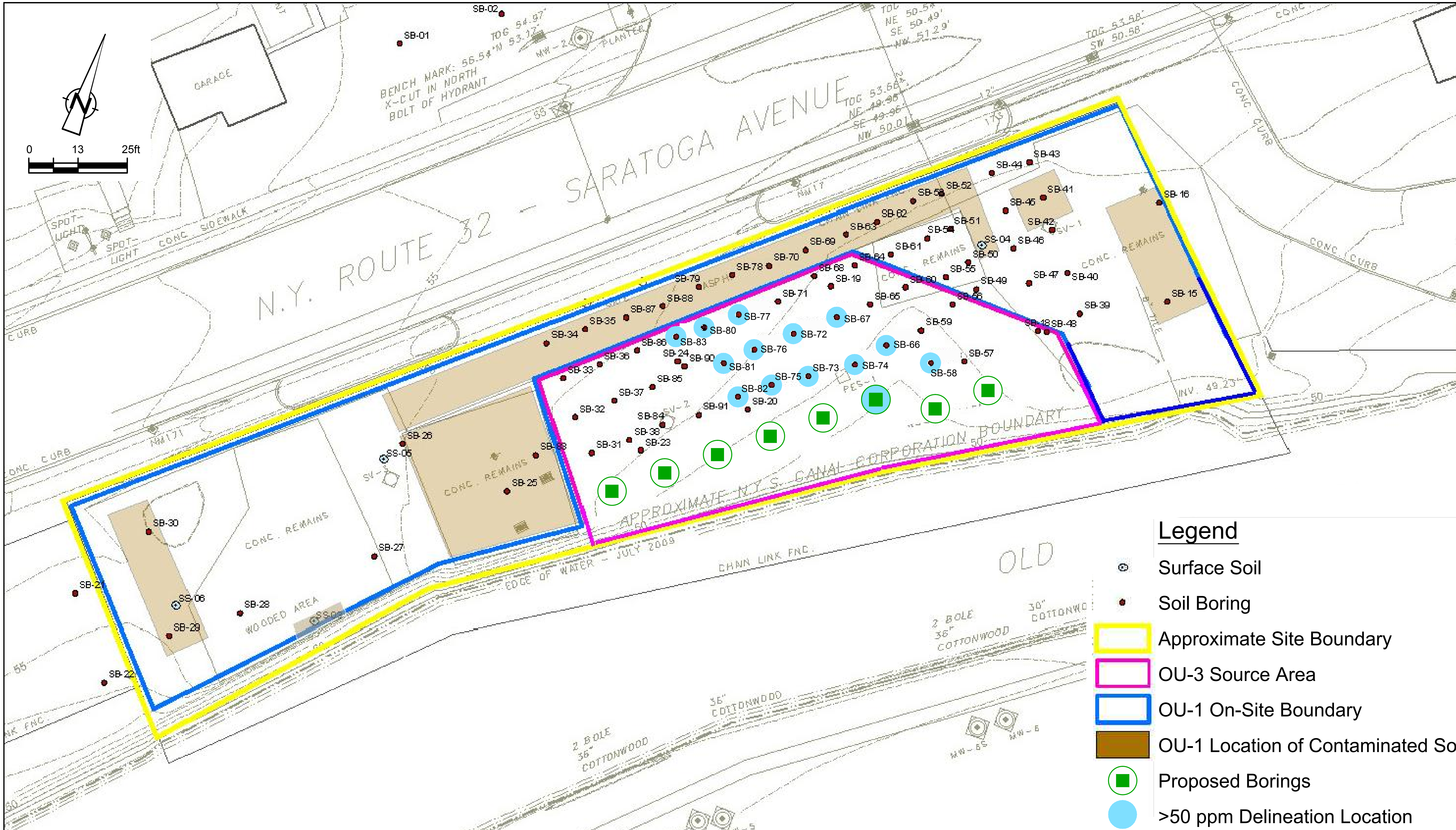


figure 5.1

PROPOSED >50 ppm PCB DELINEATION BORINGS
RD / RA WORK PLAN
FRIEDRICHSOHN COOPERAGE SITE
153-155 Saratoga Ave, Waterford, NY

SOURCE: TOPOGRAPHIC SURVEY, POPLI DESIGN GROUP, AUGUST 2009,
TOPOGRAPHIC SURVEY OF CANAL, MJ ENGINEERING AND LAND SURVEYING, P.C., APRIL 2011
BASE DRAWING INFORMATION FROM .PDF FILES OF MALCOLM PIRNIE FIGURES PROVIDED AS PART OF THE RFP PACKAGE.

80987-98(003)GN-WA004 JUL 4/2013

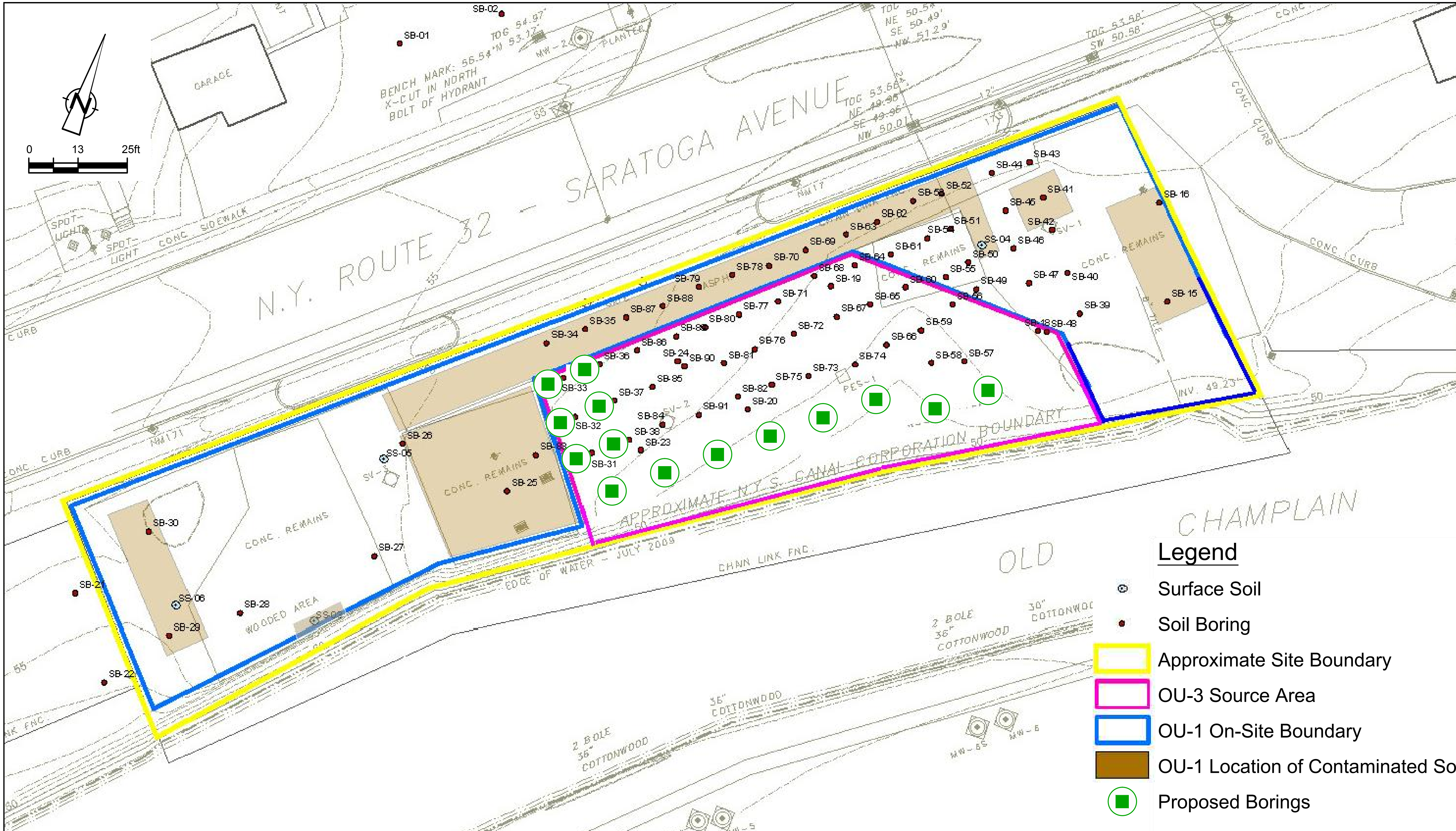


figure 5.2

PROPOSED PCB CHARACTERIZATION BORINGS
RD / RA WORK PLAN
FRIEDRICHSOHN COOPERAGE SITE
153-155 Saratoga Ave, Waterford, NY

SOURCE: TOPOGRAPHIC SURVEY, POPLI DESIGN GROUP, AUGUST 2009,
TOPOGRAPHIC SURVEY OF CANAL, MJ ENGINEERING AND LAND SURVEYING, P.C., APRIL 2011
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80987-98(003)GN-WA005 JUL 4/2013

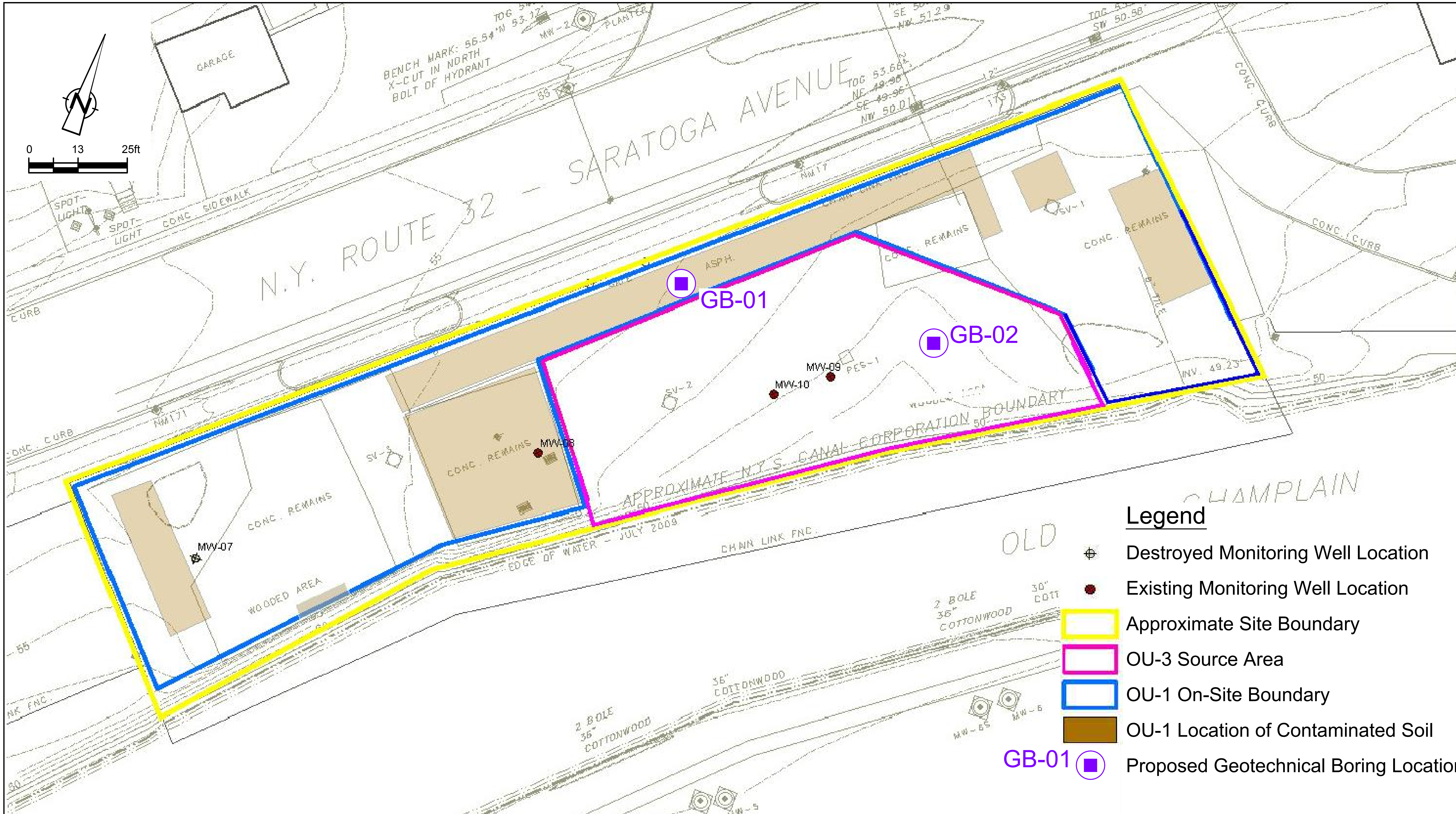

figure 5.3

PROPOSED GEOTECHNICAL BORING LOCATIONS
RD /RA WORK PLAN
FRIEDRICHSOHN COOPERAGE SITE
153-155 Saratoga Ave, Waterford, NY

SOURCE: TOPOGRAPHIC SURVEY, POPLI DESIGN GROUP, AUGUST 2009,
TOPOGRAPHIC SURVEY OF CANAL, MJ ENGINEERING AND LAND SURVEYING, P.C., APRIL 2011
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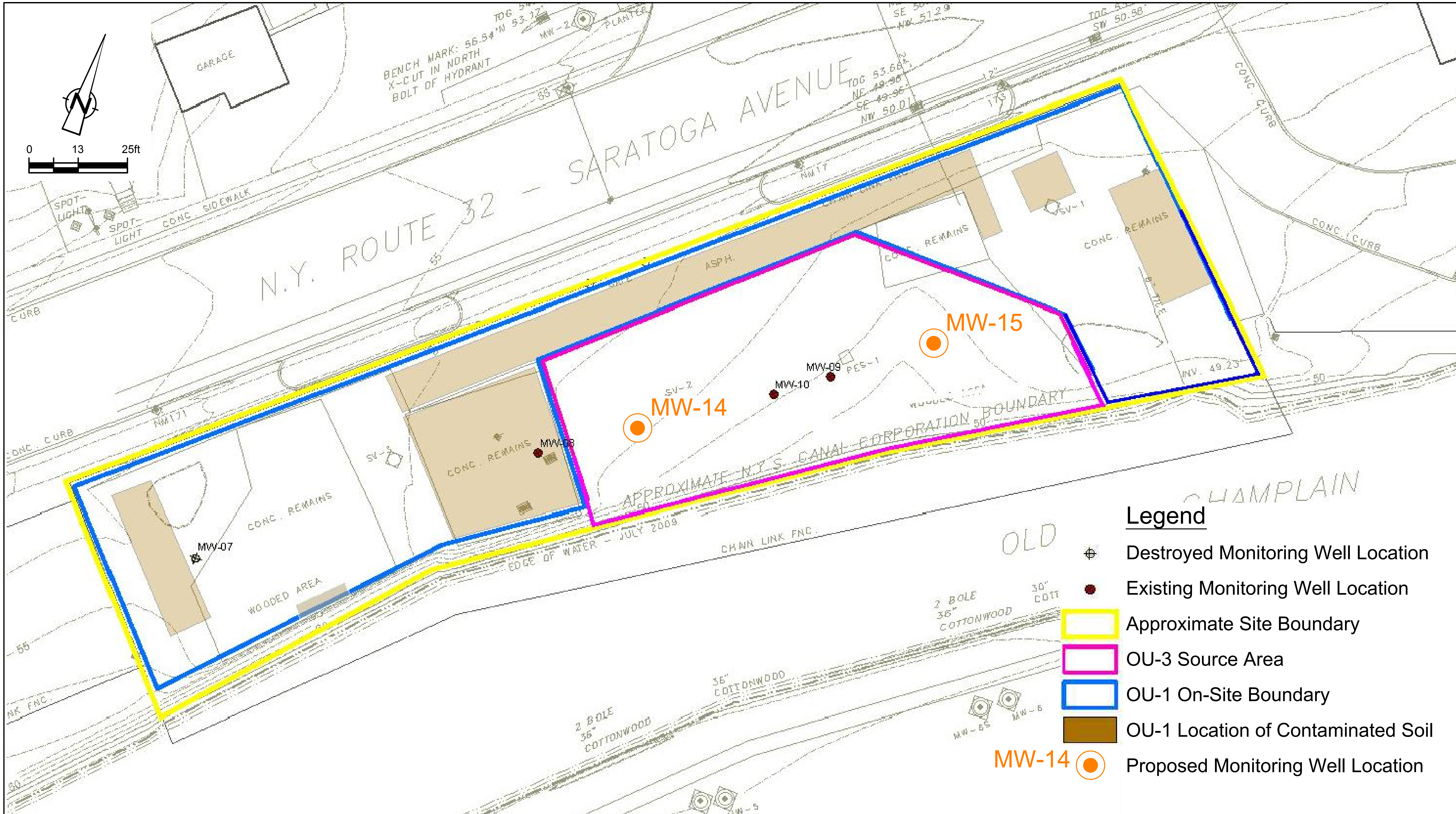


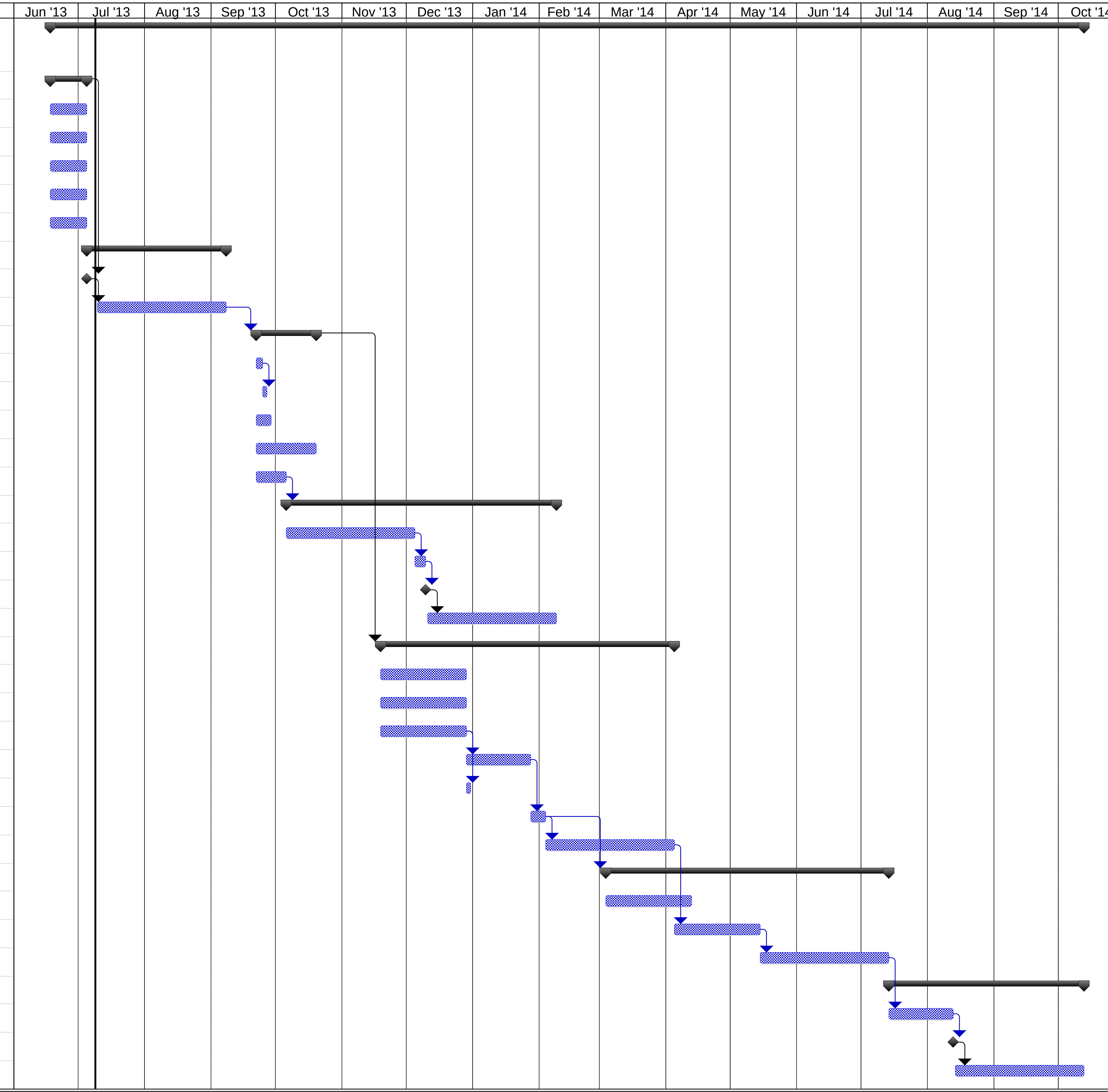
figure 5.4

PROPOSED OVERBURDEN MONITORING WELL LOCATIONS
RD /RA WORK PLAN
FRIEDRICHSOHN COOPERAGE SITE
153-155 Saratoga Ave, Waterford, NY

SOURCE: TOPOGRAPHIC SURVEY, POPLI DESIGN GROUP, AUGUST 2009,
TOPOGRAPHIC SURVEY OF CANAL, MJ ENGINEERING AND LAND
SURVEYING, P.C., APRIL 2011
BASE DRAWING INFORMATION FROM .PDF FILES OF MALCOLM
PIRNIE FIGURES PROVIDED AS PART OF THE RFP PACKAGE.

80987-98(003)GN-WA005 JUL 4/2013

ID	Task Name	Duration	Start	Finish
1	**OU-1 & OU-3 UPLAND SOURCE SOILS REMEDIAL DESIGN**	**482 days**	**Tue 6/18/13**	**Sun 10/12/14**
2	**Draft RD/RA Work Plan**	**17 days**	**Tue 6/18/13**	**Thu 7/4/13**
3	Obtain and Review Remaining Data From NYSDEC	17 days	Tue 6/18/13	Thu 7/4/13
4	Waste Management Plan - WMP	17 days	Tue 6/18/13	Thu 7/4/13
5	Quality Assurance Project Plan - QAPP	17 days	Tue 6/18/13	Thu 7/4/13
6	Health and Safety Plan - HSP	17 days	Tue 6/18/13	Thu 7/4/13
7	Community Air Monitoring Plan - CAMP	17 days	Tue 6/18/13	Thu 7/4/13
8	**Final RD/RA Work Plan**	**65 days**	**Fri 7/5/13**	**Sat 9/7/13**
9	Finalize and Submit Final RD/RA WP to NYSDEC	5 days	Fri 7/5/13	Tue 7/9/13
10	NYSDEC Approval of RD/RA Work Plan	60 days	Wed 7/10/13	Sat 9/7/13
11	**Investigation Work**	**28 days**	**Sun 9/22/13**	**Sat 10/19/13**
12	Install Monitoring Well and Borings	3 days	Sun 9/22/13	Tue 9/24/13
13	Survey New Locations	2 days	Wed 9/25/13	Thu 9/26/13
14	Collect Groundwater Samples	7 days	Sun 9/22/13	Sat 9/28/13
15	Laboratory Analysis	28 days	Sun 9/22/13	Sat 10/19/13
16	Data Validation	14 days	Sun 9/22/13	Sat 10/5/13
17	**Predesign Investigation (PDI) Report**	**126 days**	**Sun 10/6/13**	**Sat 2/8/14**
18	Prepare PDI Report	60 days	Sun 10/6/13	Wed 12/4/13
19	Finalize PDI Report	5 days	Thu 12/5/13	Mon 12/9/13
20	Submit PDI Report to NYSDEC	1 day	Tue 12/10/13	Tue 12/10/13
21	NYSDEC Approval of PDI Report	60 days	Wed 12/11/13	Sat 2/8/14
22	**Preliminary Design**	**137 days**	**Tue 11/19/13**	**Fri 4/4/14**
23	Technical Specifications	40 days	Tue 11/19/13	Sat 12/28/13
24	Supplemental Project Plans	40 days	Tue 11/19/13	Sat 12/28/13
25	Design Drawings	40 days	Tue 11/19/13	Sat 12/28/13
26	Construction Cost Estimate	30 days	Sun 12/29/13	Mon 1/27/14
27	Schedule	2 days	Sun 12/29/13	Mon 12/30/13
28	Finalize Preliminary Design	7 days	Tue 1/28/14	Mon 2/3/14
29	NYSDEC Review of Preliminary Design	60 days	Tue 2/4/14	Fri 4/4/14
30	**Pre-Final Design**	**132 days**	**Tue 3/4/14**	**Sun 7/13/14**
31	Address Comments from Preliminary Design	40 days	Tue 3/4/14	Sat 4/12/14
32	Prepare Pre-Final Design Report	40 days	Sat 4/5/14	Wed 5/14/14
33	NYSDEC Review of Draft Design Report (95%)	60 days	Thu 5/15/14	Sun 7/13/14
34	**Final Design**	**91 days**	**Mon 7/14/14**	**Sun 10/12/14**
35	Finalize Remedial Design- Address Comments	30 days	Mon 7/14/14	Tue 8/12/14
36	Submit Final Design to NYSDEC	1 day	Wed 8/13/14	Wed 8/13/14
37	NYSDEC Approval of Final Design	60 days	Thu 8/14/14	Sun 10/12/14



80987-Work Plan Schedule
Date:July 9, 2013

FIGURE 8.1: OU-1, OU-3 SOURCE SOILS RD/RA WORK PLAN SCHEDULE

FRIEDRICHSOHN COOPERAGE SITE

153-155 SARATOGA AVE, WATERFORD, NY

TABLE 2.1

ON-SITE SURFACE SOIL - OU-1
RD/RA WORK PLAN, OU-1 and OU-3 SOURCE AREA
FRIEDRICHSOHN COOPERAGE SITE
WATERFORD, NEW YORK

Detected Constituents	*Concentration Range Detected (ppm)* [a]	*Unrestricted SCO* [b] *(ppm)*	*Frequency Exceeding Unrestricted SCO*	*Restricted Use SCO* [c] *(ppm)*	*Frequency Exceeding Restricted SCO*
VOCs					
None	--	--	--	--	--
SVOCs					
Benzo(a)anthracene	0.13 to 4.4	1	2/6	1	2/6
Benzo(a)pyrene	0.18 to 4.8	1	2/6	1	2/6
Benzo(b)fluoranthene	0.24 to 6.0	1	2/6	1	2/6
Chrysene	0.18 to 5.5	1	2/6	1	2/6
Dibenzo(a,h)Anthracene	0.08 to 0.96	0.33	3/6	0.33	3/6
Indeno (1,2,3-cd)Pyrene	0.094 to 4.8	0.5	3/6	0.5	3/6
Phenol	0.43 to 9.4	0.33	4/6	100	0/6
Inorganics					
Cobalt	5.8 to 12.0	9.5[d]	1/6		
Chromium	14.9 to 621	30	3/6	180	1/6
Lead	15.9 to 3,000	63	5/6	400	1/6
Mercury	0.021 to 0.35	0.18	4/6	0.8	0/6
Pesticides/PCBs					
Total PCBs	0.013 to 0.88	0.100	3/6	1	0/6

Notes:

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil
b - Part 375-6.8(a), Unrestricted Soil Cleanup Objectives
c - Part 375-6.8(b), Restricted Use Soil Cleanup Objectives for the Protection of Public Health for Restricted Residential Use, unless otherwise noted.
d - Site Background

TABLE 2.2

ON-SITE SUBSURFACE SOIL OUTSIDE SOURCE AREA - OU-1
RD/RA WORK PLAN, OU-1 and OU-3 SOURCE AREA
FRIEDRICHSOHN COOPERAGE SITE
WATERFORD, NEW YORK

Detected Constituents	*Concentration Range Detected (ppm)* [a]	*Unrestricted SCO* [b] *(ppm)*	*Frequency Exceeding Unrestricted SCO*	*Restricted Use SCO* [c] *(ppm)*	*Frequency Exceeding Restricted SCO*
VOCs					
Acetone	0 to 0.280	0.05	5/52	100	0/52
Xylenes	0 to 3.0	0.26	3/52	100	0/52
SVOCs					
2-Methyl Naphthalene	0 to 56	NA	NA	0.41 [d]	3/52
Benzo(a)anthracene	0 to 11	1	3/52	1	3/52
Benzo(a)pyrene	0 to 9.7	1	3/52	1	3/52
Benzo(b)fluoranthene	0 to 8.5	1	3/52	1	3/52
Benzo(k)fluoranthene	0 to 3.4	0.8	1/52	1	0/52
Chrysene	0 to 13	1	2/52	3.9	2/52
Dibenzo(a,h)Anthracene	0 to 2.5	0.33	2/52	3.9	2/52
Hexachlorobenzene	0 to 9.3	NA	NA	0.41 [d]	2/52
Indeno (1,2,3-cd)Pyrene	0 to 8.1	0.5	4/52	0.5	4/52
Naphthalene	0 to 41	12	1/52	100	0/52
Phenol	0 to 6.6	0.33	10/52	100	0/52
Inorganics					
Arsenic	0 to 56.3	13	5/41	16	5/41
Chromium	10.6 to 214	30	3/41	180	1/41
Lead	7.8 to 1920	63	12/41	400	5/41
Pesticides/PCBs					
Aldrin	0 to 0.034	0.005	1/22	0.097	0/22
beta-BHC	0 to 0.22	0.036	1/22	0.36	0/22
PCBs	0 to 12	0.1	50/124	1	27/124

Notes:

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil
b - Part 375-6.8(a), Unrestricted Soil Cleanup Objectives
c - Part 375-6.8(b), Restricted Use Soil Cleanup Objectives for the Protection of Public Health for Restricted Residential Use, unless otherwise noted.
d - CP-51 Residential Supplemental Soil Cleanup Objective

TABLE 2.3

ON-SITE SURFACE SOIL - OU-3 AND VICINITY
RD/RA WORK PLAN, OU-1 and OU-3 SOURCE AREA
FRIEDRICHSOHN COOPERAGE SITE
WATERFORD, NEW YORK

Detected Constituents	*Concentration Range Detected (ppm)* [a]	*Unrestricted SCO* [b] *(ppm)*	*Frequency Exceeding Unrestricted SCO*	*Residential Use SCO* [c] *(ppm)*	*Frequency Exceeding Restricted SCO*
VOCs					
None					
SVOCs					
Phenol	0.43 to 9.4	0.33	4 of 6	100	0 of 6
Metals					
Cobalt	12.0	9.5	1 of 6		
Chromium	15 to 621	30	3 of 6	36	3 of 6
Lead	15.9 to 3,000	63	5 of 6	400	1 of 6
Mercury	0.021 to 0.35	0.18	4 of 6	0.8	0 of 6
Pesticides/PCBs					
Total PCBs	0.013 to 0.88	0.100	3 of 6	1.00	0 of 6

Notes:

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil
b - Part 375-6.8(a), Unrestricted Soil Cleanup Objectives
c - Part 375-6.8(b), Restricted Residential Soil Cleanup Objectives

TABLE 2.4

ON-SITE SUBSURFACE SOIL - OU-3 AND VICINITY
RD/RA WORK PLAN, OU-1 and OU-3 SOURCE AREA
FRIEDRICHSOHN COOPERAGE SITE
WATERFORD, NEW YORK

Detected Constituents	*Concentration Range Detected (ppm)* [a]	*Unrestricted SCO* [b] *(ppm)*	*Frequency Exceeding Unrestricted SCO*	*Residential Use SCO* [c] *(ppm)*	*Frequency Exceeding Restricted SCO*
VOCs					
Chlorobenzene	10	1.1	1 of 76	100	0 of 76
Ethylbenzene	0.009 to 160	1	12 of 76	30	0 of 76
Toluene	0.009 to 230	7	13 of 76	100	0 of 76
Xylenes	0.001 to 570	0.26	19 of 76	100	0 of 76
SVOCs					
Hexachlorobenzene	0.033 to	0.41 [d]	13 of 76		
Phenol	0.097 to 43	0.33	21 of 76	100	0 of 76
Metals					
Arsenic	2.3 to 56.3	13	8 of 56	16	7 of 56
Barium	45 to 1,770	350	4 of 56	350	4 of 56
Chromium	10.6 to 214	30	3 of 56	36	6 of 56
Lead	9.5 to 1920	63	15 of 56	400	4 of 56
Pesticides/PCBs					

Notes:

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil
b - Part 375-6.8(a), Unrestricted Soil Cleanup Objectives
c - Part 375-6.8(b), Restricted Residential Soil Cleanup Objectives
d – Residential use from CP-51 Supplemental Clean up Guidance

TABLE 5.1

PCB RESULTS - 50 PPM DELINEATION BORINGS
FRIEDRICHSOHN COOPERAGE SITE
WATERFORD, NEW YORK

Depth Interval (ft bgs)	*SB-58*		*SB-66*		*SB-67*		*SB-71*		*SB-72*		*SB-73*		*SB-74*	
	ppm	*Sample Depth (ft bgs)*	*ppm*	*Sample Depth (ft bgs)*	*ppm*	*Sample Depth (ft bgs)*	*ppm*	*Sample Depth (ft bgs)*	*ppm*	*Sample Depth (ft bgs)*	*ppm*	*Sample Depth (ft bgs)*	*ppm*	*Sample Depth (ft bgs)*
0-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-5 *	0.56	4-5	1.1	3-4	19	4-5	0.26	3-4	0.029	1-2	12	4-5	2.3	4-5
5-10	27	9-10	2.7	6-7	6.5	7-8	0.54 .074	6-7 6-7 (DUP)	3	5-6	14	6-7	1000	7-8
10-15	-	-	8.2	14-15	6.0	10-12	1.6	10-11	1.5	11-12	5.8	11-12	12	10-11

Notes

* Excludes surface samples
[yellow highlight] > 50 ppm
- No sample collected at depth

TABLE 5.1

PCB RESULTS - 50 PPM DELINEATION BORINGS
FRIEDRICHSOHN COOPERAGE SITE
WATERFORD, NEW YORK

	SB-75		*SB-76*		*SB-77*		*SB-80*		*SB-81*		*SB-82*	
Depth Interval (ft bgs)	*ppm*	*Sample Depth (ft bgs)*	*ppm*	*Sample Depth (ft bgs)*	*ppm*	*Sample Depth (ft bgs)*	*ppm*	*Sample Depth (ft bgs)*	*ppm*	*Sample Depth (ft bgs)*	*ppm*	*Sample Depth (ft bgs)*
0-0.5	-	-	0.18	0-1	-	-	-	-	-	-	-	-
0-5 *	-	-	72	4-5	1.3	3-4	0.67	4-5	-	-	-	-
5-10	15	5-6	2.1	9-10	0.28	6-7	.016	7-8	0.53	5-6	0.269	6-7
	8.9	9-10					0.15	7-8 (DUP)	1.5	8-9		
10-15	3.1	13-14	-	-	0.51	11-12	1.1	10-11	6.4	10-11	4.4	12-13

Notes

* Excludes surface samples
(yellow highlight) > 50 ppm
- No sample collected at depth

APPENDIX A

MONITORING WELL MW-09 TEST BORING LOG

MALCOLM PIRNIE	TEST BORING LOG	BORING No.MW-09

PROJECT	Friedrichsohn Cooperage	LOCATION	Waterford, Saratoga County, NY
CLIENT	New York State Department of Environmental Conservation		
DRILLING CONTRACTOR	Buffalo Drilling		
PURPOSE	Remedial Investigation		
WELL MATERIAL	Bedrock		
DRILLING METHOD(S)	Rotary		
DRILL RIG TYPE	HSA		
GROUND WATER DEPTH	'		
MEASURING POINT			
DATE OF MEASUREMENT			

	SAMPLE	CORE	CASING
TYPE			
DIA.	"		
WEIGHT	#		
FALL	"		

SHEET	1 OF 1
PROJECT No.	0266382
MEAS. PT. ELEV.	
GROUND ELEV.	
DATUM	
DATE STARTED	9/2/09
DATE FINISHED	9/8/09
DRILLER	Joe Gardner
PIRNIE STAFF	D. Giroux

DEPTH FT.	SAMPLE TYPE, RECOVERY, NUMBER	BLOWS ON SAMPLE SPOON PER 6"	PID	GRAPHIC LOG	GEOLOGIC DESCRIPTION KEY - Color, Major, Minor Moisture, Etc.	ELEV. / DEPTH	WELL Constr.	REMARKS
					No Sampling / Split Spoons Collected.			
2								
4								
6								
8								
10					Refusal at 15'			
12					5 7/8 roller bit to 20'. Set 4" PVC rock socket. Grout 15' to 20'.			
14					Drill to 59.5' with 3 7/8 roller bit. Set 49.5' riser, 10' screen; no sand pack.			
16								
18								

MALCOLM PIRNIE

TEST BORING LOG

BORING No.MW-10

PROJECT	Friedrichsohn Cooperage	LOCATION	Waterford, Saratoga County, NY	SHEET	1 OF 1
CLIENT	New York State Department of Environmental Conservation			PROJECT No.	0266382
DRILLING CONTRACTOR	Buffalo Drilling			MEAS. PT. ELEV.	
PURPOSE	Remedial Investigation			GROUND ELEV.	
WELL MATERIAL	Overburden			DATUM	
DRILLING METHOD(S)	Rotary			DATE STARTED	9/3/09
DRILL RIG TYPE	HSA			DATE FINISHED	9/3/09
GROUND WATER DEPTH	7.5'			DRILLER	Joe Gardner
MEASURING POINT				PIRNIE STAFF	D. Giroux
DATE OF MEASUREMENT					

	SAMPLE	CORE	CASING
TYPE	split spoon		pvc
DIA.	"		2"
WEIGHT	#		
FALL	"		

DEPTH FT.	SAMPLE TYPE, RECOVERY, NUMBER	BLOWS ON SAMPLE SPOON PER 6"	PID	GRAPHIC LOG	GEOLOGIC DESCRIPTION KEY - Color, Major, Minor Moisture, Etc.	ELEV. / DEPTH	WELL Constr.	REMARKS
0–2	1.5		0		Brown Silty fine SAND (moist, compact).			
2–4	1.5		0					
4–6	0		5.6		Black burnt medium SAND (moist, loose).	3.8		
					No recovery.	4.0		
6–8	.5		>9999		Brown/gray Silty SAND to Sandy SILT (moist, compact).	6.0		
8–10	.5		>9999		Gray Sandy angular GRAVEL (wet, loose).	7.5		▼ (7.5)
10–12	.5		>9999				10.0	
12–14	.5		>9999				12.0	
							13.0	
14–16	.25		396			15.0	15.0	

APPENDIX B

HEALTH AND SAFETY PLAN

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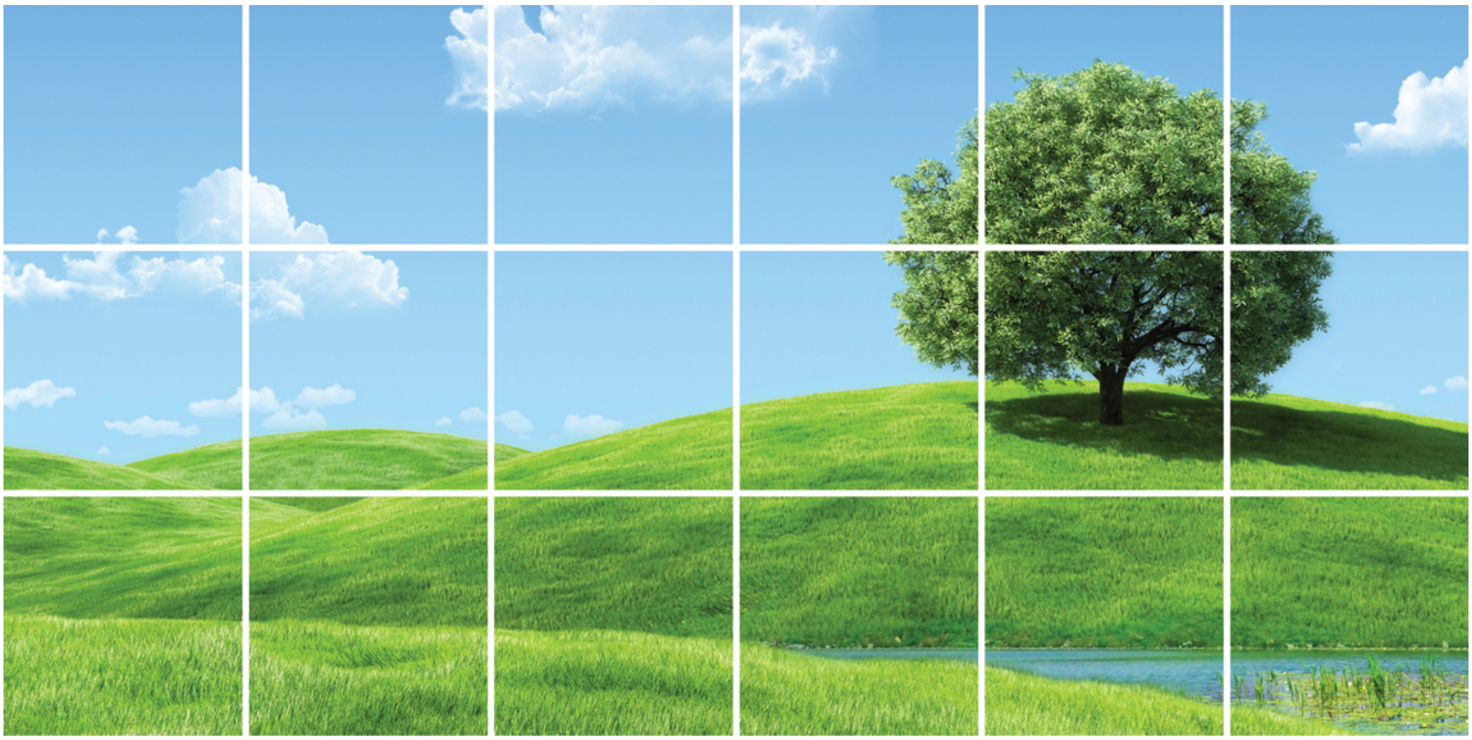

SITE-SPECIFIC HEALTH AND SAFETY PLAN

FRIEDRICHSOHN COOPERAGE SITE

Prepared for: General Electric Company and SI Group, INC.

Conestoga-Rovers & Associates
2055 Niagara Falls Boulevard, Suite #3
Niagara Falls, New York 14304

July 2013 • #080897
Report Number:2

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) describes the health and safety procedures and emergency response guidelines that will be implemented during the field activities supporting the Remedial Design (RD) for the Friedrichsohn Cooperage Site (Site) located in Waterford, New York. The layout of the Site is presented on Figure 2.1 of the Remedial Design/Remedial Action (RD/RA) Workplan. An Emergency Response Plan and Community Air Monitoring Plan are included as part of this HASP. This HASP shall be implemented and adhered to during all field activities that are presented in the Remedial Design (RD) Report.

The scope of work to be completed by the selected contractors during the RD field activities includes the following:

i) Mobilization and demobilization of labor, materials, and equipment to and from the Site, which include Site preparation/setup and Site restoration activities.
ii) Site reconnaissance activities
iii) Surveying activities.
iv) Installation of soil borings.
v) Soil Excavation.
vi) Collection of soil samples.
vii) Oversight of monitoring well installation
viii) Groundwater sampling and monitoring.
ix) Equipment and personnel decontamination activities.

During a portion of these activities, personnel may come in contact with waste materials, debris, soils, groundwater, which may contain hazardous substances. This HASP has been developed to minimize direct contact by project personnel with materials potentially having chemical presence by ensuring:

i) That project personnel are not adversely exposed to the contaminants of concern.
ii) That public health and the environment are not adversely impacted by materials with elevated chemical presence that may potentially migrate outside of the work zone during project activities at the Site.
iii) Compliance with applicable governmental and non-governmental (American Conference of Governmental Industrial Hygienists [ACGIH]) regulations and guidelines. In particular, the amended rules of the Occupational Safety and

Health Administration (OSHA) for Part 1926, of Title 29 Code of Federal Regulations (CFR). Part 1926.65 will be implemented for all Site work where project personnel may come into contact with the health and safety hazards that are present at the Site.

iv) Initiation of proper emergency response procedures to minimize the potential for any adverse impact to project personnel, the general public, or the environment.

A vital element of the selected contractor's Health and Safety Program will be the implementation of a Site-specific HASP for all field activities.

This project HASP requires the following measures:

i) The communication of the contents of this HASP to project personnel.

ii) The elimination of unsafe conditions. Efforts shall be initiated to identify conditions that can contribute to an accident and to remove exposure to these conditions.

iii) The review of all activities prior to undertaking the task/job, after an incident, and/or as a result of any unusual circumstances. Stop activities to think about the task, analyze the task hazards, determine methods to reduce risk, and review the results with affected personnel.

iv) The review of existing or the development of new Job Safety Analysis (JSA) forms for each project activity. Supervisors and affected personnel are responsible for the development and ongoing revisions of JSAs. The JSAs for all known work activities are presented in Appendix A.

v) The reduction of unsafe acts. Project personnel shall make a conscious effort to work safely. A high degree of safety awareness must be maintained so those safety factors involved in a task become an integral part of the task. Supervisory personnel shall ensure that project personnel committing unsafe acts are held accountable via counseling, mentoring, and, if necessary, reprimand.

vi) The frequent inspection of project activities. Regular safety inspections of the work site, materials, and equipment by qualified persons ensure early detection of unsafe conditions. Safety and health deficiencies shall be corrected as soon as possible, and project activities shall be temporarily suspended until the appropriate corrective actions are taken. Documentation of the daily inspections and corrective actions taken should be kept with the project files.

For the purpose of this HASP, activities performed at the Site involving contact with materials, which potentially have an elevated chemical presence will be considered contaminated operations requiring the use of Personal Protective Equipment (PPE). A detailed description of the required PPE is presented in Section 5.1 and is also identified on each JSA form.

The applicability of this HASP extends to all project personnel who will be on Site, including State and Federal Agency personnel, contractor personnel, subcontractor personnel, and visitors to the Site.

All project activities at the Site will be conducted in accordance with the provisions of an approved Site-specific HASP. A copy of the Site-specific HASP and employer-specific Standard Operating Procedures (SOPs) will be maintained on Site whenever activities are in progress. This HASP shall be used in conjunction with the selected contractor's Safety and Health Program.

1.1 PROJECT ORGANIZATION

All personnel conducting activities on the Site must conduct their activities in compliance with all applicable Safety and Health standards as specified by OSHA including, but not limited to, the OSHA 29 CFR 1910, 29 CFR 1926. Project personnel must also be familiar with the procedures and requirements in their approved Site-specific HASP and the applicable procedures found within their company's SOPs and Safety and Health Policy Manual. In the event of any conflicting safety procedures/requirements, personnel shall implement those safety practices, which afford the highest level of safety and protection.

Project Management and Safety Organization

Project Manager Contractor – (to be determined)

The Contractor's Project Manager (CPM) shall be responsible for the overall implementation of the HASP, and for ensuring that all health and safety responsibilities are carried out in conjunction with this project. This shall include, but is not limited to, review and approval of the HASP; qualifying/directing subcontractors relative to safety and health performance; coordinating all safety and health submittals; providing the appropriate technical information to write submittals; and consultation with the Frontier Chemical Site Potentially Responsible Parties Group (Frontier Group) regarding appropriate changes to the HASP.

Site Safety & Health Officer Contractor – (to be determined)

The Contractor's Safety & Health Officer (CSHO) is the person who, under the supervision of the CPM and the contractor's Corporate Safety and Health Manager, shall be responsible for the communication of the Site requirements to project personnel and any subcontractor personnel. Additional qualified safety officers will be assigned to work during shifts when the CSHO is not on Site. These safety officers will be under the watchful eye of the CSHO and will contact the CSHO after hours if necessary. The CSHO will have prior experience in working at hazardous waste sites and will be responsible for carrying out the health and safety responsibilities by making sure that:

i) He/she is on Site at all times during active excavation activities and when other active remediation work is ongoing.

ii) All necessary clean-up and maintenance of safety equipment is conducted by project personnel.

iii) Emergency services are contacted when necessary.

iv) A Site-specific Hazard Communication (HAZCOM) Program is maintained on Site.

v) Project safety forms attached to the HASP are correctly completed and filed.

vi) A pre-entry briefing is conducted, which will serve to familiarize project personnel with the procedures, requirements, and provisions of this HASP.

vii) All necessary records are maintained in the project files (e.g., air monitoring results, calibration log sheets, incident reports, daily toolbox meeting sheets, daily safety logbook entries, training certificates and/or certifications, etc.). The selected contractor may use either their employer-specific safety forms or the forms that are provided in Appendix B.

viii) Daily safety meetings are held and documented.

ix) Safe work practices for project personnel are enforced.

x) Safety of any visitors who enter the Site is ensured.

xi) Communication is maintained with the CPM.

xii) Orders the immediate shutdown of Site activities in the case of a medical emergency, unsafe condition, or unsafe practice.

xiii) Designates work areas and defines minimum PPE requirements.

xiv) Provides the safety equipment, PPE, and other items necessary for project personnel.

xv) Conducts the required air monitoring program.

xvi) Enforces the use of required safety equipment, PPE, and other items necessary for project personnel safety.

xvii) Oversees any potential confined space entry work including preplanning rescue activities with the local community responders.

xviii) Ensures that there is a competent person in place who will be supervising trenching and excavation work.

xix) Conducts job site inspections with the Construction Superintendent (CS) or Site Supervisor (SS) as a part of quality assurance for safety and health.

xx) Reports safety and health concerns to the selected contractor's management as necessary.

Emergency Coordinator

The CSHO or his/her designate will act as the Emergency Coordinator (EC). The EC shall be able to implement the emergency procedures and is responsible for implementing the following activities in the event of an emergency:

i) The EC shall immediately respond to all imminent or actual emergency situations. The EC shall notify all project personnel and emergency response agencies, identify the problem, assess the health or environmental hazards, and take all reasonable measures to stabilize the situation.

ii) The EC shall take all reasonable measures necessary to ensure that fire, explosion, emission or discharge does not occur, re-occur, or spread. These measures may include stopping operations, collecting and containing released materials, and/or removing or isolating containers.

iii) The EC shall develop Emergency Evacuation Routes on a daily basis and communicate them to all project personnel.

iv) The EC shall also be responsible for follow-up activities after any incident such as the cleanup of the affected area, maintenance and decontamination of emergency equipment, and completion and submission of an incident report.

Construction Superintendent/Site Supervisor - Contractor (to be determined)

Health and safety is a line management responsibility, and as such, the CS and/or SS will implement the overall onsite direction and enforcement of the health and safety for this project. The CS and/or SS must meet the requirements of the "competent person" as per the OSHA regulations. The CS and/or SS will report to the CPM for this project.

The CS and/or SS is the person who, under the supervision of the CPM, shall be responsible for the communication of the Site requirements to project personnel and subcontractors, and is responsible for carrying out the health and safety responsibilities by making sure that:

i) All underground utilities have been properly located prior to initiating work activities.

ii) Each work area is secured with fencing at the end of each day.

iii) All necessary cleanup and maintenance of safety equipment is conducted by project personnel.

iv) JSA forms are developed, reviewed, and revised accordingly.

v) Project personnel stop, think about, act accordingly and review the work activities that they are about to start before initiating activities.

vi) Project safety forms attached to the HASP are completed properly and then filed.

vii) A pre-entry briefing is conducted for all project personnel, which will serve to familiarize everyone with the procedures, requirements, and provisions of this HASP.

viii) Orders the immediate shutdown of project activities in the case of a medical emergency, unsafe condition, or unsafe practice.

ix) Provides the safety equipment, PPE, and other items necessary for project personnel.

x) Enforces the use of required safety equipment, PPE, and other items necessary for personnel or community safety.

xi) Conducts job site inspections as a part of quality assurance for safety and health.

xii) Reports safety and health concerns to the CPM as necessary.

xiii) Is responsible for the overall implementation of the HASP, and ensuring that all health and safety responsibilities are carried out during the project work activities. This shall include, but is not limited to, review and approval of any subcontractor HASPs, communication of site requirements to Subcontractor personnel, and consultation with the CPM regarding appropriate changes to the HASP.

xiv) THE CS and/or SS also have the responsibility for enforcing safe work practices for all project personnel.

xv) The CS and/or SS watch all personnel for any ill effects, especially those symptoms caused by heat stress and/or chemical exposure.

xvi) The CS and/or SS oversee the safety of any visitors who enter the Site.

Corporate Safety & Health Manager Contractor – (to be determined)

The Corporate Safety & Health Manager (CSHM) is an individual who is trained as a health and safety professional, works full-time for the selected contractor in a health and safety role, and who serves in a consulting role to the CPM, CSHO, and CS and/or SS regarding potential health and safety issues.

Equipment Operators

All equipment operators are responsible for the safe operation of heavy equipment. Operators are responsible for inspecting their equipment on a daily basis to ensure safe performance. Brakes, hydraulic lines, backup alarms, and fire extinguishers must be inspected routinely throughout the project. Documentation of daily inspections will be required via an equipment inspection checklist. Heavy equipment inspections will be submitted to the CS or SS for review and subsequently placed in the project files. Unsafe conditions/acts are to be immediately reported to the CS or SS. Equipment will be taken out of service if an unsafe condition occurs.

Project Personnel Safety Responsibilities

Project personnel are responsible for their own safety as well as the safety of those around them and shall use any equipment provided in a safe and responsible manner, as directed by their supervisor. Project personnel will follow the policies set forth in this HASP and those in their employer-specific SOPs and Safety and Health Program.

Project personnel are directed to take the following actions when appropriate:

i) Review all activity hazards and preventative measures before initiating work

ii) Assist in the development/revision of JSA forms that are appropriate to their current work activities

iii) Suspend any operations that may cause an imminent health hazard to project personnel

iv) Inspect tools and other equipment before each use or as the manufacturer and/or OSHA mandates

v) Correct job site hazards when possible without endangering life or health

vi) Report safety and health concerns to the CSHO, CS, and/or SS

Subcontractors

Selected subcontractor(s) will be responsible for providing a CS and/or SS ("competent person") and a SHO to direct their activities and to meet all applicable OSHA Regulations. This may be the same individual if so qualified. These individuals will be responsible for ensuring that all contract specifications are met, including those related to project health and safety. The names of these individuals will be presented in the subcontractor Site-specific HASP.

The selected contractor will review any subcontractor HASP prior to the subcontractor's mobilization to the Site. Subcontractors will be responsible for the health and safety of their personnel, which includes following all applicable OSHA Regulations and the subcontractors' Site-specific HASP. Subcontractors will be required to attend an initial Site briefing put on by the selected contractor and subsequent daily safety meetings.

Authorized Visitors

Authorized Visitors shall be provided with all known information with respect to the project operations and hazards, as applicable to the purpose of their visit.

2.0 SITE CHARACTERIZATION AND POTENTIALLY HAZARDOUS COMPOUNDS

Table 2.1 presents the available information pertaining to the Site Contaminants of Concern (COCs) and their properties including the identification of the maximum detected concentrations of the COCs in Site soils and groundwater. The exposure routes and regulatory Time Weighted Averages (TWA) exposure levels for the COCs are also listed in Table 2.1. These levels are set to protect the health of workers.

3.0 BASIS FOR DESIGN

Regulations set forth by OSHA in Title 29, CFR, Parts 1910 and 1926 (29 CFR 1910 and 1926) form the basis of this HASP. Emphasis is placed on Section 1926.65 (Hazardous Waste Operations and Emergency Response), 1910 Subpart I (Personal Protective Equipment), 1910 Subpart Z (Toxic and Hazardous Substances), 1926 Subpart O (Motor Vehicles, and Mechanized Equipment), and 1926 Subpart F (Excavations). Some of the specifications within this section are in addition to the OSHA regulations, and reflect the positions of U.S. EPA, and the National Institute for Occupational Safety and Health (NIOSH), regarding safe operating procedures at hazardous waste sites.

The health and safety of the public and Site personnel and the protection of the environment will take precedence over cost and scheduling considerations for all project work.

4.0 PERSONNEL TRAINING

4.1 GENERAL

Required project personnel as discussed in Section 1.1 shall complete hazardous waste operations and emergency response related training, as required by the OSHA Standard 29 CFR 1926.65. Project personnel shall also initially receive a minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed their training more than 12 months prior to the start of this project shall have also completed an 8-hour refresher course within the past 12 months. The CS and or SS shall complete the additional 8 hours of training that is required for supervisors along with any "competent persons" training that may be needed for the required work.

Additional safety training for specific tasks/activities may include safety training for fall protection, ladder safety, confined space entry work, excavation safety, and the control of hazardous energy etc. Further safety training may also be required based on the scheduled scope of work. This safety training is to be conducted and documented before any tasks that require additional training are initiated. It is the responsibility of the CSHO and CS and/or SS to ensure that personnel have the necessary training and skills prior to activity assignment. Task safety training requirements are included on each JSA form.

4.2 BASIC 40-HOUR COURSE

The following is a list of the topics typically covered in a 40-hour training course:

i) General safety procedures
ii) Physical hazards (fall protection, noise, heat stress, cold stress)
iii) Names and job descriptions of key personnel responsible for Site health and safety
iv) Safety, health, and other hazards typically present at hazardous waste sites
v) Use, application, and limitations of PPE
vi) Work practices by which employees can minimize risks from hazards
vii) Safe use of engineering controls and equipment on Site
viii) Medical surveillance requirements

ix) Recognition of symptoms and signs, which might indicate overexposure to hazards
x) Worker right-to-know (Hazard Communication OSHA 1926.59/1910.1200)
xi) Routes of exposure to contaminants
xii) Engineering controls and safe work practices that may be implemented
xiii) Components of a project HASP
xiv) Decontamination practices for personnel and equipment
xv) Confined space entry procedures
xvi) General emergency response procedures

4.3 SUPERVISOR COURSE

Management and supervisors (i.e., the CS and SS) are required to receive an additional 8 hours of training in topics that are pertinent to the management of hazardous waste operations, which typically includes:

i) Instruction in detailed project safety and health procedures dealing with emergencies
ii) PPE programs
iii) Implementation of specialized emergency response procedures
iv) Air monitoring techniques

4.4 SITE-SPECIFIC TRAINING

All project personnel attending the initial safety meeting will accomplish the project-specific training on the contents of this HASP before work begins. The review will include a discussion of the chemical, physical, and biological hazards that may be present at the Site, the protective equipment and safety procedures to be used and followed, and emergency procedures that will be implemented at the Site. The Training Acknowledgment Form that project personnel will sign off on is provided in Appendix B (Project Safety Forms).

4.5 DAILY SAFETY MEETINGS

Daily safety meetings (tailgate safety talks) will be held to cover the work that is anticipated to be accomplished each day, the associated hazards, the PPE, procedures required to minimize exposure to these hazards, and the required emergency response procedures. The CS, SS, and/or CSHO will preside over these meetings prior to beginning the day's fieldwork. No work will be performed in an Exclusion Zone (EZ) before the daily safety meeting has been held. Additional safety meetings shall also be held prior to initiating new tasks, and repeated if new hazards are encountered. The form for documenting the daily safety meetings is also found in Appendix B.

4.6 FIRST AID AND CPR

At least one individual with current certification in First Aid/CPR will be assigned to the work crew and will be on the Site during all field activities. Refresher training in First Aid and CPR is required to keep the certificate current. These individuals must also receive training regarding the precautions and protective equipment necessary to protect against exposure to blood-borne pathogens. Blood-borne pathogen training should be included as part of the First Aid/CPR training course delivered by the training provider.

5.0 PERSONAL PROTECTIVE EQUIPMENT

PPE will be required to safeguard project personnel from various hazards. Varying levels of protection may be used depending on the level of contaminants and the degree of any physical hazard. This section presents the various levels of personal protection and defines the conditions of use for each level. Subcontractor Site-specific HASPs, if required, will adequately address PPE concerns for each specific task activity based on their proposed scope of work.

5.1 LEVELS OF PROTECTION

Protection levels are determined based upon chemicals and physical hazards present in the work area. The specific protection levels to be employed at the Site for each work task are presented on each JSA form, which are presented in Appendix A.

5.1.1 LEVEL D PROTECTION

The minimum level of protection that will be required for all project personnel will be Level D. Level D will only be used in clean areas where there is no potential for exposure to the COCs. The following equipment is to be worn as Level D PPE:

i) Work clothing as prescribed by the weather.
ii) Steel toed work boots meeting American National Standard Institute (ANSI) Z41.
iii) Safety glasses or goggles, meeting ANSI Z87.
iv) Leather work gloves.
v) High visibility safety vest (Class II) when working near moving equipment.
vi) Hard hat, meeting ANSI Z89.
vii) Hearing protection, if necessary.

5.1.2 MODIFIED LEVEL D PROTECTION

Modified Level D will be worn when airborne contaminants are not present at levels where respiratory protection is required, but where project activities present an increased potential for skin contact with hazardous substances. The following equipment is to be worn as Modified Level D:

i) Tyvek® coveralls or polyethylene coated Tyvek® coveralls (if liquids/splash hazards are present).

ii) Steel toed work boots meeting ANSI Z41.

iii) Neoprene or polyvinyl chloride (PVC) over boots.

iv) Safety glasses or goggles.

v) Hard hat.

vi) Face shield in addition to safety glasses or goggles when projectiles and/or splashing liquids pose a hazard.

vii) Disposable nitrile inner gloves (NDEX 8005, as manufactured by Best, or equivalent).

viii) Nitrile over gloves.

ix) Hearing protection (if necessary) (if noise levels exceed 85 dBA, then hearing protection with a Noise Reduction Rating (NRR) of at least 20 dBA must be used).

x) High visibility safety vest (Class II) when working near moving equipment.

5.1.3 LEVEL C PROTECTION

Level C protection will be required when the airborne concentration of suspected contaminants are present in the worker's breathing zone at sustained levels of greater than 1 part per million (ppm) as measured with a photoionization detector (PID) or 1.0 milligram per cubic meter (mg/m^3) measured with a particulate monitor (MIE personal Data Ram or equivalent). Supplied air will be required when the PID readings are sustained at levels greater than 25 ppm. If PID readings subside, workers can downgrade as necessary. The selected contractor shall attempt to obtain additional information on the chemicals present in the work area when readings are sustained above 25 ppm.

The following equipment will be used for Level C protection:

i) Full-face air purifying respirator (APR) with organic vapor/acid gas cartridges in combination with particulate filters (P-100) which are NIOSH approved (MSA GME P100 cartridges or equivalent).

ii) Polyethylene coated Tyvek® or Saranex® hooded suit (if liquids/splash hazards are present) or Tyvek® coveralls, ankles, and cuffs taped to boots and gloves.

iii) A chemical splash apron and/or a polycoated Tyvek® suit when handling NAPL.

iv) Nitrile over glove.

v) Inner nitrile disposable gloves (NDEX 8005, as manufactured by Best, or equivalent).

vi) Safety toe work boots, ANSI approved.

vii) Chemical resistant neoprene or rubber boots with steel toes, or latex/PVC booties over safety toe shoes.

viii) Hard hat, ANSI approved.

ix) Hearing protection (if necessary).

x) High visibility safety vest (Class II).

5.1.4 LEVEL B PROTECTION

Level B protection will be worn when the airborne concentrations of suspended contaminants are present at sustained levels greater than 25 ppm due to the presence of organic vapors or if carbon monoxide levels exceed 35 ppm. Therefore, Level B protection will be required when sustained readings reach 25 ppm as 25 ppm is the level where supplied air respiratory protection becomes required.

The action level necessitating Level B protection may be revised subject to determination of the compounds triggering the Level B protection requirement. However, if the CSHO is unable to identify/quantify the contaminants, supplied air will continue to be required when the PID reading is greater than 25 ppm.

The following equipment will be used for Level B protection:

i) Supplied air respirator (NIOSH approved). Respirators may be positive pressure-demand self-contained breathing apparatus (SCBA), or positive pressure-demand airline respirator (with 5-minute escape bottle for immediately dangerous to life and health (IDLH) situations).

ii) Polyethylene coated Tyvek®(equipment operators) or Saranex® hooded coverall (directly exposed personnel or personnel working with NAPL) with ankles and cuffs taped to boots and gloves. (Note: Kimberly Clark Kleenguard A80 Hazard-Gard II Saranex® coveralls or equivalent).

iii) A chemical splash apron and/or a polycoated Tyvek® suit when handling NAPL.

iv) Nitrile over gloves.

v) Inner nitrile disposable gloves (NDEX 8005, as manufactured by Best, or equivalent).

vi) Safety toe work boots, ANSI approved.

vii) Chemical resistant neoprene or rubber boots with steel toes, or latex/PVC booties over safety toe shoes.

viii) Hard hat, ANSI approved.

ix) Hearing protection (if necessary).

x) High visibility safety vest (Class II).

5.1.5 SELECTION OF PPE

Equipment for personal protection will be selected based on the potential for contact, Site conditions, ambient air quality, and the judgment of the CPM, CS, SS, CSHO, and the CSHM. The PPE used will be chosen to be effective against the compound(s) present on the Site.

5.2 RESPIRATORY PROTECTION

Respiratory protection is an integral part of personnel health and safety at sites with potential airborne contamination.

5.2.1 SITE RESPIRATORY PROTECTION PROGRAM

The Site respiratory protection program will consist of the following:

i) All project personnel who may use respiratory protection will have an assigned respirator.

ii) All project personnel who may use respiratory protection will have been fit tested and trained in the use of all respirators within the past 12 months.

iii) All project personnel who may use respiratory protection must, within the past year, have been medically certified as being capable of wearing a respirator. Documentation of the medical certification must be provided to the CSHO prior to commencement of Site work.

iv) Only cleaned, maintained, NIOSH approved respirators are to be used on this Site.

v) If respirators are used, the respirator cartridge is to be properly disposed of at the end of each work shift, prior to expected breakthrough, or when breathing becomes labored (filter load-up occurs).

vi) Contact lenses may be worn with a full-face respirator.

vii) All project personnel who may use respiratory protection must be clean-shaven. Mustaches and sideburns are permitted, but they must not interfere with the sealing surface of the respirator.

viii) Respirators will be inspected and a negative pressure test performed prior to each use.

ix) After each use, the respirator will be wiped with a disinfectant cleansing wipe or washed during a formal respirator cleaning procedure. When used, the respirator will be thoroughly cleaned at the end of the work shift. The respirator will be stored in a clean plastic bag, away from direct sunlight in a clean, dry location, in a manner that will not distort the facepiece.

Respiratory protection may be required during some of the project activities. This is to ensure worker protection from potentially contaminated particulates and volatile organic carbons (VOCs). It is expected that Modified Level D personal protection will be worn during the majority of the project activities involving the handling of impacted materials. However, the CSHO will make the determination of the acceptable level of protection based upon the results of the air-monitoring program. Also, if during these field activities, the real-time air monitoring program indicates the need for an upgrade in protection to Level C or Level B, then these activities will be continued with the increased level of personal protection and additional source controls (e.g., forced ventilation, foam, plastic sheeting, modified production rate, water spray, etc.) to control vapors and/or particulates.

A PID with a 10.6 or greater eV lamp will be used to determine if organic vapors are present. A background reading will be established prior to commencing work activities at each active work area.

Action levels to determine the level of respiratory protection necessary for organic vapors are based on the sustained (15-minute) concentration of COCs measured within the breathing zone. The action levels and appropriate respiratory protection are referenced in Table 8.1 of this document. The PID action levels have been set based on the presence of the known VOCs, which have been identified at the Site. However, if the ambient concentrations of organic vapors are due to identifiable substances, the level of respiratory protection may be altered by the CSHO.

The appropriate air purifying respirator cartridges to be used at the Site are a combination organic vapor/acid gas and P-100 cartridge. The cartridge must be of the same manufacturer as the respirator face piece.

A personal aerosol monitor (e.g., MIE® Personal DataRam or equivalent) will also be utilized to determine airborne dust/particulate concentrations. A background reading will be established prior to commencing work activities at the upwind perimeter of each active work area.

Action levels to determine the level of respiratory protection necessary for dust levels are based on the concentration of the COCs measured within the breathing zone. The action levels and appropriate respiratory protection for particulates are included in Table 8.1 of this document.

5.3 USING PPE

Depending upon the level of protection selected for this project, specific donning and doffing procedures may be required. The procedures presented in this section are mandatory if Level B or Level C PPE is used.

All personnel entering the EZ must put on the required PPE in accordance with the requirements of this plan. When leaving the EZ, PPE will be removed in accordance with the procedures listed, to minimize the spread of contamination.

5.3.1 DONNING PROCEDURES

These procedures are mandatory only if Level B or Level C PPE is used on the project:

i) Remove bulky outerwear. Remove street clothes and store in clean location.
ii) Put on work clothes or coveralls.
iii) Put on the required chemical protective coveralls or rain gear.
iv) Put on the required chemical protective boots or boot covers.
v) Tape the legs of the coveralls to the boots with duct tape.
vi) Put on the required chemical protective gloves.
vii) Tape the wrists of the protective coveralls to the gloves.
viii) Don the required respirator and perform appropriate fit check.
ix) Put hood or head covering over head and respirator straps and tape hood to facepiece.
x) Check and secure all seams.
xi) Don remaining PPE, such as hard hat.

When these procedures are instituted, one person (bottle watch/decon attendant) must remain outside the work area to ensure that each person entering has the proper protective equipment.

5.3.2 DOFFING PROCEDURES

The following procedures are only mandatory if Level B or C PPE is required for this project. Whenever a person leaves a Level B or C work site, the following decontamination sequence will be followed:

i) Upon entering the Contamination Reduction Zone (CRZ) rinse contaminated materials from the boots or remove contaminated boot covers.
ii) Clean reusable protective equipment.
iii) Remove protective garments, equipment, and respirator. All disposable clothing should be placed in a covered container, which is labeled.
iv) Clean the respirator using the appropriate method as determined by the CSHO.
v) Wash hands, face, and neck and shower as soon as possible at the end of the day.

vi) Proceed to clean area and dress in clean clothing.

vii) Clean and disinfect respirator for next use.

All disposable equipment, garments, and PPE must be placed in covered containers and labeled for disposal. See Section 9.0 for detailed information on decontamination procedures.

5.4 SELECTION MATRIX

The level of personal protection selected will be based upon real-time air monitoring of the work environment and an assessment by the CSHO and CS and/or SS of the potential for skin contact with contaminated materials. The PPE selection matrix is given in each JSA form that is provided in Appendix A. This matrix is based upon information available at the time this HASP was written.

5.5 DURATION OF WORK TASKS

The duration of activities involving the usage of PPE will be established by the CSHO based upon ambient temperature and weather conditions, the capacity of personnel to work in the designated level of PPE (heat stress, see Section 7.3) and the limitations of the protective equipment (i.e., ensemble permeation rates, life expectancy of air purifying respirator (APR) cartridges, etc.).

All rest breaks will be taken in the Support Zone (SZ) after full decontamination and PPE removal. Rest breaks will be observed based upon the heat stress monitoring guidelines presented in Section 7.3.

5.6 LIMITATIONS OF PROTECTIVE CLOTHING

PPE ensembles have been selected to provide protection against contaminants at anticipated concentrations. However, no protective garment, glove, or boot is chemical-proof, nor will it afford protection against all chemical types. Permeation of a given chemical through PPE is a complex process governed by contaminant concentrations, environmental conditions, physical condition of the protection garment, and the resistance of a garment to a specific contaminant. Chemical permeation may continue even after the source of contamination has been removed from the garment.

In order to obtain optimum usage from PPE, the following procedures are to be followed by all Site personnel using PPE:

i) When using disposable coveralls, don a clean, new garment after each rest break or at the beginning of each shift

ii) Inspect all clothing, gloves, and boots both prior to and during use for:

   a) Imperfect seams
   b) Non-uniform coatings
   c) Tears
   d) Poorly functioning closures

iii) Inspect reusable garments, boots, and gloves both prior to and during use for:

   a) Visible signs of chemical permeation
   b) Swelling
   c) Discoloration
   d) Stiffness
   e) Brittleness
   f) Cracks
   g) Any sign of puncture
   h) Any sign of abrasion

Reusable gloves, boots, or coveralls exhibiting any of the characteristics listed above will be discarded. PPE used in areas known or suspected to exhibit elevated concentrations of contaminants will not be reused.

Project personnel also carry certain responsibilities for their own health and safety, and are required to observe the following safe work practices:

i) Familiarize themselves with this HASP.

ii) Use the "buddy system" when working in a contaminated operation.

iii) Use the safety equipment in accordance with training received, labeling instructions, and common sense.

iv) Maintain safety equipment in good condition and proper working order.

v) Refrain from activities that would create additional hazards (e.g., smoking, eating, etc., in restricted areas, leaning against dirty, contaminated surfaces).

vi) Smoking, eating, and drinking will be prohibited except in designated areas. These designated areas may change during the duration of the project to maintain adequate separation from the active work area(s). Designation of these areas will be the responsibility of the CSHO.

vii) Soiled disposable outerwear shall be removed and placed into a covered container prior to washing hands and face, eating, using lavatory facilities, or leaving the Site.

6.0 SITE CONTROL

Site control is provided by the implementation of the following measures:

i) The CPM, CSHO, CS, and/or SS are to be advised of the dates and purpose of all field activities

ii) All visitors must sign in and sign out each time they pass the Site access gate

6.1 AUTHORIZATION TO ENTER

All personnel working in EZs must have completed hazardous waste operations initial training as defined under OSHA Regulation 29 CFR 1926.65. They shall also have completed their training or refresher training within the past 12 months, and have been certified by a physician as fit for hazardous waste operations in order to enter a Site area designated as an EZ or CRZ. Personnel without such training or medical certification may enter the designated SZ only. The CSHO will maintain a list of authorized persons; only personnel on the authorized list will be allowed within the EZ or CRZ.

6.2 SITE ORIENTATION AND HAZARD BRIEFING

No person will be allowed in the general work area during project activities without first being given a Site orientation and hazard briefing. This orientation will be presented by the CSHO, and will consist of attending an initial safety meeting. This training will cover the chemical, physical, and biological hazards, protective equipment, safe work procedures, and emergency procedures for the project. A Training Acknowledgment Form for documentation purposes is provided in Appendix B. In addition to this meeting, daily safety meetings will be held each day before work begins. All individuals on Site, including visitors, must document their attendance to this briefing as well as to each daily safety meeting on the form that is also provided in Appendix B.

6.3 CERTIFICATION DOCUMENTS

The CSHO will be responsible for verifying that all project personnel have the required training, medical, and respirator fit testing qualifications prior to starting work. Subcontractor personnel, if needed, will provide a copy of their training, respirator fit test, and medical documentation to the CSHO prior to the start of fieldwork. Additional safety training certification documents (e.g., fall protection) may be necessary based on the scheduled task activity.

6.4 ENTRY LOG

A log-in/log-out sheet must be maintained at the Site by the CSHO. Personnel may sign in and out on a log sheet as they enter and leave the CRZ, or the CSHO may document entry and exit in the field notebook.

6.5 ENTRY REQUIREMENTS

In addition to the authorization, hazard briefing and certification requirements listed above, no person will be allowed to enter the Site unless he/she is wearing the minimum SZ PPE as described in Section 5.0. Personnel entering the EZ or CRZ must wear the required PPE for those locations as identified on each JSA form.

6.6 EMERGENCY ENTRY AND EXIT

Individuals who must enter the Site on an emergency basis will be briefed of the hazards by the CSHO. All hazardous activities will cease in the event of an emergency and any sources of emissions will be controlled, if possible.

Individuals exiting the Site because of an emergency will gather in a safe area, as determined by the CSHO for a head count. The CSHO is responsible for ensuring that all individuals who entered the work area have exited in the event of an emergency. See Section 11.0 of this HASP for additional information.

6.7 CONTAMINATION CONTROL ZONES

Contamination control zones are maintained to prevent the spread of contamination and to prevent unauthorized people from entering hazardous areas.

6.7.1 EXCLUSION ZONE (EZ)

The EZ consists of the specific work area, or may be the entire area of suspected contamination. All employees entering the EZ must use the required PPE, and must have the appropriate training and medical clearance for hazardous waste work. The EZ is the defined area where there is a possible respiratory and/or contact health hazard. Barrier tape, fencing, or other appropriate means will identify the location of each EZ.

6.7.2 CONTAMINATION REDUCTION ZONE (CRZ)

The CRZ or transition area will be established to perform decontamination of personnel and equipment and to provide a buffer zone around the EZ. All personnel entering or leaving the EZ will pass through this area to prevent any cross-contamination. Tools, equipment, and machinery will be decontaminated in the CRZ (or a separate CRZ decontamination area) that may be set up to better address equipment decontamination. The decontamination of all personnel will be performed on Site in the CRZ that is adjacent to each EZ. Personal protective outer garments and respiratory protection will be removed in the CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the EZ and the SZ.

A separate CRZ may be set up at the boundary of the active excavation area and the outer ring of the EZ. The purpose of this CRZ will allow project personnel to replenish fluids and to sit down and cool off in the shade. These measures will help to prevent heat-related illness. Potable water will be available at this CRZ as will an umbrella or small tent with a couple of chairs. Personnel will not go through a full decontamination in this area but rather will partially unzip their polycoated Tyvek® suit and lower it to their waist. Respirators will then be removed followed by the removal of the gloves. Exposed skin areas will be washed and then personnel will be allowed to drink water and sit in the shade. Any personnel who have gross contamination on them will be directed to the primary CRZ where they will go through the full decontamination process and disposal of the contaminated polycoated Tyvek® suit.

6.7.3 SUPPORT ZONE (SZ)

The SZ is a clean area outside of the CRZ located to prevent project personnel from exposure to hazardous substances. Eating and drinking will be permitted in the SZ only after proper decontamination. Smoking will not be allowed in any portion of the SZ.

7.0 ACTIVITY HAZARD/RISK ANALYSIS AND GENERAL SAFETY PRACTICES

This section identifies and evaluates the potential chemical, physical, and biological hazards, which may be encountered while conducting project activities. Specific JSA forms (see Appendix A) have been developed to address the hazards associated with scheduled/known project activities, which are outlined in Section 1.0 of this HASP.

Note: If a non-routine task or previously unidentified task becomes necessary, then a JSA that addresses the new task shall be developed and implemented before initiating the new activity.

In addition to the chemical hazards identified in Table 2.1 of this HASP, physical and biological hazards may exist at the Site including: potential heat/cold stress; hazards presented by the use of heavy equipment; underground/overhead utility hazards; hazards presented by excavations/trenches; biological hazards including, vegetation, stray dogs, mosquitoes, bees, wasps, snakes; uneven terrain and slippery surfaces; and the use of decontamination equipment. It will be the responsibility of the CSHO and all project personnel to identify the physical and/or biological hazards posed by the various project activities that they are partaking in and implement all necessary preventative measures.

7.1 GENERAL PRACTICES

Additional general safety practices to be implemented are as follows:

i) At least one copy of this HASP must be at the Site, in a location readily available to all personnel.

ii) All project personnel must use the buddy system (working in pairs or teams).

iii) Food, beverages, or tobacco products must not be present or consumed in the EZ and CRZ. Cosmetics must not be applied within these zones.

iv) Emergency equipment such as eyewash, fire extinguishers, etc., must be removed from storage areas and staged in readily accessible locations.

v) Contaminated waste, debris, and clothing must be properly contained and legible and understandable precautionary labels must be affixed to the containers.

vi) Removing contaminated soil or waste debris from protective clothing and/or equipment using compressed air, shaking, or any other means that disperses contaminants into the air is prohibited.

vii) Containers must be moved only with the proper equipment, and must be secured to prevent dropping or loss of control during transport.

viii) Visitors to the Site must be instructed to stay outside of the EZ and CRZ and remain within the SZ during the extent of their stay. Visitors must be cautioned to avoid skin contact with surfaces, which are contaminated or suspected to be contaminated.

ix) All project personnel are to stay a minimum of 50 feet away (50-foot zone) from operating equipment. The only exception to this rule will be when eye contact is made with the equipment operator and the equipment operator acknowledges the presence of the individual, lowers the excavation bucket or blade on the equipment to the ground and then motions for the individual to approach or enter the 50-foot zone.

7.1.1 BUDDY SYSTEM

All project personnel shall use the buddy system. Visual contact must be maintained between project team members at all times, and personnel must observe each other for signs of chemical exposure and heat stress. Indications of adverse effects include, but are not limited to:

i) Changes in complexion and skin coloration

ii) Changes in coordination

iii) Excessive salivation and papillary response

iv) Changes in speech pattern

Team members must also be aware of potential exposure to possible safety hazards, unsafe acts, or noncompliance with safety procedures. Personnel shall inform their partners, fellow team members, CSHO, CS, and/or the SS of non-visible effects of exposure to toxic materials. The symptoms of such exposure may include:

i) Headaches

ii) Dizziness

iii) Nausea

iv) Blurred vision

v) Cramps

vi) Irritation of eyes, skin, or respiratory tract

If protective equipment or noise levels impair communications, pre-arranged hand signals must be used for communication. Personnel must stay within line of sight of another team member. Downrange field teams in conjunction with the "buddy" system will use the following hand signals. These signals are very important when working with heavy equipment. The entire field team shall know them before operations commence.

Signal	*Meaning*
Hand Gripping Throat	Out of Air; Can't Breathe
Grip Partner's Wrist	Leave Area Immediately
Hands on Top of Head	Need Assistance
Thumbs Up	Ok, I'm All Right, I Understand
Thumbs Down	No, Negative

7.1.2 <u>SANITATION</u>

Sanitation at the Site will be maintained according to OSHA and Department of Health requirements.

7.1.3 BREAK AREA

Breaks must be taken in the SZ, away from the active work area after project personnel go through decontamination procedures. There will be no eating, drinking, or chewing gum in any area other than the SZ.

7.1.4 POTABLE WATER

The following rules apply for all project field operations:

i) An adequate supply of potable water will be provided in each CRZ. Potable water must be kept away from hazardous materials, contaminated clothing, and contaminated equipment.

ii) Portable containers used to dispense drinking water must be capable of being tightly closed, and must be equipped with a tap dispenser. Water must not be drunk directly from the container, nor dipped from the container.

iii) Containers used for drinking water must be clearly marked and not used for any other purpose.

iv) Disposable cups must be supplied, and both a sanitary container for unused cups and a receptacle for disposing of used cups must be provided.

7.1.5 WASHING FACILITIES

Access to facilities for washing ones hands, face and neck before eating, drinking, or smoking will be provided.

7.1.6 LAVATORY

If permanent toilet facilities are not available, an adequate number of portable chemical toilets will be provided.

7.1.7 TRASH COLLECTION

Trash collected from the CRZ will be separated as potentially contaminated waste. Trash collected in the support and break areas will be disposed of as non-hazardous waste. Trash receptacles will be set up in the CRZ and in the SZ.

7.2 CHEMICAL EXPOSURE

Preventing exposure to toxic chemicals is a primary concern. Chemical substances can enter the unprotected body by inhalation, skin absorption, ingestion, or through a puncture wound (injection). A contaminant can cause damage at the point of contact or can act systematically, causing a toxic effect at a part of the body distant from the point of initial contact. The COCs and their properties are identified in Table 2.1

Chemical exposures are generally divided into two categories: acute and chronic. Symptoms resulting from acute exposures usually occur during or shortly after exposure to a sufficiently high concentration of a contaminant. The concentration required to produce such effects varies widely from chemical to chemical. The term "chronic exposure" generally refers to exposures to "low" concentrations of a contaminant over a long period of time. The "low" concentrations required to produce symptoms of chronic exposure depend upon the chemical, the duration of each exposure, and the number of exposures. For a given contaminant, the symptoms of an acute exposure may be completely different from those resulting from chronic exposure.

For either chronic or acute exposure, the toxic effect may be temporary and reversible, or may be permanent (disability or death). Some chemicals may cause obvious symptoms such as burning, coughing, nausea, tearing eyes, or rashes. Other chemicals may cause health damage without any such warning signs (this is a particular concern for chronic exposures to low concentrations). Health effects such as cancer or respiratory disease may not become evident for several years or decades after exposure. In addition, some toxic chemicals may be colorless and/or odorless, may dull the sense of smell, or may not produce any immediate or obvious physiological sensations. Thus, a worker's senses or feelings cannot be relied upon in all cases to warn of potential toxic exposure.

The effects of exposure not only depend on the chemical, its concentration, route of entry, and duration of exposure, but may also be influenced by personal factors such as the individual's smoking habits, alcohol consumption, medication use, nutrition, age, and sex.

An important exposure route of concern at the Site is inhalation. The lungs are extremely vulnerable to chemical agents. Even substances that do not directly affect the lungs may pass through lung tissue into the bloodstream, where they are transported to other vulnerable areas of the body. Some toxic chemicals present in the atmosphere may not be detected by human senses (e.g., they may be colorless, odorless, and their toxic effects may not produce any immediate symptoms). Respiratory protection is therefore extremely important if there is a possibility that the work site atmosphere may contain such hazardous substances. Chemicals can also enter the respiratory tract through punctured eardrums. Where this is a hazard, individuals with punctured eardrums should be medically evaluated specifically to determine if such a condition would place them at an unacceptable risk and preclude their working at the task in question.

Direct contact of the skin and eyes by hazardous substances is another important route of exposure. Some chemicals directly injure the skin. Some pass through the skin into the bloodstream where they are transported to vulnerable organs. Abrasions, cuts, heat, and moisture enhance skin absorption. The eye is particularly vulnerable because airborne chemicals can dissolve in its moist surface and be carried to the rest of the body through the bloodstream (capillaries are very close to the surface of the eye). Wearing protective equipment, not using contact lenses in contaminated atmospheres (since they may trap chemicals against the eye surface), keeping hands away from the face, and minimizing contact with liquid and solid chemicals can help protect against skin and eye contact.

Although ingestion should be the least significant route of exposure at the Site, it is important to be aware of how this type of exposure can occur. Deliberate ingestion of chemicals is unlikely; however, personal habits such as chewing gum or tobacco, drinking, eating, smoking cigarettes, and applying cosmetics at the Site may provide a route of entry for chemicals.

The last primary route of chemical exposure is injection, whereby chemicals are introduced into the body through puncture wounds (e.g., by stepping or tripping and falling onto contaminated sharp objects). Wearing safety shoes, avoiding physical hazards, and taking common sense precautions are important protective measures against injection.

Chemical Hazard Controls

Airborne exposure or contact with the contaminants of concern at the Site shall be controlled by:

i) Skin contact with chemicals may be controlled by use of the proper PPE and good housekeeping procedures. The proper PPE (e.g., polycoated Tyvek®, gloves) as described in Section 5.0 of this HASP shall be worn for all activities where contact with potentially harmful media or materials is anticipated.

ii) Monitoring air concentrations for VOCs and particulates shall be conducted in the breathing zone with a PID with a 10.6 eV lamp or greater and a particulate monitor, as described in Section 8.0.

iii) Dust control measures, such as wetting the immediate area, shall be employed when visible dust is generated in active work areas.

iv) Contact the CSHM for additional information regarding a particular product's or activity's exposure hazards.

v) Using respiratory protection as appropriate, in areas known to have concentrations above the specified action level.

Hazard Communication

Personnel required to handle or to use hazardous materials as part of their job duties will be trained and educated in accordance with the Hazard Communication Standard. The training shall include instruction on the safe usage, and handling procedures of hazardous materials, how to read and access Material Safety Data Sheets (MSDSs), and the proper labeling requirements.

The MSDSs for those chemicals in use at the Site will be available to project personnel. The CSHO will be responsible for maintaining a copy of all MSDSs on Site.

7.3 HEAT STRESS

Heat stress is caused by a number of interacting factors including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with heavy outdoor work conducted with direct solar load, and in particular, because wearing PPE can increase the risk of developing heat stress, workers must be capable of recognizing the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses and be able to recognize the signs and symptoms of these illnesses in both themselves and their co-workers.

Heat Rashes: Are one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

Heat Cramps: Are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much and too little salt.

Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution (plus or minus 0.3 percent NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

Heat Exhaustion: Occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include pale, cool, moist skin, heavy sweating, dizziness, nausea, headache, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment.

Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment, be given fluid replacement, and be encouraged to get adequate rest.

Heat Stroke: Is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict.

Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion, irrational behavior, loss of consciousness, convulsions, a lack of sweating (usually), hot, dry skin, and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of workload and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protestations, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

Heat Stress Safety Precautions: Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. A minimum work rest regimen and procedures for calculating ambient adjusted temperature are described below.

Adjusted Temperature(1)	***Work-Rest Regimen Normal Work Ensemble***(2)	***Work-Rest Regimen Impermeable Ensemble***
90°C (32.°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5° to 90°F (30.8°C to 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5° to 87.5°F (28.1° to 30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5° to 82.5°F (25.3° to 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5° to 77.5°F (30.8° to 32.2°C)	After each 150 minutes of work	After each 120 minutes of work

Notes:

(1) Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F=ta °F + (13 x percent sunshine). Measure air temperature (ta) with a standard thermometer, with the bulk shielded from radiant heat. Estimate percent sunshine by judging what percent of the time the sun is not covered by clouds that are thick enough to produce a shadow (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows).

(2) A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

In order to determine if the work rest cycles are adequate for the personnel and specific Site conditions, additional monitoring of individual heart rates will be conducted during the rest cycle. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one-third and maintain the same rest period.

Additionally, one or more of the following control measures can be used to help control heat stress and are mandatory if any Site worker has a heart rate (measure immediately prior to rest period) exceeding 115 beats per minute:

i) Project personnel will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day.

ii) On-Site drinking water will be kept cool (50 to 60°F).

iii) A work regimen that will provide adequate rest periods for cooling down will be established, as required.

iv) All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps.

v) Cooling devices such as vortex tubes or cooling vests should be used when personnel must wear impermeable clothing in conditions of extreme heat.

vi) Project personnel shall be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary.

vii) A shaded rest area must be provided. All breaks should take place in the shaded rest area.

viii) Project personnel must not be assigned to other tasks during breaks.

ix) Project personnel must remove impermeable garments during rest periods. This includes Tyvek® garments.

x) All project personnel must be informed of the importance of adequate rest, acclimation (usually takes about 2 hours/day for 1 to 2 weeks to become acclimated), and proper diet in the prevention of heat stress disorders.

7.4 SUN EXPOSURE

Overexposure to sunlight is a common concern when field activities occur during warm weather conditions. Overexposure can occur on clear, sunny days as well as on overcast and cloudy days. Ultraviolet (UV) rays from the sun can cause skin damage or sunburn, but can also result in vision problems, allergic reactions, and other skin concerns. Two types of UV rays are emitted from the sun: UVA and UVB rays.

UVB rays cause sunburn, skin cancer, and premature aging of the skin. UVB rays stimulate tanning but are also linked to other problems such as impaired vision, skin rashes, and some allergic and other reactions to certain drugs. Extra care should be taken if activities are to be conducted on or near water. Sunlight reflected off the surface of the water is intensified resulting in accelerated effects. The following steps should be taken to protect against overexposure to sunlight:

i) Always use sunscreen: Apply a broad-spectrum sunscreen with Sun Protection Factor (SPF) of at least 15 or higher liberally on exposed skin. Reapply every 2 hours or more. Even waterproof sunscreen can come off when you towel off or sweat.

ii) Cover up: Wearing tightly woven, loose-fitting, and full-length clothing is a good way to protect your skin from UV rays.

iii) Wear a hat: A hat with a wide brim offers good sun protection to your eyes, ears, face, and the back of your neck – areas particularly prone to overexposure to the sun.

iv) Wear sunglasses that block 99 to 100 percent of UV radiation: Sunglasses that provide 99 to 100 percent UVA and UVB protection will greatly reduce sun exposure that can lead to cataracts and other eye damage. Check the label when buying sunglasses.

v) Seek shade: Shade is a good source of protection, but keep in mind that shade structures (e.g., trees, umbrellas, canopies) do not offer complete sun protection.

vi) Limit time in the midday sun: The sun's rays are strongest between 10 a.m. and 4 p.m. Whenever possible, limit exposure to the sun during these hours.

7.5 COLD STRESS

Cold stress is similar to heat stress in that it is caused by a number of interacting factors including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Fatal exposures to cold have been reported in individuals failing to escape from low environmental air temperatures or from immersion in low temperature water. Hypothermia, a condition in which the body's deep core temperature falls significantly below 98.6°F (37°C), can be life threatening. A drop in core temperature to 95°F (35°C) or lower must be prevented.

Air temperature is not sufficient to determine the cold hazard of the work environment. The wind chill must be considered as it contributes to the effective temperature and insulating capabilities of clothing. The equivalent chill temperature should be used when estimating the combined cooling effect of wind and low air temperatures on exposed skin or when determining clothing insulation requirements to maintain the body's core temperature.

The body's physiologic defense against cold includes constriction of the blood vessels, inhibition of the sweat glands to prevent loss of heat via evaporation, glucose production, and involuntary shivering to produce heat by rapid muscle contraction.

The frequency of accidents increases with cold temperature exposures as the body's nerve impulses slow down, individuals react sluggishly, and numb extremities make for increased clumsiness. Additional safety hazards include ice, snow blindness, reflections from snow, and possible skin burns from contact with cold metal.

Pain in the extremities may be the first early warning of danger to cold stress. During exposure to cold, maximum severe shivering develops when the body temperature has fallen to 95°F (35°C). This must be taken as a sign of danger to the individuals on Site, and cold exposures should be immediately terminated for any individual when severe shivering becomes evident. Useful physical or mental work is limited when severe shivering occurs.

Predisposing Factors for Cold Stress

There are certain predisposing factors that make an individual more susceptible to cold stress. It is the responsibility of the project team members to inform the CSHO/SS to monitor an individual, if necessary, or use other means of preventing/reducing the individual's likelihood of experiencing a cold related illness or disorder.

Predisposing factors that will increase an individual's susceptibility to cold stress are listed below:

- **Dehydration:** The use of diuretics and/or alcohol, or diarrhea can cause dehydration. Dehydration reduces blood circulation to the extremities.
- **Fatigue during Physical Activity:** Exhaustion reduces the body's ability to constrict blood vessels. This results in the blood circulation occurring closer to the surface of the skin and the rapid loss of body heat.
- **Age:** Some older and very young individuals may have an impaired ability to sense cold.
- **Poor Circulation:** Vasoconstriction of peripheral vessels reduces blood flow to the skin surface.

- **Heavy Work Load:** Heavy workloads generate metabolic heat and make an individual perspire even in extremely cold environments. If perspiration is absorbed by the individual's clothing and is in contact with the skin, cooling of the body will occur.
- **The Use of PPE:** PPE usage that traps sweat inside the PPE may increase an individual's susceptibility to cold stress.
- **Lack of Acclimatization:** Acclimatization, the gradual introduction of workers into a cold environment, allows the body to physiologically adjust to cold working conditions.
- **History of Cold Injury:** Previous injury from cold exposures may result in increased cold sensitivity.

Prevention of Cold Stress

There are a variety of measures that can be implemented to prevent or reduce the likelihood of individuals developing cold related ailments and disorders. These include acclimatization, fluid and electrolyte replenishment, eating a well balanced diet, wearing warm clothing, the provision of shelter from the cold, thermal insulation of metal surfaces, adjusting work schedules, and personnel education.

- **Acclimatization:** Acclimatization is the gradual introduction of workers into the cold environment to allow their bodies to physiologically adjust to cold working conditions. However, the physiological changes are usually minor and require repeated uncomfortably cold exposures to induce them.
- **Fluid and Electrolyte Replenishment:** Cold, dry air can cause individuals to lose significant amounts of water through the skin and lungs. Dehydration affects the flow of blood to the extremities and increases the risk of cold injury. Warm, sweet, caffeine-free, non-alcoholic drinks and soup are good sources to replenish body fluids.
- **Eating a Well Balanced Diet:** Restricted diets including low salt diets can deprive the body of elements needed to withstand cold stress. Eat high-energy foods throughout the day.
- **Warm Clothing:** It is beneficial to maintain air space between the body and outer layers of clothing in order to retain body heat. However, the insulating effect provided by such air spaces is lost when the skin or clothing is wet.
- **Work/Rest Regimes:** Schedule work during the warmest part of the day, if possible. Rotate personnel and adjust the work/rest schedule to enable individuals to recover from the effects of cold stress.

The parts of the body most important to keep warm are the feet, hands, head, and face. As much as 40 percent of body heat can be lost when the head is exposed.

7.6 EARTHWORK - EXCAVATION AND TRENCHING

Project activities will involve excavation and stockpiling of contaminated soil. Prior to initiating excavation activities, the CS is responsible for making sure that the following conditions are in place:

i) Ensure that all above and underground utilities have been properly located prior to initiating work activities
ii) Ensure that approved protective shoring devices are available for use at the Site if this means of protection is going to be used
iii) Ensure that the competent person has inspected the excavation and determined that it is safe to enter prior to allowing project personnel to enter any excavation
iv) Ensure that all excavation work is completed in accordance with 29 CFR 1926 Subpart P

v) Ensure that the proper fencing materials are available to secure each active work area

Before excavation begins, the existence and location of underground utilities (e.g., pipe, electrical equipment, and gas lines) will be determined. This will be done, if possible, by contacting the appropriate client representative to mark the location of the lines. If the client's knowledge of the area is incomplete, an appropriate device, such as a magnetometer, will be used to locate the line. A Property Access Utility Clearance Form is presented is Appendix B to document that nearby utilities have been marked on the ground and that the excavation site has been cleared. The form shall be in the possession of the SS prior to commencement of the excavation.

The selected contractor's competent person shall observe all excavation and trenching operations where project personnel will enter. The competent person shall be responsible for evaluating, classifying and inspecting excavation and trenching operations to prevent possible cave-in and entrapment, and to avoid other hazards presented by excavation activities.

It is the responsibility of the CS and CSHO to implement the following components of the selected contractor's Excavation and Trenching Safety Program as they relate to project activities:

i) Ensure that all excavations are completed in accordance with the approved Excavation and Trenching Safety Program
ii) Ensure that the proper protective materials and equipment are available and being used to complete the excavation and/or trenching procedures
iii) Ensure that the necessary inspections of the excavation are completed as required

Personnel required to enter or work in the excavation at any time must be protected from the hazards of cave-ins. This requires the use of sloping and/or shoring systems that comply with State and Federal OSHA standards. Excavation and trenching operations require pre-planning to develop appropriate designs for such systems. The selected contractor will make the appropriate plans.

The estimated location of all underground installations shall be determined before excavation begins. If there are any nearby buildings, walls, sidewalks, trees, or roads that may be threatened or undermined by the excavation, where the stability of any of these items may be endangered by the excavation, they must be removed or supported by adequate shoring, bracing, or underpinning.

Excavations may not go below the base of footings, foundations, or retaining walls, unless they are adequately supported or a person who is registered as a PE has determined that they will not be affected by the soil removal. OSHA requires using civil engineers or those with licenses in a related discipline and experience in the design and use of sloping and shoring systems. PE qualifications shall be documented in writing and available at the Site.

Access and Egress

Personnel access and egress from trench and/or excavations are as follows:

i) A stairway, ladder, ramp, or other means of egress must be provided in excavations greater than 4 feet deep and for every 25 feet of lateral travel
ii) All ladders shall extend 3 feet above the top of the excavation

Atmosphere Monitoring and Testing

Air quality is measured by the following three parameters:

Oxygen concentration

Flammability

Presence of toxic substances

There is a potential for hazardous atmospheres to exist in each proposed excavation. As such, project personnel will not be allowed to be exposed to any hazardous atmosphere. Whenever potentially hazardous atmospheres are suspected in excavations, the competent person shall test the atmosphere. A gas monitor capable of measuring the oxygen level, lower explosive limit (LEL) and toxicity will be used to take readings prior to and while workers are in any excavation. A hazardous atmosphere is defined as one that could contain less than 19.5 percent of oxygen, concentrations of hazardous substances greater than their permissible exposure level (PEL) including carbon monoxide and a LEL reading greater than 10 percent. A forced air ventilator will first be used to pump fresh air into the excavation and to push out (purge) any potentially contaminated air.

In the event that an unusual odor or liquid is suspected in excavations, the competent person shall stop work and arrange for air quality assessment and mitigation, if necessary.

Daily Inspections

The competent person shall perform daily inspections of excavations, the adjacent areas, and all protective systems for situations that could potentially result in slope failure.

The competent person shall inspect, evaluate, and document the inspection of the excavation on an Excavation Inspection Checklist at the following intervals:

i) Prior to the start of work, after each extended halt in work, and as needed throughout the shift as new sections of the excavation are opened

ii) After every rainstorm and other natural or man-made event that may increase the load on the walls of the excavation, or otherwise affect their stability

The SC or SS shall use the safety inspection checklist for excavations that is presented in Appendix B. The competent person shall stop the work and instruct all project personnel to leave the excavation when any potential hazards are detected. The competent person has the ***authority*** to immediately suspend work if any unsafe condition is detected.

7.7 HEAVY EQUIPMENT AND DRILLING SAFETY

Heavy Equipment

The following practices shall be adhered to by personnel operating heavy equipment (such as backhoes) and personnel working in the vicinity of heavy equipment:

- Heavy equipment is to be inspected when equipment is initially mobilized, delivered to a job site, or after it is repaired and returned to service, to ensure that it meets all manufacturer and OSHA specifications (e.g., fire extinguishers, backup alarms, etc.).
- Heavy equipment is to be inspected on a daily basis. Documentation of this daily pre-operational inspection is to be filed with the project files.
- Heavy equipment is only to be operated by authorized, competent operators.
- Seat belts are to be provided on heavy equipment that is not designed for stand-up operation.
- Equipment/vehicles whose payload is loaded by crane, excavator, loader, etc. will have a cab shield and/or canopy to protect the operator.
- Personnel will not be raised/lowered in buckets.
- Personnel will not ride on fender steps or any place outside the cab.
- Before leaving the equipment controls, ensure that the equipment is in its safe resting position. For a backhoe, apply the parking brake, put the front loader bucket down on the ground level, and ensure that the rear excavator bucket is locked in the travel position. Bulldozers and scraper blades, loader buckets, dump bodies, and similar equipment will be fully lowered or blocked when not in use.
- Before raising any booms, buckets, etc., check for overhead obstructions.
- Employees involved in the operation shall not wear any loose-fitting clothing, as it has the potential to be caught in moving machinery.
- Personnel shall wear high visibility safety vests, steel toed shoes, safety glasses, hearing protection, and hard hats during heavy equipment operations.
- When moving heavy equipment or when working within 10 feet of a stationary object or in tight quarters, a spotter will be used.

Drilling Equipment

The following practices shall be adhered to by drilling personnel:

- Equipment should be inspected daily by the operator to ensure that there are no operational problems.
- The kill switch will be function-checked and verified to be operational during the documented daily equipment check.
- Personnel shall be instructed in the location and use of the emergency kill switch on the drill rig.
- Employees involved in the operation shall not wear any loose-fitting clothing, including untied shoe/boot laces, draw strings, etc., which have the potential to be caught in moving machinery.
- Before leaving the controls, shift the transmission controlling the rotary drive into neutral and place the feed lever in neutral. Before leaving the vicinity of the drill, shut down the drill engine.
- Before raising the mast, check for overhead obstructions.
- Before the mast of a drill rig is raised, the drill rig must first be leveled and stabilized with leveling jacks and/or cribbing. Re-level the drill rig if it settles after initial setup. Lower the mast only when the leveling jacks are down, and do not raise the leveling jack pads until the mast is lowered completely.
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- Personnel shall wear steel toed shoes, safety glasses, hearing protection, and hard hats during drilling operations.
- The area shall be roped off, marked, or posted to keep the area clear of pedestrian traffic or spectators.

7.7.1 DRILLING SAFETY PROCEDURES

Drill Crews: All drillers must possess required State or local licenses to perform such work. All members of the drill crew shall receive Site-specific training prior to beginning work.

The driller is responsible for the safe operation of the drill rig as well as the crew's adherence to the requirements of their HASP. The driller must ensure that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions of the driller, wear all PPE, and be aware of all hazards and control procedures. The drill crews must participate in the Daily Safety Meetings and be aware of all emergency procedures.

Rig Inspection: Each day, prior to the start of work, the driller and/or drill crew must inspect the drill rig and associated equipment. The following items must be inspected:

i) Vehicle condition
ii) Proper storage of equipment
iii) Condition of all wire rope
iv) Fire extinguisher
v) First aid kit

Drill Rig Setup: The drill rig must be properly blocked and leveled prior to raising the derrick. The wheels, which remain on the ground, must be chocked. The leveling jacks shall not be raised until the derrick is lowered. The rig shall be moved only after the derrick has been lowered.

Site Drilling Rules: Before drilling, the existence and location of underground utilities (e.g., pipe, electrical equipment, and gas lines) will be determined. This will be done, if possible, by contacting the appropriate client representative to mark the location of the lines. If the client's knowledge of the area is incomplete, an appropriate device, such as a magnetometer, will be used to locate the line. A Property Access Utility Clearance Form shall be developed and used to document that nearby utilities have been marked on the ground and that the drill site has been cleared. The form shall be in the possession of the SS prior to commencement of the intrusive investigation.

Under no circumstances will personnel be permitted to ride the traveling block or elevators, nor will the cat line be used as a personnel carrier.

Overhead Electrical Clearances: If drilling is conducted in the vicinity of overhead power lines, the power to the lines must be shut off or the equipment must be positioned and blocked such that no part, including cables, can come within the minimum clearances as follows:

Nominal System Voltage	*Minimum Required Clearance*
0 to 50 kV	10 Feet
51 to 100 kV	12 Feet

Nominal System Voltage	*Minimum Required Clearance*
101 to 200 kV	15 Feet
201 to 300 kV	20 Feet
301 to 500 kV	25 Feet
501 to 750 kV	35 Feet
751 to 1,000 kV	45 Feet

When the drill rig is in transit with the boom lowered and no load, the equipment clearance must be at least 4 feet for voltages less than 50 kV, 10 feet for voltages of 50 kV to 345 kV, and 16 feet for voltages above 345 kV.

Rig Set Up: All well sites will be inspected by the driller prior to the location of the rig to verify a stable surface exists. This is especially important in areas where soft, unstable terrain is common.

All rigs will be properly blocked and leveled prior to raising the derrick. Blocking provides a more stable drilling structure by evenly distributing the weight of the rig. Proper blocking ensures that differential settling of the rig does not occur.

When the ground surface is soft or otherwise unstable, wooden blocks, at least 24 inches by 24 inches and 4 inches to 8 inches thick shall be placed between the jack swivels and the ground. The emergency brake shall be engaged, and the wheels that are on the ground shall be chocked.

Hoisting Operations: Drillers should never engage the rotary clutch without watching the rotary table and ensuring it is clear of personnel and equipment.

Unless the draw-works is equipped with an automatic feed control, the brake should not be left unattended without first being tied down.

Auger strings or casing should be picked up slowly.

During instances of unusual loading of the derrick or mast, such as when making an unusually hard pull, only the driller should be on the rig floor, no one else should be on the rig or derrick.

The driller should test the brakes on the draw-works of the drill rig each day. The brakes should be thoroughly inspected by a competent individual each week.

A hoisting line with a load imposed should not be permitted to be in direct contact with any derrick member or stationary equipment, unless it has been specifically designed for line contact.

Workers should never stand near the borehole when any wire device is being run.

Hoisting control stations should be kept clean and controls labeled as to their functions.

Cat Line Operations: Only experienced workers will be allowed to operate the cathead controls. The kill switch must be clearly labeled and operational prior to operation of the cat line. The cathead area must be kept free of obstructions and entanglements.

The operator should not use more wraps than necessary to pick up the load. More than one layer of wrapping is not permitted.

Personnel should not stand near, step over, or go under a cable or cat line, which is under tension.

Personnel rigging loads on cat lines shall:

i) Keep out from under the load
ii) Keep fingers and feet where they will not be crushed
iii) Be sure to signal clearly when the load is being picked
iv) Use standard visual signals only and not depend on shouting to co-workers
v) Make sure the load is properly rigged, since a sudden jerk in the cat line will shift or drop the load

Wire Rope: When two wires are broken or rust or corrosion is found adjacent to a socket or end fitting, the wire rope shall be removed from service or resocketed. Special attention shall be given to the inspection of end fittings on boom support, pendants, and guy ropes.

Wire rope removed from service due to defects shall be cut up or plainly marked as being unfit for further use as rigging.

Wire rope clips attached with u-bolts shall have the u-bolts on the dead or short end of the rope; the clip nuts shall be retightened immediately after initial load carrying use and at frequent intervals thereafter.

When a wedge socket fastening is used, the dead or short end of the wire rope shall have a clip attached to it or looped back and secured to it by a clip; the clip shall not be attached directly to the live end.

Protruding ends of strands in splices on slings and bridles shall be covered or blunted. Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads, shall consist of one continuous piece without knot or splice.

An eye splice made in any wire rope shall have not less than five full tucks.

Knots shall not secure wire rope. Wire rope clips shall not be used to splice rope.

Eyes in wire rope bridles, slings, or bull wires shall not be formed by wire clips or knots.

Auger/Drill Pipe Handling: Auger/drill pipe sections shall be transported by cart or carried by two persons. Individuals should not carry auger/drill pipe sections without assistance.

Workers should not be permitted on top of the load during loading, unloading, or transferring of rolling stock.

When equipment is being hoisted, personnel should not stand where the bottom end of the equipment could whip and strike them.

Augers/drill pipe stored in racks, catwalks, or on flatbed trucks should be secured to prevent rolling.

7.8 FALL HAZARDS

Site personnel may be exposed to fall hazards greater than 6 feet above another surface and where there are no barriers in place to protect them. These hazards may be found next to each excavation and on top of any of the structures (buildings) that are on Site. Project personnel exposed to fall hazards greater than 6 feet will follow the selected contractor's Fall Protection Program.

The CSHO, CS and/or SS will control all fall hazards as they relate to project activities. It is their responsibility to implement the following components of the project's fall protection requirements as they relate to project activities:

i) Ensure appropriate fall protection systems are utilized for project activities.

ii) Verify that all project personnel are fully protected from fall hazards.

iii) Ensure that necessary materials for proper fall protection (PPE including a harness and lanyard etc.) are available for project activities.

iv) Provide for proper inspection and replacement of fall protection devices.

v) Provide and ensure that all personnel have received the required training in the use, inspection, and the need for fall protection devices (proper fit, proper use, and proper inspection procedures). Note: This includes additional training required for the usage of ladders, scaffolds, and manlifts/aerial lifts.

vi) Develop a written emergency rescue plan for retrieval of any worker who falls and is suspended in air while wearing personal fall arrest equipment.

Slip/Trip/Hit/Fall Injuries

Slip/trip/hit/fall injuries are the most frequent of all injuries to workers. They occur for a wide variety of reasons, but can be minimized by the following prudent practices:

i) Spot check the work area to identify hazards

ii) Establish and utilize a pathway which is free of slip and trip hazards

iii) Beware of trip hazards such as slippery and uneven surfaces or terrain

iv) Carry only loads which you can see over

v) Keep work areas clean and free of clutter, especially walkways

vi) Communicate hazards to project personnel

7.9 NOISE

Exposure to noise over the OSHA action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on Site. The selected contractor's Hearing Conservation Program will be implemented for affected project personnel.

Control: All personnel must wear hearing protection with a Noise Reduction Rating (NRR) of at least 20 when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA, and hearing protection is necessary. All Site personnel who may be exposed to noise must also receive baseline and annual audiograms and training as to the causes and prevention of hearing loss.

Whenever possible, equipment that does not generate excessive noise levels will be selected for this project. If the use of noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

7.10 ELECTRICAL HAZARDS

Electricity may pose a particular hazard to project personnel due to the use of portable electrical equipment. When electrical work is needed, a qualified electrician must perform it.

General electrical safety requirements include:

i) All electrical wiring and equipment must be a type listed by Underwriters Laboratory (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency.

ii) All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or United States Coast Guard regulations.

iii) A multi-conductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle must ground portable and semi-portable tools and equipment.

iv) Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double insulated tools must be distinctly marked and listed by UL or FM.

v) Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them.

vi) Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching.

vii) All circuits must be protected from overload.

viii) Temporary power lines, switch boxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage.

ix) Plugs and receptacles must be kept out of water unless of an approved submersible construction.

x) All extension outlets must be equipped with ground fault circuit interrupters (GFCIs).

xi) Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment.

xii) Extension cords or cables must be inspected prior to each use, and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire.

xiii) Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician.

xiv) The OSHA requirements for electrical safety will be adhered to as minimum requirements to be followed by all Site personnel, including subcontractors. Electrical inspections are to occur during initial Site setup and monthly thereafter. These inspections are to be documented via either the CS's and/or the SS's logbook, the CSHO's logbook, or on specific forms that the selected contractor may have as part of their Electrical Safety Program.

7.11 MATERIAL HANDLING

Material handling operations to be conducted at the Site will include manual lifting of materials to and from trucks, placement of soil in stockpiles, placement and compaction of soil in excavations, and the setup/maintenance of thermal treatment units, soil handling equipment, soil storage areas, and storage enclosures.

Hoisting and Rigging

Wire ropes, chains, ropes, and other rigging equipment will be inspected prior to each use and as necessary during use to assure their safety. Defective rigging equipment will be immediately removed from service.

Rigging will not be used unless the weight of the load falls within the rigging's safe work operating range. The authorized rigger prior to any "pick" or lifting operation must verify this.

Only personnel trained in safe rigging procedures will be authorized to engage in rigging procedures. Additionally, the rigger must understand and use recognized crane signals.

Job or shop hooks and links and other makeshift fasteners **will not** be used. When U-bolts are used for eye splices, the U-bolt will be applied so the "U" section is in contact with the dead end of the rope.

Wire ropes, chains, ropes, and other rigging equipment will be stored where they will remain clean, dry, and protected from the weather and corrosive fumes.

The proper length of rope or chain slings will be used to avoid wide-angle lifts and dangerous slack. Knotted ropes or lengths of ropes reduced by bolts, knots, or other keepers will not be used.

General Storage Practices

The basic safety requirement for storage areas is that the storage of materials and supplies shall not create a hazard. Additional general storage area practices include the following:

i) Bags, containers, bundles, etc. stored in tiers shall be stacked, blocked, interlocked, and limited in height so that they are stable and secure against sliding or collapse.

ii) All stacked materials, cargo, etc. shall be examined for sharp edges, protrusions, signs of damage, or other factors likely to cause injury to persons handling these objects. Defects should be corrected as they are detected.

iii) Storage areas shall be kept free from accumulation of materials that constitute hazards from tripping, fire, explosion, or pest harborage.

iv) Storage areas shall have provisions to minimize manual lifting and carrying. Aisles and passageways shall provide for the movement of mechanical lifting and conveyance devices.

v) Stored materials shall not block or obstruct access to emergency exits, fire extinguishers, alarm boxes, first aid equipment, lights, electrical control panels, or other control boxes.

vi) "NO SMOKING" signs shall be conspicuously posted, as needed, in areas where combustible or flammable materials are stored and handled.

vii) Cylindrical materials such as pipes and poles shall be stored in racks, or stacked on the ground and blocked.

Special Precautions for Hazardous or Incompatible Materials Storage

Generally, materials are considered hazardous if they are ignitable, corrosive, reactive, or toxic. Manufacturers and suppliers of these materials must provide the recipient with MSDSs, which describe their hazardous characteristics, and give instructions for their safe handling and storage.

Many hazardous materials are incompatible, which means they form mixtures that may have hazardous characteristics not described on the individual MSDSs. The following special precautions shall be followed regarding the storage of hazardous materials:

i) Based on the information available on the MSDSs, incompatible materials shall be kept in separate storage areas

ii) Warning signs shall be conspicuously posted, as needed, in areas where hazardous materials are stored

Hand Protection

Hand protection is the most important form of PPE when handling materials manually. The CSHO will select the appropriate hand protection for the task/activity. Gloves are often relied upon to prevent against abrasions, cuts and burns during material handling activities and many types of gloves actually improve your grip factor. Therefore, it is most important that the most appropriate glove (leather, cotton, Kevlar, metal mesh, nitrile, etc.) is selected for the given situation. The following table presents protection factors for commonly used gloves.

Type of Glove	*Protection*
Rubber	Acids, bases, alcohol – moderate resistance to cuts
Canvas or cloth	Dirt, wood slivers, sharp edges – some resistance to cuts
Metal mesh or Kevlar	Highly resistant to cuts and scratches and caught between hazards (crushing, etc.)
Insulated	Electrical charges
Cuffed	Protects against liquids trickling into glove and protects the wrist/forearm area from cuts and abrasions
Leather	Moderate resistance to cuts and abrasions and caught between hazards

It is important to wash hands frequently when wearing gloves to prevent the build-up of sweat and dirt on the hands. Check gloves regularly for cracks, holes and rips/tears. Keep gloves clean and dry as much as possible.

7.11.1 MANUAL LIFTING

When lifting objects, use the following proper lifting techniques:

i) Feet must be parted, with one foot alongside the object being lifted and one foot behind. When the feet are comfortably spread, a more stable lift can occur and the rear foot is in a better position for the upward thrust of the lift.

ii) Do not lift more than 50 pounds without the assistance of another individual.

iii) Use the squat position and keep the back straight - but remember that straight does not mean vertical. A straight back keeps the spine, back muscles, and organs of the body in correct alignment. It minimizes the compression of the guts that can cause a hernia.

iv) Grip is one of the most important elements of correct lifting. The fingers and the hand are extended around the object you're going to lift - using the full palm. Fingers have very little power - use the strength of your entire hand.

v) The load must be drawn close, and the arms and elbows must be tucked into the side of the body. Holding the arms away from the body increases the strain on the arms and elbows. Keeping the arms tucked in helps keep the body weight centered.

vi) The body must be positioned so that the weight of the body is centered over the feet. This provides a more powerful line of thrust and also ensures better balance. Start the lift with a thrust of the rear foot. Do not twist your back while lifting or moving heavy objects.

7.12 HAND AND POWER TOOLS

Hand Tools Requirements:

i) Hand tools must meet the manufacturer's safety standards

ii) Hand tools must not be altered in any way

iii) At a minimum, eye protection must be used when working with hand tools

iv) Wrenches (including adjustable, pipe, end, and socket wrenches) must not be used when jaws are sprung to the point that slippage occurs

v) Impact tools (such as drift pins, wedges, and chisels) must be kept free of mushroom heads

vi) Wooden handles must be free of splinters or cracks and secured tightly to the tool

Power Tools Requirements:

i) All power tools must be inspected regularly and used in accordance with the manufacturer's instructions and the tool's capabilities

ii) Electric tools must not be used in areas subject to fire or explosion hazards, unless they are approved for that purpose

iii) Portable electric tools must be connected to a Ground Fault Circuit Interrupter (GFCI) when working in wet areas

iv) Proper eye protection must be used when working with power tools

v) Personnel must be trained in the proper use of each specific tool

vi) Any damaged or defective power tools must be immediately tagged and removed from service

7.13 ADVERSE WEATHER CONDITIONS

The CSHO, CS and/or SS shall decide on the continuation or discontinuation of work based on current and pending weather conditions. Electrical storms, tornado warnings, and strong winds (approximately 40 mph) are examples of conditions that would call for the discontinuation of work and evacuation of the Site. Strong winds can generate hazardous conditions during the handling of materials.

In addition, no work with elevated super structures (e.g., drilling, crane operations, etc.) will be permitted during any type of electrical storm or during wind events that have wind speeds exceeding 25 mph.

7.14 BIOLOGICAL HAZARDS

Biological hazards may include snakes, thorny bushes, ticks, mosquitoes, and other pests.

7.14.1 VEGETATION OVERGROWTH

Overgrown weeds, bushes, trees, grass and other vegetation are fire and safety hazards. There are a number of hidden hazards not immediately recognized due to the overgrowth of vegetation in areas where field activities may occur, including discarded junk, litter, and debris. Construction materials such as boards, nails, concrete, and other debris may be hidden beneath blades of tall grass, weeds, and bushes. Other hazards may include steep slopes, potholes, trenches, soft spots, dips, etc.; all dangerously concealed from the view of the individual walking or operating motorized equipment in the area. Additionally, there are biological hazards such as snakes, ticks, chiggers, and mosquitoes that breed in overgrowth conditions.

Actions to be taken are:

i) Assess the work area and determine if the area requires vegetation clearance. Consider that overgrowth that extends above the lowest level of motorized equipment (i.e., bumper or fender) or 6 inches above your ankle has hidden hazards that you will not be able to readily identify.

ii) Determine if the area is safe to walk or whether you need motorized equipment. Consider the limitations of the equipment.

iii) Identify slip, trip, and fall hazards and remove from the general work area. Remember to give adequate clearance so that the items being removed do not pose future hazards.

iv) Adequately protect yourself against the hazards by wearing boots that protect the ankles, long pants, and using insecticides.

v) Consider the limitations of manual or mechanical equipment for the clearance of overgrowth, particularly the safety hazards when using sling blades, machetes, weed eaters, bush hogs, or other brush removing equipment.

Before taking any action, determine whether there are any ecological issues that would affect or prevent the removal of overgrowth in protected areas such as wetlands, wildlife habitats, or sanctuaries for endangered and/or protected species.

7.14.2 TICK-BORNE DISEASES

Lyme Disease, Erlichiosis, and Rocky Mountain Spotted Fever (RMSF) are diseases transmitted by ticks and occur throughout the United States during spring, summer, and fall.

Lyme Disease: The disease commonly occurs in summer and is transmitted by the bite of infected ticks. "Hot spots" in the United States include New York, New Jersey, Pennsylvania, Massachusetts, Connecticut, Rhode Island Minnesota, and Wisconsin. Few cases have been identified in other states.

Erlichiosis: The disease also commonly occurs in summer and is transmitted by the bite of infected ticks. "Hot spots" in the United States include New York, Massachusetts, Connecticut, Rhode Island Minnesota, and Wisconsin. Few cases have been identified in other states.

Primarily the Deer Tick transmits these diseases, which is smaller and redder than the common Wood Tick. The disease may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page.

Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull's eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, swelling and pain in the joints, and eventually, arthritis. Symptoms of Erlichiosis include muscle and joint aches, flu-like symptoms, but there is typically no skin rash.

Control: Tick repellent containing diethyltoluamide (DEET) should be used in tick-infested areas, and pants legs should be tucked into boots. In addition, workers should search the entire body every 3 or 4 hours for attached ticks. Ticks should be removed promptly and carefully without crushing, since crushing can squeeze the disease-causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

7.14.3 POISONOUS PLANTS

Common Poison Ivy (Rhus radicans) grows as a small plant, a vine, and a shrub. Poison Ivy occurs in every state. The leaves always consist of three glossy leaflets. Poison Sumac (Rhus vernix) grows as a woody shrub or small tree 5 to 25 feet tall. It usually contains nine leaves, with eight paired leaves and one on top, and is common in swampy areas. The plants are potent sensitizers and can cause a mild to severe allergic reaction. This reaction is called contact dermatitis.

Dermatitis, in Rhus-sensitive persons, can result from contact with the milky sap found in the roots, stems, leaves, and fruit. The sap may retain its potency for months or years in a dry atmosphere, and can occur during any time of the year. The sap may also be carried by animals, equipment or apparel.

The best form of prevention is to avoid contact. This can occur by wearing long sleeves and gloves if necessary. Disposable clothing, such as Tyvek, is recommended in high-risk areas to avoid exposure from contaminated apparel. Barrier creams and cleaners are also recommended.

7.14.4 <u>INSECTS</u>

Construction work presents many opportunities to be exposed to a variety of insects. Many these insects may present health and safety hazards. Wasps, bees, spiders, and mosquitoes present the bulk of these hazards.

Bees and wasps present problems to people working outdoors due to being stung and having adverse reactions to the venom injected during the sting. Mosquitoes on the other hand cause hazards by transmitting disease(s) from other infected animals and humans.

It is important to recognize the venomous spiders (spiders dangerous to humans) that are present in your work environment. Inspect boots, clothing, and other areas before using/entering, as spiders tend to hide in dark places. Many spiders are nocturnal.

<u>Preventing Exposure</u>

Preventing exposure to insects can be accomplished by the following:

i) Wearing proper clothing and PPE
ii) Inspecting work areas for wasp or bee nests prior to conducting work activities
iii) Awareness of regional insects and their behavioral habits
iv) Shaking out clothing and shoes and inspecting areas for spiders
v) Using repellants

Proper Clothing

While working outdoors it is important to wear proper clothing and PPE. Insects tend to be attracted to bright colors, floral, prints, black, white, green, tan and khaki colors. Also it is important to wear long pants and if possible a long-sleeved shirt. Personnel should tuck the pant bottoms into the tops of boots and use insect proof work gloves (leather, thick cloth, etc.).

Repellants

It is important to ensure that there is an adequate supply of insect repellent. Use insect repellent, which contains DEET. Apply it to any exposed skin in accordance with the manufacturer's directions.

Reaction to insect bites can range from mild reactions to severe allergic reactions. In addition, mosquitoes may carry life-threatening diseases such as West Nile virus.

Bee (and Wasp) Stings

Reaction to bee stings may range from painful swelling, redness, itching all the way to shock. Swelling, redness, and itching should stop hurting within a day or two. Treatment for these items can be done at home. The treatment will involve initially removing any stinger left in the skin by scraping away from the skin and towards the venom sac (thus preventing one from squeezing more venom into the wound). Afterwards apply ice and anti-histamine cream. If irritation, swelling and/or pain persist seek medical attention.

If the victim of a bee sting is aware that they are allergic to bees, or if they begin to exhibit signs such as difficulty swallowing, difficulty breathing, abdominal cramps, nausea, and then they may be going into anaphylactic shock and will require medical treatment.

If personnel know that they are allergic to insects then they will be required to carry their own insect sting kit as directed by their personal physician. The victim must be taken to hospital immediately.

Mosquito Bites

Mosquito bites can range from mild skin irritation to severe viral infections. One of the most common viruses that mosquitoes carry is the West Nile virus. West Nile virus can cause encephalitis (swelling of the brain) and meningitis (swelling of the spinal cord).

First symptoms are as follows: rapid onset of headaches, dizziness, difficulty swallowing, and deep muscle aches, nausea, stiff neck, high-fever, high fever, confusion, muscle weakness. Once any of these symptoms are exhibited seek medical attention.

7.14.5 POISONOUS SPIDERS

Spider Bites

Spider bites can range from mild skin irritation to severe infections and tissue damage depending on the type of spider. The United States has only two spiders that are considered dangerous to humans (the black widow and the brown recluse).

A brown recluse spider (or fiddleback) possesses a V-shaped marking on its back. Its bite will cause tissue damage/destruction for up to 6 weeks. Symptoms can start with little initial pain followed by severe pain, headaches, fever, skin rash, muscle spasms, renal failure and possible coma. A halo may form around the bite. Medical treatment is to be sought immediately.

A black widow spider is an outdoor, nocturnal and non-aggressive spider. She's shiny, black with an hourglass shape on her abdomen. Only about 1 percent of her bites are fatal. The bite is not painful and may not be noticed until later when stomach, muscular, or feet pains begin. Other symptoms include heavy sweating, swollen eyelids, erratic saliva production, and difficulty breathing. Seek medical treatment if bitten.

7.14.6 THREATENING DOGS

If you are approached by a frightened or menacing dog:

i) Do not attempt to run and don't turn your back.

ii) Stay quiet, and remember to breathe.

iii) Be still, with arms at sides or folded over chest with hands in fists.

iv) Slowly walk away sideways.

v) Don't stare a dog in the eyes, as this will be interpreted as a threat.

vi) Avoid eye contact.

vii) If you have a jacket, you could wrap it around your arm and should he snap, take the bite harmlessly.

viii) Try calling its bluff. Yell, "sit!" "stay!" or "go home!". You might convince the dog that you are the stronger in the situation.

7.14.7 RODENTS

Rodentia: (rats, mice, beavers, squirrels, guinea pigs, capybaras, coypu)

Rodents, or Rodentia, are the most abundant order of mammals. There are hundreds of species of rats; the most common being the black and brown rat.

The **Brown Rat** has small ears, blunt nose, and short hair. It is approximately 14 to 18 inches long (with tail). They frequently infest garbage/rubbish, slaughterhouses, domestic dwellings, warehouses, shops, super-markets, in fact, anywhere there is an easy meal and potential nesting sites.

The **Black Rat** can be identified by its' tail, which is always longer than the combined length of the head and body. It is also slimmer and more agile than the Norwegian or Brown rat. Its size varies according to its environment and food supply.

The **House Mouse** has the amazing ability to adapt and it now occurs more or less in human dwellings. In buildings, mice will live anywhere and they are very difficult to keep out. Mice are also totally omnivorous; in other words, they will eat anything.

Rats and mice often become a serious problem in cold winter months when they seek food and warmth inside buildings. They may suddenly appear in large numbers when excavation work disturbs their in-ground nesting locations or their food source is changed.

There are six major problems caused by rats and mice:

i) They eat food and contaminate it with urine and excrement.

ii) They gnaw into materials such as paper, books, wood, or upholstery, which they use as nest material. They also gnaw plastic, cinder blocks, soft metals such as lead and aluminum, and wiring, which may cause a fire hazard.

iii) Rats occasionally bite people and may kill small animals.

iv) They, or the parasites they carry (such as fleas, mites, and worms), spread many diseases such as salmonella, trichinosis, rat bite fever, Hantavirus, Weils disease, and the bubonic plague.

v) Rats can damage ornamental plants by burrowing among the roots or feeding on new growth or twigs. They also eat some garden vegetables, such as corn and squash.

vi) Rats and mice are socially unacceptable. These rodents have been a problem for centuries, chiefly because they have an incredible ability to survive and are so difficult to eliminate. In addition, they are extremely compatible with human behavior and needs.

The CHSO will determine what actions to take should rodents become an issue.

8.0 AIR MONITORING PROGRAM

This section of the HASP presents the requirements for conducting air monitoring at the Site. The air-monitoring program is designed to ensure protection for personnel working on Site as well as the surrounding community. The on-Site monitoring program will be conducted by the CSHO or designee (i.e., Environmental Monitoring Technician) and will consist of monitoring project personnel exposures to VOCs and dust/particulate matter. A Community Air Monitoring Plan will also be conducted at the Site and is presented in Appendix C. The air monitoring program will be completed with the use of real-time direct reading instruments.

Inhalation hazards are caused from the intake of vapors and contaminated dust. Air monitoring shall be performed when potential exposure to on-Site contaminants is anticipated and during all confined space entry work. The purpose of air monitoring is to identify and quantify airborne contaminants in order to determine the level of worker protection needed. Initial screening for identification is often qualitative, but the determination of its concentration (quantification) must wait subsequent testing. The principle approaches available for identifying and/or quantifying airborne contaminants:

i) The use of real-time (on-Site) reading instruments (i.e., photoionization detector etc.)

Direct reading instruments may be used to rapidly detect certain gases and vapors, and dusts. They are the primary tools of initial Site characterization and remediation. The information provided by direct reading instruments can be used to institute appropriate measures (i.e., PPE, evacuation), and determine the most appropriate equipment for future monitoring. All direct reading instruments have inherent constraints in their ability to detect hazards. It is imperative that direct reading instruments are operated, and the data interpreted by qualified individuals who are thoroughly familiar with the particular devices, operating principles and limitations. At hazardous waste sites, where unknown and multiple contaminants are the rule rather than the exception, instrument readings should be interpreted conservatively. The following guidelines may facilitate accurate recording and interpretation:

i) Calibrate instruments according to the manufacturer's instructions before and after each use.

ii) Develop chemical response curves if the instrument manufacturer does not provide these. Response curves/response factors are necessary to adapt PID action levels to actual PID readings when a specific contaminant of concern is detected via air sampling.

iii) Remember that the instrument readings have limited value where contaminants are unknown. When reading unknown contaminants, report them as "needle deflection", or "positive instruments response", or "units", rather than a specific concentration (i.e., ppm). Conduct additional monitoring at any location where a positive response occurs.

iv) A reading of zero should be reported as "no instrument response" rather than "clean" because quantities of the chemicals may be present that is not detectable by the instrument.

v) The survey should be repeated with several detection systems to maximize the number of chemicals detected.

The data collected throughout the monitoring effort shall be used to determine the appropriate levels of protection.

8.1 SITE AIR MONITORING

The CSHO or designee (i.e., Environmental Monitoring Technician) will perform air monitoring to evaluate the exposure of project personnel to chemical and physical hazards, verify the effectiveness of engineering controls, evaluate the effectiveness of Site control measures, and to determine the proper level of PPE. During the progress of remedial activities, the CSHO will monitor the levels of VOCs, and particulate levels on an hourly basis or more frequently as necessary based on Site conditions. The following monitoring equipment will be used for this purpose:

i) A PID equipped with an 10.6 or greater eV lamp

ii) A particulate monitor

An EZ perimeter air monitoring program will be implemented. PID and particulate monitoring will be conducted on an hourly basis or more frequently as necessary at the perimeter of the EZ in order to evaluate the effectiveness of Site control measures and verifies the integrity of the Site's clean areas. If necessary, the CSHO in conjunction with the SS will adjust the EZ and CRZ boundaries.

In the event that an EZ perimeter air monitor reading identifies levels that are above background conditions, then air monitoring readings will also be taken at the Site perimeter. The CSHO will evaluate all air monitor readings and modify operating conditions on the Site as necessary to ensure all potentially exposed receptors are within safe limits.

All instruments will be calibrated on a daily basis in accordance with the manufacturer's instructions. Records of all calibrations and real-time measurements will be kept in a bound field logbook or documented via air monitoring and calibration log sheets. All air monitoring data collected by CSHO will be filed and made available upon request.

8.1.1 REAL-TIME VOC MONITORING

The CSHO or designee will continuously monitor for the presence of VOCs during the handling of impacted soil, intrusive activities, and operation of the soil treatment system. PID readings will be taken in and around all EZs. Action levels for upgrading or downgrading of PPE have been established and Table 8.1 presents the action levels for the on-Site Air Monitoring Program.

An action level is a point at which increased protection or cessation of activities is required due to the concentration of contaminants in the work area. Most activities shall be initiated in Modified Level D. The appropriate actions will be taken at designated action levels.

In addition to the action levels, an upgrade to Level C, supplied air, or evacuation of the immediate area is required if:

i) Any symptoms occur, as described in Section 7.2

ii) Sustained readings (15 minutes or greater) occur in the worker's breathing zone that are above the applicable action levels

iii) Requested by an individual performing the task

iv) Any irritation to eye, nose, throat, or skin occurs

8.1.2 PARTICULATE MONITORING

Based upon the results of an industrial hygiene air monitoring modeling program, the mixture PEL total dust levels have been calculated using "worst case" scenario concentrations for the principal contaminants identified in the Site soil. The particulate action levels are located in Table 8.1. Dust control measures (water spray, etc.) should be implemented at the Site to control visible dust emissions. All readings should be taken in the worker's breathing zone.

8.1.3 PERSONAL AIR SAMPLING PROGRAM

The selected contractor shall also implement a personnel air sampling program for those project personnel who have the highest risk of potential for exposure to chemicals present on Site. This monitoring will be done in compliance with 1926.65(h). Samples will be collected during startup of those project activities where personnel face potential exposure. The CSHO and PM will determine what chemicals will be sampled and the number and frequency of sampling events. Appropriate National Institute of Occupational Safety and Health (NIOSH) methodology will be followed and all samples will be sent to an American Industrial Hygiene Association (AIHA) accredited laboratory. Results for all personnel air sampling will be posted for all project personnel to review. The requirements of this paragraph will be met when soil removal activities are taking place.

9.0 DECONTAMINATION PROCEDURES

In general, everything that enters the EZ at this Site must either be decontaminated or properly discarded upon exit from the EZ. All personnel, including any State and local officials must enter and exit the EZ through the CRZ. Prior to demobilization, potentially contaminated equipment will be decontaminated on a wash pad (decontamination pad) which has a built in sump and the equipment will be inspected by the CSHO before it is moved into the clean zone. A decontamination facility complete with water supply and sump for collection of wash water will be constructed at the Site. Any material that is generated by decontamination procedures will be collected and stored in a designated area in the EZ until disposal arrangements are made.

The type of decontamination solution to be used is dependent on the type of chemical hazards. The decontamination solution for heavy equipment and for any reusable PPE is Alconox/Liqui-nox soap. The MSDSs for Liqui-nox and any other chemical containing products brought to the Site will be maintained on Site by the CSHO.

9.1 EQUIPMENT DECONTAMINATION PROCEDURES

All equipment that comes in contact with waste material must be decontaminated within the CRZ by high-pressure water cleaner upon exit from the EZ. Decontamination procedures will include knocking soil/mud from machines; water brush scrubbing using a solution of water and Liqui-nox; and a final water rinse. Personnel shall wear Level C or Modified Level D protection, as determined by the CSHO, when decontaminating equipment. All decontamination wash water and residues will be carefully collected and disposed of in accordance with the appropriate environmental regulations. Following decontamination and prior to exiting from the EZ, the CSHO shall be responsible for ensuring that the item has been sufficiently decontaminated. This inspection shall be included in the Site log.

9.2 PERSONNEL DECONTAMINATION PROCEDURES

Procedures for decontamination must be followed to prevent the spread of contamination and to eliminate the potential for chemical exposure. Personnel decontamination will be completed in accordance with the procedures that are presented below. Potentially contaminated PPE and trash will be stored in covered and labeled containers until disposal arrangements are made. It will be kept separate from trash generated in clean areas of the Site.

All disposable equipment shall be doffed before meal breaks and at the conclusion of the workday and replaced with new equipment prior to commencing work. Spent PPE will be kept in covered containers.

Personnel - Decontamination will take place upon exiting the contaminated work area in the CRZ.

Modified Level D decontamination procedures are as follows:

Step 1: Remove all visible contamination and loose debris by washing with clean water

Step 2: Remove all outer clothing that came in contact with the contamination (i.e., boot covers and outer gloves) and either dispose of in disposable container or wash in detergent solution and rinse

Step 3: Remove protective clothing; dispose of in used PPE storage container

Step 4: Remove inner gloves, dispose of in used PPE storage container

Step 5: Wash and rinse hands

Level C decontamination procedures to be utilized as follows:

Step 1: Remove all visible contamination and loose debris by washing with clean water

Step 2: Remove all outer clothing that came in contact with the contamination (i.e., boot covers and outer gloves) and either dispose of in used PPE container or wash in detergent solution and rinse

Step 3: Remove protective clothing; dispose of in used PPE container

Step 4: Remove respirator, sanitize prior to reuse

Step 5: Remove inner gloves; dispose of in used PPE container

Step 6: Wash and rinse hands with soap and water

10.0 MEDICAL SURVEILLANCE

In accordance with the requirements detailed in 29 CFR 1926.65 and 29 CFR 1910.134, all project personnel who will come in contact with potentially contaminated materials will have received medical surveillance by a licensed physician or physician's group.

Medical records for all project personnel will be maintained by their respective employers. The medical records will detail the tests that were taken and will include a copy of the consulting physician's statement regarding the tests and the individual's suitability for work as per the employer's medical surveillance program which is to be in accordance with 29 CFR 1926.65.

The medical records will be available to the employee or his designated representative upon written request, as outlined in 29 CFR 1910.1020.

If it becomes necessary to use subcontractors, they will also provide certifications to the CSHO showing that their personnel involved in Site activities have all necessary medical examinations prior to commencing work. The certifications will show proof of medical surveillance and respiratory fit testing. Personnel not obtaining medical certification will not perform work within contaminated areas.

Interim medical surveillance will be completed if an individual exhibits poor health or high stress responses due to any project activity or when accidental exposure to elevated concentrations of contaminants occur.

11.0 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

It is essential that project personnel be prepared in the event of an emergency. Emergencies can take many forms; illnesses or injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful contaminants, or sudden changes in the weather. The following sections outline the general procedures for emergencies.

Emergency information should be posted as appropriate. Radios will be provided for contact purposes. All emergencies will be reported to the appropriate emergency responders. They may give the selected contractor further direction as to the responsibilities during any emergency situation. In general, project personnel will shut down equipment and evacuate to a safe pre-determined meeting area (rally point) during Site emergencies.

The CSHO will contact and meet on Site with local emergency response agencies (e.g., fire department, police department, etc.) prior to initiating construction activities. The purpose of this meeting is to inform these local authorities of the nature of the work and potential risks, to ensure that these responders are equipped to respond to a Site emergency, and to identify and resolve any potential problems, concerns, or conflicts.

The CSHO will be informed of Site hazards and activities prior to project initiation so those emergency situations can be handled most efficiently. A general orientation meeting to discuss emergency response procedures is to be held prior to initiating project activities.

In case of an emergency, an evacuation alarm would sound, which means that all the personnel should evacuate the area and proceed to a rally point for further instruction.

The CSHO will notify all project personnel of the emergency through radio/cell phone communications. Radios and cell phones will be taken to the rally point to enable further receipt of instruction(s) from the CSHO.

11.1 ACCIDENT, INJURY AND ILLNESS REPORTING

Any work-related incident, accident, injury, illness, exposure, or property loss shall be immediately reported to the CSHO and the SS. The SS and/or CSHO will report the accident details to the CSHM and will submit a completed accident report form. A sample Incident Reporting Form is provided in Appendix B. The selected contractor may use their own company-specific form if they so choose. The report must be filed for the following circumstances:

i) Accident, injury, illness, or exposure to project personnel

ii) Injury to any subcontractor personnel

iii) Damage, loss, or theft of property

iv) Any motor vehicle accident regardless of fault, which involves a company vehicle, rental vehicle, or personal vehicle while the individual is acting in the course of employment for the Site

The CSHO and CPM will investigate occupational accidents resulting in employee injury or illness. This investigation will focus on determining the cause of the accident and modifying future work activities to eliminate the hazard.

All project personnel have the obligation and right to report unsafe work conditions, previously unrecognized safety hazards, or safety violations of others. If anyone wish to make such a report, it may be made orally to the CSHO, a supervisor, or other member of management, or it may be submitted in writing, either signed or anonymously.

11.2 EMERGENCY CONTACTS

Fire Department 911

Police Department 911

Ambulance 911

Hospital: Samaritan Hospital .... (518) 271-3300

See Figure 11.1 – Hospital Route Map Directions to the Hospital.

Communication between work areas and the command post, located within the CZ, will be via verbal communication, auto horn, or two-way radio. The CSHO will use a mobile telephone to communicate with outside emergency and medical facilities.

The following signals shall be established for use with auto or compressed air-type horns:

i) Three Blasts: Evacuate exclusion area and meet at the northwest corner of the intersection of 47th Street and Royal Avenue
ii) An "All Clear" will be conveyed by radio communication

11.3 ADDITIONAL EMERGENCY NUMBERS

National Response Center (NRC)	800-424-8802
Poison Information	800-764-7661
Utility Locating Commission (One Call Nationwide)	811
Agency for Toxic Substances and Disease Registry	404-488-4100 (24 Hours)
U.S. EPA Emergency Response	800-424-8802
State of New York Emergency Response Commission	513-457-9996
Project Manager-Jamie Puskas	519-830-3254
Contractor Project Manager	TO BE DETERMINED
Contractor Corporate Safety and Health Manager	TO BE DETERMINED
Contractor Site Superintendent	TO BE DETERMINED
Contractor Safety and Health Officer	TO BE DETERMINED

11.4 EMERGENCY AND FIRST AID EQUIPMENT

Emergency safety equipment will be available for use by project personnel and will be located and maintained on Site. The safety equipment will include, but is not limited to, the following:

i) Portable emergency eye wash and drench shower (pressurized)
ii) Two 20-pound ABC type dry chemical fire extinguishers
iii) Field eye wash/flush bottles
iv) Approved first-aid kit for a minimum of twenty personnel
v) Fire blanket

vi) Spill response kit containing absorbent materials (booms/socks, pads, and earth/clay), overpack drum, shop vacuum, and hand tools (shovel, rake/hoe, etc.)

vii) Two Self Contained Breathing Apparatus (SCBA) units; and

viii) Portable air horn

11.5 PROJECT PERSONNEL RESPONSIBILITIES DURING EMERGENCIES

Contractor Safety and Health Officer (CSHO)

As the administrator of the HASP, the CSHO has primary responsibility for responding to and correcting emergency situations. The CSHO will:

i) Take appropriate measures to protect personnel including: posting of acceptable Site evacuation routes, withdrawal from the EZ, total evacuation and securing of the Site or upgrading or downgrading the level of protective clothing and respiratory protection.

ii) Take appropriate measures to protect the public and the environment including isolating and securing the Site, preventing runoff to surface waters, and ending or controlling the emergency to the extent possible.

iii) Ensure that appropriate Federal, State, and local agencies are informed, and emergency response plans are coordinated. In the event of fire or explosion, the local fire department should be summoned immediately. In the event of an air release of toxic materials, the local authorities should be informed in order to assess the need for evacuation. In the event of a spill, sanitary districts and drinking water systems may need to be alerted.

iv) Ensure that appropriate decontamination treatment or testing for exposed or injured personnel is obtained.

v) Determine the cause of the incident and make recommendations to prevent the reoccurrence.

vi) Ensure that all required reports have been prepared.

11.6 MEDICAL EMERGENCIES

Any person who becomes ill or injured in the EZ must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed as much as possible without causing further harm to the patient. First aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must immediately be reported to the CSHO, SS, and CPM.

Any person transporting an injured/exposed person to a clinic or hospital for treatment should take with them directions to the hospital and a copy of the identified chemicals on Site to which they may have been exposed.

Any vehicle used to transport contaminated personnel, will be cleaned or decontaminated as necessary.

11.7 FIRE OR EXPLOSION

In the event of a fire or explosion, the local fire department should be summoned immediately. Upon their arrival, the CSHO or designated alternate will advise the fire commander of the location, nature, and identification of the hazardous materials on Site.

If it is safe to do so, Site personnel should:

i) Report to the CPM
ii) Use firefighting equipment available on Site
iii) Remove or isolate flammable or other hazardous materials, which may contribute to the fire

11.8 SPILL CONTROL AND COUNTERMEASURES

If a spill has occurred, the first step is personal safety, then controlling the spread of contamination if possible. Contractor personnel will immediately contact the CPM and/or CSHO to inform them of the spill and activate emergency spill procedures.

General Spill Response Procedures

If a spill occurs, the following general procedures will be followed:

i) Notify the CSHO, SS, and CPM
ii) Evacuate immediate area of spill
iii) Determine the needed level of PPE
iv) Don required levels of PPE and prepare to make entry to apply spill containment and control procedures
v) No entry will be made until atmosphere is less than 20 percent of the LEL
vi) After obtaining the proper spill response tools (shovels, booms and pads, absorbent socks, etc.) and PPE, personnel will attempt to contain the spill so that it does not enter any conveyance (sewer, drainage ditch, etc.) that eventually discharges to surface water
vii) Locate and abate source of spill
viii) Absorb or otherwise clean up the spill and containerize the material, sorbent, and affected soils
ix) Clean and decontaminate the affected area(s)
x) Replace used/spent spill kit contents

All spill material and debris will be managed in a manner that complies with applicable federal, state, and local environmental rules regarding recycling or disposal of wastes.

The CSHO and SS have the authority to commit resources as needed to contain and control released material and to prevent its spread to off-Site areas.

12.0 RECORDKEEPING

The CSHO shall establish and maintain records of all necessary and prudent monitoring activities as described below:

i) Name and job classification of the employees involved on specific tasks

ii) Records of fit testing and medical surveillance results for project personnel

iii) Records of all OSHA and other applicable safety training certifications for project personnel

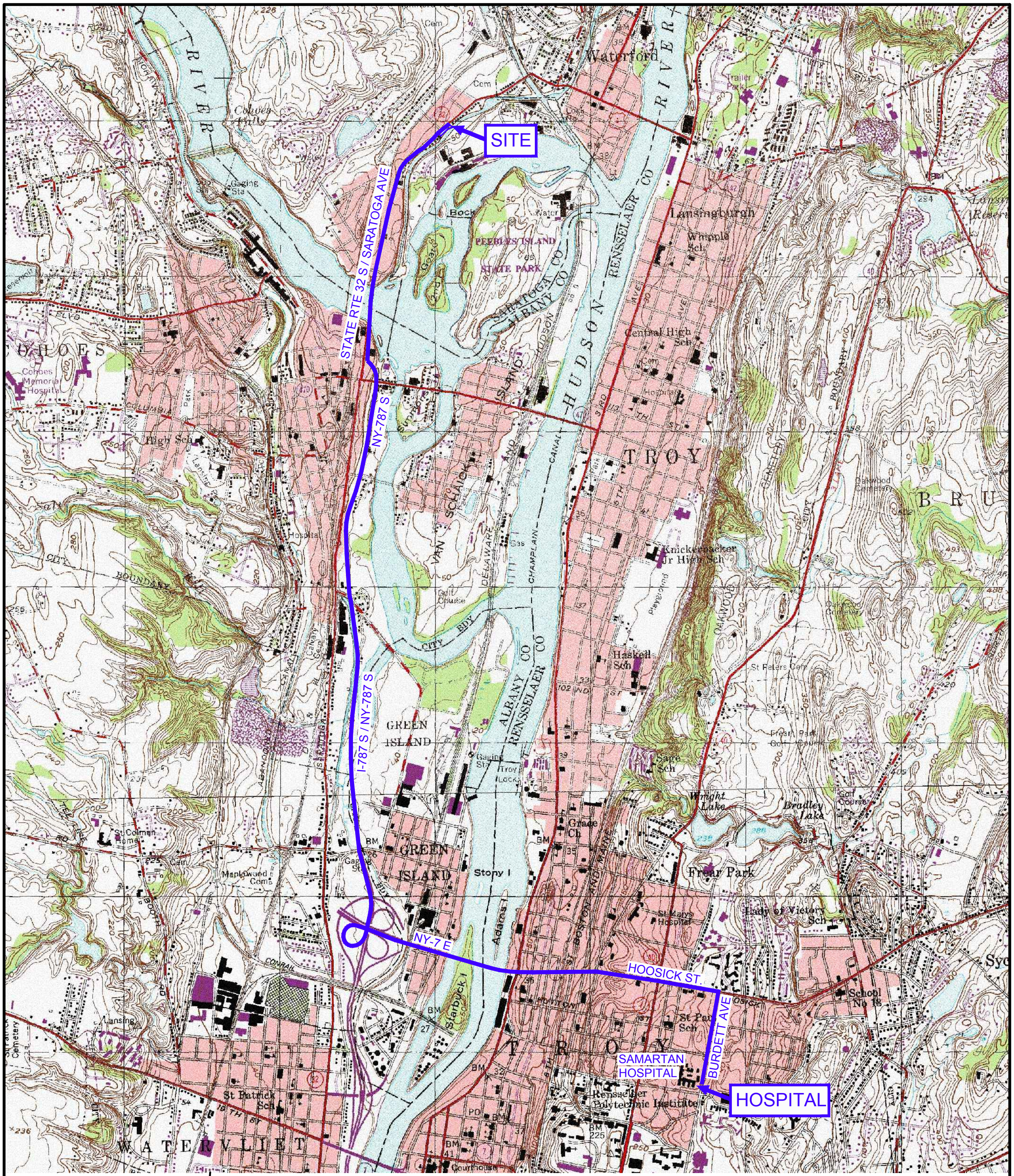
iv) Records of Site safety inspections

v) Records of training acknowledgment forms and daily safety meetings

vi) Emergency report sheets describing any incidents or accidents

vii) Air monitoring equipment calibrations

viii) Air monitoring data



USGS QUADRANGLE MAP
NORTH TROY, NEW YORK

HOSPITAL DRIVING DIRECTIONS

1. Head south on NY-32 S / RTE32 S / State 32 S / State Route 32 S / Saratoga Ave toward Hill St.
2. Turn left onto NY-787 S
3. Continue onto I-787 S / NY-787 S
4. Take exit 9E to merge onto NY-7 E toward Troy / Bennington
5. Continue onto I-787 / NY-7 E
6. Slight left onto Hoosick St. (signs for New York 7 E)
7. Turn right onto Burdett Ave.

0 1500 3000ft

figure 11.1

HOSPITAL ROUTE
HEALTH & SAFETY PLAN
FRIEDRICHSOHN COOPERAGE SITE
153-155 Saratoga Ave., Waterford, N.Y.

80987-98(002)GN-WA001 JUL 3/2013

TABLE 2.1

PROPERTIES OF POTENTIAL SITE CONTAMINANTS

Chemical Name (Synonyms)	Concentration at Site	Exposure Limits	Routes Of Entry	Symptoms/Health Effects	Chemical Properties	Physical Characteristics
cis-1,2-Dichloroethene Acetylene dichloride 1,2-Dichloroethylene CAS-540-59-0	0-250 ppb	TLV: 200 ppm PEL: 200 ppm STEL: NE IDLH: 1000 ppm	Inhalation Ingestion Skin contact Eye contact	ACUTE: Irritation of the eyes and respiratory tract. CNS depression. Exposure could cause lowering of consciousness. CHRONIC: Defatting of the skin. May cause damage to liver.	(FP) 36-39°F (VP) 180-265 mm (IP) 9.65 eV (UEL) 12.8% (LEL) 5.6%	Colorless liquid (usually a mixture of the cis and trans isomers) with a slightly acrid, chloroform-like odor.
Arsenic CAS-7440-38-2	0-168 ppb	TLV: 0.01 mg/m3 PEL: 0.010 mg/m3 STEL: NE IDLH: 5 mg/m3 (as As)	Inhalation Absorption Ingestion	ACUTE: Contact dermatitis, gastrointestinal disturbances, ulceration of the nasal septum, and respiratory irritation. CHRONIC: Hyperpigmentation of the skin and cancers of the skin, lungs, and lymphatic system.	(FP) NA (VP) 0 mm (approx.) (IP) NA (UEL) NA (LEL) NA	Silver-gray or tin-white, brittle, odorless, solid.
Barium and soluble compounds as BA (excluding barium sulfate) CAS-7440-39-3	6.08-1,860 ppb	TLV: 0.5 mg/m3 PEL: 0.5 mg/m3 STEL: NE IDLH: 50 mg/m3	Inhalation Ingestion Skin/eye contact	ACUTE: Irritation to the eyes, skin, upper respiratory system; skin burns CHRONIC: Gastroenteritis; muscle spasms; slow pulse; extrasystoles; hypokalemia (low blood potassium)	(FP) NE (VP) 0 mm (IP) NE (UEL) NE (LEL) NE	Yellow-white, slightly lustrous solid.
Benzene Benzol CAS-71-43-2	0-190 ppb	TLV: 0.5 ppm [skin] PEL: 1 ppm STEL: 2.5 ppm IDLH: 500 ppm	Inhalation Absorption (skin) Ingestion	ACUTE: Irritation to eyes, skin, respiratory tract; dizziness; headache; nausea; staggered gait; fatigue, abdominal pain. CHRONIC: Defatting of the skin, may have effects on bone marrow and immune system, decrease in blood cells. Carcinogenic to humans.	(FP) 12°F (VP) 75 mm (IP) 9.24 eV (UEL) 7.8% (LEL) 1.2%	Colorless to light-yellow liquid with an aromatic odor. Solid below 42°F.

Notes:

FP	FP - Flash Point	PEL	PEL - OSHA Permissible Exposure Limit
IDLH	IDLH - Immediately Dangerous to Life ord Health	STEL	STEL - Short Term Exposure Limit
IP	IP - Ionization Potential	TLV	TLV - ACGIH Threshold Limit Value
NE	NE - Not Established (Information Not Available)	VP	VP - Vapor Pressure
NA	NA - Not Applicable	C	C - Ceiling Exposure Limit
CNS	CNS - Central Nervous System	[skin]	[skin] - potential for dermal absorption
PNS	PNS - Peripheral Nervous System	mm	mm - milimeters Hg (mercury)
ppm	ppm - parts per million	eV	eV - electrovolts
mg/m3	mg/m3 - miligrams per cubic meter		

TABLE 2.1

PROPERTIES OF POTENTIAL SITE CONTAMINANTS

Chemical Name (Synonyms)	Concentration at Site	Exposure Limits	Routes Of Entry	Symptoms/Health Effects	Chemical Properties	Physical Characteristics
Cadmium (dust/metal) CAS-7440-43-9	-	TLV: 0.01 mg/m3 PEL: 0.005 mg/m3 STEL: NE IDLH: 9 mg/m3	Inhalation Ingestion	ACUTE: Irritation to eyes and respiratory tract. Pulmonary edema, coughing, tightness in chest, headache, chills, muscle aches, nausea, mild anemia. CHRONIC: Damage to respiratory system and kidneys, resulting in proteinuria and kidney dysfunction. Potential occupational carcinogen	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	Metal: silver-white, blue tinged, lustrous, odorless solid.
Chlorobenzene Benzene chloride Chlorobenzol Phenyl chloride CAS-108-90-7	0-30 ppb	TLV: 10 ppm PEL: 75 ppm STEL: NE IDLH: 1,000 ppm	Inhalation Ingestion Skin contact Eye contact	ACUTE: Irritation of the eyes, nose and skin; causes drowsiness and uncoordination. Chemical pneumonitis if swallowed. CNS depression CHRONIC: Defatting of the skin. May cause liver and kidney damage.	(FP) 82°F (VP) 9 mm (IP) 9.07 eV (UEL) 9.6% (LEL) 1.3%	Colorless liquid with an almond-like odor.
Chromium (metal) Chrome CAS-7440-47-3	0-197 ppb	TLV: 0.5 mg/m3 PEL: 1 mg/m3 STEL: NE IDLH: 250 mg/m3	Inhalation Ingestion Skin contact Eye contact	ACUTE: Irritation to eyes, skin and lungs. CHRONIC: Skin sensitization, fibrosis (histologic)	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	Blue-white to steel gray, lustrous, brittle, hard, odorless solid.
DDT p,p-DDT Dichlorodiphenyltrichloroethane 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane CAS-50-29-3	-	TLV: 1 mg/m3 PEL: 1 mg/m3 [skin] STEL: NE IDLH: 500 mg/m3 (ca)	Inhalation Ingestion Skin contact Absorption Eye contact	ACUTE: Inhalation - Nausea, drowsiness, loss of appetite, visual disturbances, and insomnia. Skin - See ingestion. Ingestion - Headaches, nausea, insomnia, profuse sweating, frothing at the mouth, convulsions, and lack of consciousness. CHRONIC: Dizziness, nausea, muscle twitch, convulsions, enlarged liver, and skin irritation. Suspected carcinogen.	(FP) 162-171°F (VP) 0.00000002 mm (IP) NI (UEL) NI (LEL) NI	White to yellow crystalline powder with a slight musty aromatic odor, (pesticide).

Notes:

FP	FP - Flash Point	PEL	PEL - OSHA Permissible Exposure Limit
IDLH	IDLH - Immediately Dangerous to Life ord Health	STEL	STEL - Short Term Exposure Limit
IP	IP - Ionization Potential	TLV	TLV - ACGIH Threshold Limit Value
NE	NE - Not Established (Information Not Available)	VP	VP - Vapor Pressure
NA	NA - Not Applicable	C	C - Ceiling Exposure Limit
CNS	CNS - Central Nervous System	[skin]	[skin] - potential for dermal absorption
PNS	PNS - Peripheral Nervous System	mm	mm - milimeters Hg (mercury)
ppm	ppm - parts per million	eV	eV - electrovolts
mg/m3	mg/m3 - miligrams per cubic meter		

TABLE 2.1

PROPERTIES OF POTENTIAL SITE CONTAMINANTS

Chemical Name (Synonyms)	Concentration at Site	Exposure Limits	Routes Of Entry	Symptoms/Health Effects	Chemical Properties	Physical Characteristics
Styrene Vinyl Benzene Ethenyl Benzene CAS-100-42-5	0-650 ppb	TLV: 20 ppm PEL: 100 ppm C 200 ppm STEL: 40 ppm IDLH: 700 ppm	Inhalation Skin Contact Eye Contact Ingestion	ACUTE: The substance irritates the eyes, the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. Exposure could cause lowering of consciousness. CHRONIC: Repeated or prolonged contact skin with skin may cause dermatitis. Repeated or prolonged contact may cause skin sensitization. Repeated or prolonged inhalation exposure may cause asthma. The substance may have effects on the central nervous system,. This substance is possibly carcinogenic to humans.	(FP) 88°F (VP) 5 mm (IP) 8.40 eV (UEL) 6.8% (LEL) 0.9%	Colorless to yellow, oily liquid with a sweet floral odor.
Hexachlorobenzene HCB Perchlorobenzene Phenyl perchloryl CAS-118-74-1	0-9.3 ppb	TLV: 0.002 mg/m3 [skin] PEL: NE STEL: NE IDLH: NE	Inhalation Ingestion Skin contact Absorption Eye contact	ACUTE: Inhalation - Coughing, shortness of breath. Skin - May cause slight irritation and burns may occur at higher doses. Eyes - May cause irritation of the eyes and blurred vision. Ingestion - Headache, dizziness, nausea, vomiting, numbness of hands and arms, apprehension, excitement, tremors, partial paralysis of arms and legs, loss of muscle control, loss of sensory perception, convulsions and coma may result from high doses. CHRONIC: May affect liver and CNS, resulting in impaired organ functions and skin lesions. Possible human carcinogen.	(FP) 468 °F (VP) NE (IP) NE (UEL) NE (LEL) NE	Colorless to white solid in various forms.
Lead (metal) CAS-7439-92-1	0-321 ppb	TLV: 0.05 mg/m3 PEL: 0.05 mg/m3 STEL: NE IDLH: 100 mg/m3	Inhalation Ingestion Skin contact Eye contact	ACUTE: Lead is a cummulative poison, however, it may cause eye and skin irritation. CHRONIC: Effects blood, bone marrow, CNS, PNS and kidneys resulting in anemia, convulsions, peripheral nerve disease and kidney impairment. Toxicity to human reproduction or development.	(FP) NA (VP) NA (IP) NA (UEL) NA (LEL) NA	A heavy, ductile, soft, gray solid. Turns tarnished on exposure to air.
Mercury (metal) Quicksilver Liquid silver CAS-7439-97-6	0-1.03 ppb	TLV: 0.025 mg/m3 PEL: 0.1 mg/m3 STEL: 0.03 mg/m3 IDLH: 10 mg/m3	Inhalation Absorption (skin) Ingestion	ACUTE: Irritation to skin. Vapor inhalation may cause pneumonitis. May effect CNS and kidneys. CHRONIC: May effect CNS and kidneys, resulting in irritability, tremors, speech disorders, mental/memory disturbances. Inflammation/discoloration of gums. Danger of cumulative effects.	(FP) NA (VP) 0.0012 mm (IP) NE (UEL) NA (LEL) NA	Odorless, heavy and mobile silvery-white liquid metal

Notes:

FP	FP - Flash Point	PEL	PEL - OSHA Permissible Exposure Limit
IDLH	IDLH - Immediately Dangerous to Life ord Health	STEL	STEL - Short Term Exposure Limit
IP	IP - Ionization Potential	TLV	TLV - ACGIH Threshold Limit Value
NE	NE - Not Established (Information Not Available)	VP	VP - Vapor Pressure
NA	NA - Not Applicable	C	C - Ceiling Exposure Limit
CNS	CNS - Central Nervous System	[skin]	[skin] - potential for dermal absorption
PNS	PNS - Peripheral Nervous System	mm	mm - milimeters Hg (mercury)
ppm	ppm - parts per million	eV	eV - electrovolts
mg/m3	mg/m3 - miligrams per cubic meter		

TABLE 2.1

PROPERTIES OF POTENTIAL SITE CONTAMINANTS

Chemical Name (Synonyms)	Concentration at Site	Exposure Limits	Routes Of Entry	Symptoms/Health Effects	Chemical Properties	Physical Characteristics
Polychlorinated Biphenyls PCB (54%) Chlorodiphenyl (54% chlorine) Aroclor 1254 CAS-11097-69-1	0 - 53000 ppb	TLV: 0.5 mg/m3 [skin] PEL: 0.5 mg/m3 [skin] STEL: NE IDLH: 5 mg/m3	Inhalation Absorption (skin) Ingestion	ACUTE: Eye irritation. CHRONIC: Dermatitis, chloracne, liver damage, reproductive system damage. Potential occupational carcinogen.	(FP) NA (VP) 0.00006 mm (IP) NA (UEL) NA (LEL) NA	Colorless to pale yellow viscous liquid or solid (<50°F) with a mild hydrocarbon odor.
Tetrachloroethene PCE Perchloroethylene Tetrachloroethylene CAS-127-18-4	0-86 ppb	TLV: 25 ppm PEL: 100 ppm STEL: 100 ppm IDLH: 150 ppm	Inhalation Ingestion Absorption	ACUTE: Irritation to skin, eyes and respiratory tract. Ingestion may cause chemical pneumonitis. Affects CNS. Unconsciousness at high level exposures. CHRONIC: Dermatitis. May cause liver and kidney damage. Probable human carcinogen.	(FP) NA (VP) 14 mm (IP) 9.32 eV (UEL) NA (LEL) NA	Colorless liquid with a mild, chloroform-like odor.
Phenol Hydroxybenzene Carbolic acid CAS-108-95-2	0-80000 ppb	TLV: 5 ppm [skin] PEL: 5 ppm [skin] STEL: NE IDLH: 250 ppm	Inhalation Absorption Ingestion	ACUTE: CORROSIVE to eyes, skin and respiratory tract. May cause lung edema, affects CNS, heart, and kidneys, resulting in convulsions, coma, cardiac disorders and respiratory failure. CHRONIC: Dermatitis. May damage liver and kidneys.	(FP) 175°F (VP) 0.4 mm (IP) 8.50 eV (UEL) 8.6% (LEL) 1.8%	Colorless to yellow or light pink, crystalline solid with a sweet, acrid odor.
Toluene Methylbenzene Toluol CAS-108-88-3	0-25000 ppb	TLV: 20 ppm PEL: 200 ppm STEL: NE IDLH: 500 ppm	Inhalation Ingestion Absorption	ACUTE: Irritation to eyes and respiratory tract. Ingestion may cause chemical pneumonitis. Affects CNS. Unconsciousness and cardiac dysrhythmia at high level exposures. CHRONIC: Defatting of the skin. Affects CNS. Enhanced hearing damage.	(FP) 40°F (VP) 21 mm (IP) 8.82 eV (UEL) 7.1% (LEL) 1.1%	Colorless liquid with a sweet, pungent, benzene-like odor.

Notes:

FP	FP - Flash Point	PEL	PEL - OSHA Permissible Exposure Limit
IDLH	IDLH - Immediately Dangerous to Life ord Health	STEL	STEL - Short Term Exposure Limit
IP	IP - Ionization Potential	TLV	TLV - ACGIH Threshold Limit Value
NE	NE - Not Established (Information Not Available)	VP	VP - Vapor Pressure
NA	NA - Not Applicable	C	C - Ceiling Exposure Limit
CNS	CNS - Central Nervous System	[skin]	[skin] - potential for dermal absorption
PNS	PNS - Peripheral Nervous System	mm	mm - milimeters Hg (mercury)
ppm	ppm - parts per million	eV	eV - electrovolts
mg/m3	mg/m3 - miligrams per cubic meter		

TABLE 2.1

PROPERTIES OF POTENTIAL SITE CONTAMINANTS

Chemical Name (Synonyms)	Concentration at Site	Exposure Limits	Routes Of Entry	Symptoms/Health Effects	Chemical Properties	Physical Characteristics
Vinyl Chloride Chloroethene VCM Chloroethylene CAS-75-01-4	0-31 ppb	TLV: 1 ppm PEL: 1 ppm STEL: NE IDLH: NE	Inhalation Skin contact Eye contact	ACUTE: Irritation to eyes. Affects CNS. May cause unconsciousness. CHRONIC: Affects liver, spleen, blood and peripheral blood vessels, tissue and bones in fingers. Human carcinogen.	(FP) NA (gas) (VP) 3.3 atm (IP) 9.99 eV (UEL) 33.0% (LEL) 3.6%	Colorless gas or liquid (<7°F) with a pleasant odor at high concentrations.
Xylene (o;m;p isomers) CAS-106-42-3	0-550 ppb	TLV: 100 ppm PEL: 100 ppm STEL: 150 ppm IDLH: 900 ppm	Inhalation Absorption Ingestion	ACUTE: Irritation to eyes and respiratory tract. Ingestion may cause chemical pneumonitis. Affects CNS. CHRONIC: Defatting of the skin, lung damage resulting in chronic bronchitis. Affects CNS and blood.	(FP) 90/82/81°F (IP) 7/9/9 mm (IP) 8.56eV (UEL) 6.7% (LEL) 0.9%	Colorless liquid with an aromatic odor. (p-isomer solid <56°F).

Notes:

FP	FP - Flash Point	PEL	PEL - OSHA Permissible Exposure Limit
IDLH	IDLH - Immediately Dangerous to Life ord Health	STEL	STEL - Short Term Exposure Limit
IP	IP - Ionization Potential	TLV	TLV - ACGIH Threshold Limit Value
NE	NE - Not Established (Information Not Available)	VP	VP - Vapor Pressure
NA	NA - Not Applicable	C	C - Ceiling Exposure Limit
CNS	CNS - Central Nervous System	[skin]	[skin] - potential for dermal absorption
PNS	PNS - Peripheral Nervous System	mm	mm - milimeters Hg (mercury)
ppm	ppm - parts per million	eV	eV - electrovolts
mg/m3	mg/m3 - miligrams per cubic meter		

TABLE 8.1

ON-SITE AIR MONITORING PROGRAM ACTION LEVELS
HEALTH AND SAFETY PLAN
FRIEDRICHSOHN COOPERAGE SITE
WATERFORD, NEW YORK

Monitoring Device	*Action Level*	*Action*
Photoionization Detector (PID) - Check correction factors (CF) from the manufacturer to convert PID reading to actual gas concentration		
10.6 or greater eV lamp	< 1.0 ppm or Background	Full-Face Respirator Available
	≥ 1 ppm and ≤ 25 ppm	Full-face air purifying respirator Level C PPE
	>25 ppm and < 500 ppm	Supplied air respirator Level B PPE. Implement additional engineering controls.
	≥ 500 ppm	Shut down activities. Notify CSHO. Implement additional engineering controls.
Dust / Particulate - (Impacted	< 1.0 mg/m³ or Background	Full-Face Respirator Available
	≥ 1.0 mg/m³ and < 50 mg/m³	Wear Full-Face Respirator - Level C PPE
	> 50 mg/m³	Wear Supplied Air Respirator - Level B PPE, Implement Additional Engineering Controls

Notes:

CSHO Safety and Health Officer (Contractor)
PPE Personal Protection Equipment.
ppm Parts Per Million.

APPENDIX A

JOB SAFETY ANALYSIS (JSA) FORMS

JOB SAFETY ANALYSIS (JSA)

Soil Borings

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. CRA personnel have the authority and responsibility to use **Stop Work Authority (SWA).**

Date Issued/Revised:	July 2013	**JSA Type:**	Drilling
Work Type:	Construction	**Client:**	General Electric Company and SI Group, INC.
Work Activity:	Heavy Equipment Decontamination Activities		
Work Site:	Friedrichsohn Cooperage Site. Town of Waterford, New York		
Key Equipment:	Air monitoring equipment; safety cones/fencing/barricades		
Task-specific Training:	40 HR and 8 HR HAZWOPER; PPE		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)						
☒ Reflective Vest	☐ Goggles	☒ Gloves*	**Supplied Air**	**APR**		
☒ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate	☐ Organic Vapor
☐ Lifeline/Harness*	☒ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined	
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas	
☐ Other*			☐ Other*	☐ Other*		
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)						

Project Development Team Name	**Signature**	**Position/Title**	**Modified By**	**Reviewed By**	**Position/Title**	**Date**

JOB SAFETY ANALYSIS (JSA)

Soil Borings

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
1	Markout underground utilities	• Property damage • Explosion • Electrocution • Injury • Death	• Call public underground utility agency (One-Call) at least 5 or more days prior to work activities • Review State Law pertaining to underground pipe line safety and have private utility mark-out performed • Expose lines if warranted (i.e., hand dig, test pit, or daylight)	Project Manager and Site Supervisor
2	Conduct site walk - identify unsafe conditions and determine sample point locations	• Traffic hazard • Slip/trip/fall hazards • Biological hazard • Overhead/underground hazards	• Maintain awareness of on-site traffic and walking surfaces • When selecting soil boring locations, be aware of biological hazards (e.g., ants, poison ivy, wasps) and overhead/underground hazards (e.g., overhead utilities, concrete scarring, station canopy)	Site Personnel
3	Equipment inspection	• Pinch points • Property damage • Lost time due to damaged equipment/parts	• Discuss pinch points on equipment (e.g., drill rig, air knife, pressure washer, etc.) • Familiarize all personnel with location/operation of fire extinguisher(s) and kill switch on drill rig • Visually inspect equipment/parts for damage and document inspections	Site Personnel
4	Set up work zone for drilling	• Traffic hazard • Slip/trip/fall hazards • Property damage • Overhead hazards • Environmental impact • Unstable ground conditions	• Maintain awareness of on-site traffic, work zones, walking surfaces, overhead hazards (e.g., canopy and low hanging overhead lines) • Utilize barricades/cones/caution tape to define work zone and direct traffic • Wear leather/cotton when setting up barricades • Be aware of any potential sensitive receptors and verify all personnel are aware of the location of spill kit • Inspect soil for loose soft or unstable conditions under rig jacks or outriggers	Site Personnel
5	Set up staging area	• Traffic hazard • Slip/trip/fall hazards • Lifting hazards • Back injury • Manual material handling • Pinch points • Heat/cold stress	• Maintain awareness of on-site traffic and walking surfaces • Utilize barricades/cones/caution tape to define work zone and direct traffic • Reduce distance needed to travel when carrying materials and or equipment • Wear leather/cotton gloves when setting up barricades • Size up the load, If the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical or a buddy lift) will be required. • Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position • Avoid one-handed carrying if possible; maintain awareness of footing • Avoid placing hands/fingers in pinch point locations • In extreme temperatures, ensure all personnel have proper clothing, hydration, and heat/cold protection (e.g., canopy, fan, glove warmers)	Site Personnel

JOB SAFETY ANALYSIS (JSA)

Soil Borings

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
6	Contractor oversight/ management of hole clearance/drilling activities	• Traffic hazard • Slip/trip/fall hazards • Lifting hazards • Back injury • Manual material handling • Underground utilities • Contaminant exposure • Heat/cold stress	• Maintain awareness of on-site traffic and practice good housekeeping • Perform a prestart meeting, inform subcontractor of safe lifting practices • Refer to step 5 and the HASP for additional lifting information • Ensure subcontractors don proper PPE (e.g., face shield, leather/cotton gloves, hearing protection) • If non-native material (e.g., pea gravel, sand, fill material) or underground utilities are observed, utilize SWA and assess situation • Monitor safe drill movement/positional setup • Monitor breathing zone and refer to HASP for action levels • Monitor all personnel for signs and symptoms of heat/cold stress and refer to HASP for recommendations • Be aware of unsafe hoisting and material handling practices • Be aware of proper augering and auger handling techniques	Site Personnel
7	Site/boring security	• Traffic hazard • Slip/trip/fall hazards • Lifting hazards • Back safety • Manual material handling	• Wear leather/cotton gloves when moving barricades • Maintain awareness of on-site traffic and walking surfaces • Maintain proper lifting techniques as described in Step 5 and 6. • Ensure good house keeping methods are practiced. Work area is kept clean of debris. • Secure boring location if open overnight	Site Personnel

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(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
EXCAVATOR OPERATION

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	July 2013	**JSA Type**	Loading Soil and/or Waste Material
Work Type	Construction	**Client**	General Electric Company and SI Group, INC.
Work Activity	Excavator Operation		
Work Site	Friedrichsohn Cooperage Site. Town of Waterford, New York		
Key Equipment	Excavator		
Task-specific Training	40 HR and 8 HR HAZWOPER, PPE, Mobile Equipment Operations, Excavation Safety Training; Heavy Equipment Safety		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: Full Facepiece*	☒ GLOVES*
☒ HARD HAT	☒ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☒ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER*
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* ______________	☐ OTHER* ______________
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest - Class II Gloves - Leather			
APR –Full-Facepiece equipped with organic vapor and particulate cartridges			

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
EXCAVATOR OPERATION

JOB STEPS (1)	TASK ACTIVITY	POTENTIAL HAZARD(S) (2)	CORRECTIVE MEASURE(S)(3)	Person Responsible
1	Perform the STAR Process (Stop Think Act Review) and discuss Stop Work Authority (SWA) -	• Slips, trips, falls; • Situational risks - use STAR;	• Verify personnel training is sufficient for scheduled task(s). Is Job Instruction (hands-on) Training necessary?	Site Supervisor on all
2	Inspect equipment	• Equipment malfunction or damage • Hydraulic fluid, fuel, oil leaks/spills • Loss of steering, loss of brakes, etc.; accidents, decreased visibility • Fire • Slip/trip/fall hazards • Unexpected operation of equipment • Swing radius signage missing	• Follow Equipment Inspection Form/Tag Out if malfunction found • Grease moving parts • Check all fluids • Ensure that fluids are not too low or too full • Walk around equipment and look for leaking fluids • Ensure that tracks are acceptable (no unacceptable wear and no objects present) • Ensure that windows and mirrors are clean. Adjust mirrors! • Remove trash or other debris from cab • Ensure that back up alarm and horn are operational • Correct any problems immediately and inform supervisor • If equipment appears as though it has been tampered with or vandalized, do not start it • Ensure that fire extinguisher is in place and functioning • Inspect the fire extinguisher monthly • Use three point mount/dismount at all times • Be cautious of where you step and be aware of your surroundings • Ensure that ignition key is in your pocket, equipment is in neutral and parking brake is engaged • Use interlock safety mechanism any time equipment is not conducting a productive and/or controlled activity	Site Supervisor and Operator
3	Entering equipment	• Reduced visibility • Uncomfortable seating - back strain • Debris on floor getting stuck under pedals • Unexpected movement of excavator	• Adjust seat and mirrors so that you are able to see where traveling • Adjust controls and seat to your comfort and safety • Ensure that all materials inside cab are secured • Be cautious of where you step and be aware of your surroundings • Ensure steps are clear of water, mud, and other debris • Ensure parking brake is engaged and gear is in neutral • Use interlock safety mechanism any time equipment is not conducting a productive and/or controlled activity	Site Supervisor and Operator
4	Configure controls and seating	• Ergonomics/unnecessary physical stress/ back injury • Incapable of reaching controls • Visual blocks	• Upon sitting, adjust seat fully to accommodate reach and comfort zone • Fasten seat belt • Make certain all controls are set in neutral positions • Adjust mirrors	Site Supervisor and Operator
5	Starting and warming up	• Unanticipated rolling or movement, engine fire, or mechanical/electrical faults	• Review operator's manual if new to this particular machine • Start engine and check controls to ensure all are in working conditions • Allow a minimum of 2 minutes to warm up	Site Supervisor and Operator

Job Safety Analysis (JSA)
EXCAVATOR OPERATION

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
6	Moving equipment work area	• Other equipment, personnel, or objects in work area • Uneven terrain	• Perform STAR – be aware of surroundings • Know the daily task and other people and equipment in the area • Make eye contact with other operators and site personnel in the immediate vicinity • Inspect pathway prior to moving equipment to ensure clear pathway	Site Supervisor and Operator
7	Performing tasks	• Other equipment (collision) • Slopes, ground conditions possible injuries to personnel and equipment, buried obstacles, underground and overhead utilities • Dust	• Perform STAR • Know where utilities are located – know where your bucket is in relation to any underground utilities at all times • Be aware of the scope of work to be performed • Use a spotter • Know the paths of other equipment or persons entering and leaving your work area • Communicate with supervisors and other operators throughout the day with any questions • Stop work immediately and contact a supervisor if you are uncertain of your task, experience equipment failure, or personal injury or near loss • Wear dust mask if conditions warrant	Site Supervisor and Operator
8	Stopping at end of day	• Slip/trip/fall hazards • Overnight parking of equipment	• Be cautious of where you step and be aware of your surroundings • Park in designated area • Set brake/control locks • Idle for 2 minutes if engine is hot • Lower bucket to ground – zero energy state • Turn equipment off; remove keys • Use three-point dismount • Secure inside equipment (i.e., fire extinguisher)	Site Supervisor and Operator

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[2] A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

[3] Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
GROUNDWATER SAMPLING ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority (SWA).**

Date Issued/Revised:	July 2013	**JSA Type:**	Groundwater Sampling
Work Type:	Environmental	**Client:**	General Electric Company and SI Group, INC.
Work Activity:	Groundwater sampling		
Work Site:	Friedrichsohn Cooperage Site. Town of Waterford, New York		
Key Equipment:	Bailer or pump (select one or both – address in task activity and hazards); photoionization detector; safety cones/barricades		
Task-specific Training:	40 HR & 8 HR HAZWOPER, Electrical Safety, PPE, HAZCOM and Power and Hand Tool Safety		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)						
☐ Reflective Vest	☐ Goggles	☒ Gloves*	**Supplied Air**	**APR**		
☐ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☒ Full Face APR	☐ Particulate	☐ Organic Vapor
☐ Lifeline/Harness*	☐ Hearing Protection*	☒ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined	
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas	
☒ Other*			☐ Other*	☐ Other*		
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)						
Gloves - Use inner nitrile gloves when handling wet sampling containers; use leather gloves for other tasks.						
Other - Sunscreen and Insect Repellant PPE Clothing – Polycoated Tyvek® APR – wear cartridges for organic vapors when organic vapors are present						

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
GROUNDWATER SAMPLING ACTIVITIES

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
1	Discuss STAR (Stop Think Act & Review) and Stop Work Authority (SWA)	• Near Loss, Injury, and even Death	• Identify any hazards. Modify the JSA accordingly. Discuss the task and expectations of the task to all personnel. Have all applicable personnel sign off on this JSA prior to starting work. • Project team (CRA) discusses importance of and documentation procedures for SWA during pre-job safety meeting. Use SWA to stop any work that is unsafe.	Sampling Team
2	Inspect/calibrate sampling equipment	• Loss due to malfunctioning equipment	• Check all equipment to ensure it is in proper working order and has been calibrated to CRA and manufacturer's standards, and document	Sampling Team
3	Establish work zone at monitoring well location, including traffic control	• Traffic • Pinch points • Back strain	• Maintain awareness of on-site traffic patterns and walking paths; setup barricades • Use work gloves when setting up barricades and be aware of hand placement • Use buddy system and proper lifting techniques • Develop a temporary traffic control plan when necessary	Sampling Team
4	Open monitoring well cover(s)	• Pinch points • Hand injury • Biological hazards	• Avoid placing hands in pinch points • Wear proper PPE (gloves) for task and use the proper tool(s) when opening well covers (open face wrench/socket wrench) • Inspect for other hazards that may affect the hands (hypodermic needles, etc.) • Heightened awareness of wasps, ants, bees, spiders, and poison plants	Sampling Team
5	Measure water levels	• Contaminant exposure • Cross contamination	• Wear proper PPE (Ndex nitrile gloves) • use PID to monitor air quality • Decon probe and measuring tape following gauging of well	Sampling Team
6	Develop/purge monitoring well location (select one or both – peristaltic pump or bailer – hazards will be contingent upon method)	• Slip/trip/fall hazards • Cuts • Pinch points • Electrical (AC or DC) • Back and shoulder strain	• Maintain housekeeping; be aware of ground conditions • Use PPE and proper tools • Keep hands away from pinch points • Inspect wiring, clamps, cables, etc.; avoid arcing • Stretch affected muscles (triceps, back, neck, and shoulder) prior to/during/after activity • Avoid repetitive motions and overhead lifts; use proper lifting techniques and neutral postures and take breaks	Sampling Team
7	Collect groundwater sample utilizing bailer or sampling pump	• Chemical exposure • Cuts from container breaking • Sample misidentification	• Wear proper PPE • Inspect bottles for signs of breakage/damage; do not use suspect containers • Close glass bottles carefully – avoid cross threading lid and bottle • Ensure sample id numbers match sample location/site plan • Check sample labels for accuracy prior to placing in container	Sampling Team
8	Close monitoring well cover	• Traffic • Hand injury • Pinch points	• Maintain awareness of on-site traffic patterns; verify barricades are still in place • Wear appropriate gloves and use proper tool(s) • Avoid placing hands in pinch points	Sampling Team
9	Pack samples in container (i.e., cooler)	• Bottle breakage • Chemical exposure • Back strain • Lost time due to sampling error	• Pack glass containers in bubble wrap or equivalent protection • Wear appropriate PPE (Ndex nitrile gloves) • Use proper lifting techniques and buddy lifts (if necessary) • Ensure samples are packed/labeled/shipped correctly – double check	Sampling Team

Job Safety Analysis (JSA)
GROUNDWATER SAMPLING ACTIVITIES

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
10	Manage any investigative derived waste (IDW)	• Chemical exposure • Pinch points • Slip/trip/fall hazards • Heavy lifting • Mislabeling waste	• Wear appropriate PPE (Ndex gloves) and work gloves • Avoid pinch points • Use proper PPE • Inspect for proper housekeeping; clean up work area • Use proper lifting techniques; stretch affected muscles; do not lift more than 50 pounds unassisted – use lifting devices and a buddy to assist • Label IDW appropriately (generator, contact number, identification of contents, and site location); specify type of contents; arrange for disposal	Sampling Team and Project Manager

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(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
SOIL SAMPLING ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority (SWA).**

Date Issued/Revised:	July 2013	**JSA Type:**	Soil Sampling Activities
Work Type:	Environmental	**Client:**	General Electric Company and SI Group, INC.
Work Activity:	Soil Sampling Activities		
Work Site:	Friedrichsohn Cooperage Site. Town of Waterford, New York		
Key Equipment:	Air monitoring equipment, PPE		
Task-specific Training:	40-hr HAZWOPER and 8-hr refresher, HAZCOM, PPE, Power and Hand Tool Safety and CRA Field Method Training (Soil Sampling Procedures)		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)						
☐ Reflective Vest	☐ Goggles	☒ Gloves*	**Supplied Air**	**APR**		
☒ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate	☐ Organic Vapor
☐ Lifeline/Harness*	☐ Hearing Protection*	☒ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined	
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas	
☐ Other*			☐ Other*	☐ Other*		
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)						
PPE Clothing -Tyvek®; Gloves inner nitrile for sampling, leather for moving supplies, Ansell Crusader Flex Delux Hot Mill Glove or a Wells Lamont Extra Heavy Weight Terry Glove when contacting hot objects						

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
SOIL SAMPLING ACTIVITIES

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
1	Project Coordination	• Miscommunication • Possible Injury	• Inform Site Operator of planned activities at Site.	Sampling Technician
2	Perform the STAR Process and discuss Stop Work Authority (SWA). Refer to the specific snow thrower's equipment manufacturer's operating manual before using the equipment.	• Slips, Trips, Falls • Situational risks	• Verify personnel's training is sufficient for the scheduled task(s). • Is job instruction training (hands-on) training necessary? • Employees should remove finger rings, necklaces, or jewelry, which may be hazardous in equipment operation.	Sampling Technician
3	Inspect and calibrate sampling and monitoring equipment	• Lost time from improperly functioning equipment • Incorrect sampling procedures/collection due to malfunctioning equipment	• Ensure all equipment is functioning properly • Complete Quality Control documents	Sampling Technician
4	Prepare to collect soil samples	• Back strain • Pinch points • Cuts • Punctures • Sample misidentification	• Use proper lifting techniques and buddy system if needed • Avoid placing hands/fingers in pinch point locations • Use proper tools when opening container packaging • Do not use fixed open blade knives when opening boxes or containers • Ensure the sample id label matches sample location with site plan/CRA site supervisor/subcontractor	Sampling Technician
5	Opening the sample sleeve (if applicable)	• Cuts due to sharp edges of sample sleeve • Contaminant exposure	• Use sleeve cutter for opening the sample sleeves • Keep hands clear of the sleeve when cutting • Wear nitrile gloves • Maintain awareness of sharp edges of sample sleeve	Sampling Technician
6	Sample collection	• Contaminant exposure • Cuts from container breakage • Sample misidentification • Contact with soils that are very hot (400F+)	• Wear nitrile gloves and replace between soil samples Note: wear Ansell Crusader Flex Delux Hot Mill Glove or a Wells Lamont Extra Heavy Weight Terry Glove when contacting hot objects • Inspect glass bottles for breaks/cracks • Do not attempt to use any suspect containers • Close glass sample containers carefully to avoid breakage • Check sample labels for accuracy prior to placing in cooler	Sampling Technician
7	Headspace screening of samples	• Contaminant exposure • Incorrect headspace readings	• Wear nitrile gloves • Ensure proper calibration of equipment	Sampling Technician
8	Sample selection	• Bottle breakage • Contaminant exposure • Pinch points • Lost time due to incorrect sample selection	• Wear nitrile gloves when handling sample containers • Confirm selected samples are correct based on work plan selection criteria, PID readings, and soil boring logs • Avoid placing hands/fingers in pinch point locations (e.g., between cooler and lid)	Sampling Technician

Job Safety Analysis (JSA)
SOIL SAMPLING ACTIVITIES

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
9	Packing samples in cooler(s)	• Bottle breakage • Contaminant exposure • Cuts • Pinch points • Back strain • Lost time due to incorrect sample packaging or hold time exceedances	• Wear nitrile gloves when handling sample containers • Pack glass containers in bubble wrap • Check COC against sample labels and SSOW for accuracy before shipping • Avoid placing hands/fingers in pinch point locations (e.g., between cooler and lid) • Use proper lifting techniques and buddy system if needed • Ensure equipment and supplies are loaded correctly and do not shift during transport	Sampling Technician
10	Investigation derived waste (IDW) management	• Contaminant exposure • Heavy lifting • Pinch points • Slips/trips/fall hazards • Mislabeled waste	• Wear nitrile gloves when handling IDW • Use proper lifting techniques to transport/dispose of IDW into drums and use buddy system if needed • Avoid placing hands/fingers in pinch point locations • Maintain awareness of walking surfaces • Label IDW with generator, a contact number, identification of contents, and site location • Specify IDW as either hazardous or non-hazardous material	Sampling Technician

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(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
HEAVY EQUIPMENT DECONTAMINATION ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	July 2013	**JSA Type**	Heavy Equipment Decontamination Activities
Work Type	Construction	**Client**	General Electric Company and SI Group, INC.
Work Activity	Heavy Equipment Decontamination Activities		
Work Site	Friedrichsohn Cooperage Site. Town of Waterford, New York		
Key Equipment	Alconox/Liquinox, buckets water, brushes and a high-pressure washer		
Task-specific Training	40 HR and 8 HR HAZWOPER; PPE, HAZCOM and High-Pressure Washing Equipment		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☐ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: ________________*	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☒ PPE CLOTHING*	☐ OTHER*
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* ____________________	☐ OTHER* ____________________
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest – Class II PPE Clothing – Polycoated Tyvek® suits			
Gloves – Outer Nitrile (e.g., Solvex) and Inner Nitrile gloves (e.g., Ndex)			

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
HEAVY EQUIPMENT DECONTAMINATION ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process and discuss Stop Work Authority (SWA) Perform Review of this JSA.	Failing to identify hazardous conditions resulting in losses or near losses.	• Perform the STAR Process. • Assess the risks. • Determine the hazards of performing the task and survey the work area. • Consider weather conditions and review heat stress and cold stress information as applicable • Always consider the worst case scenario. • Analyze the hazards determined. • Decide a plan of action to eliminate or reduce the hazards and act on it.	Decontamination Personnel
2	Remove by hand excess visible dirt and debris from equipment	Pinch points	• Keep hands, feet, & clothing away from moving parts/devices. • Use proper climbing/access platforms to reach the various parts of the equipment.	Decontamination Personnel
3	Use high pressure/low volume hot water or steam equipment	Use of hand and power tools	• Follow manufacturers' safety precautions, inspect tools regularly, replace defective tools, wear the appropriate eye and foot protection. • Use proper climbing/access platforms to reach the various parts of the equipment.	Decontamination Personnel
4	Segregate all waste materials	Chemical hazard	• Wear the PPE that is identified on the first page of this JSA. • Maintain waste materials in a controlled area. • Remove accumulated waste material as reasonably accumulated. • Do not lift more than 50 pounds. Ask for assistance with heavy items.	Decontamination Personnel
5	Containerize all waste materials	Pinch points, heavy lifting	• Keep hands, feet, & clothing away from moving parts/devices; follow safe lifting practices. Lift items within your capabilities. Do not lift more than 50 pounds. Ask for assistance with heavy items	Decontamination Personnel

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2 A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

3 Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
MATERIAL HANDLING ACTIVITIES – RIGGING AND PLACEMENT OF MATERIALS

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	July 2013	**JSA Type**	Material Handling Activities
Work Type	Construction	**Client**	General Electric Company and SI Group, INC.
Work Activity	Rigging and Placement of Materials		
Work Site	Friedrichsohn Cooperage Site. Town of Waterford, New York		
Key Equipment	Excavator, Backhoe, or Crane		
Task-specific Training	Rigging; lifting signals; heavy equipment safety; use of taglines; proper use of load charts; 40 HR and 8 HR HAZWOPER, HAZCOM, PPE, Mobile Equipment Operations		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: ________________*	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER* ____________________________
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* ____________________________	☐ OTHER* ____________________________
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest - Class II			
Gloves - Leather			

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
MATERIAL HANDLING ACTIVITIES – RIGGING AND PLACEMENT OF MATERIALS

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process and discuss Stop Work Authority (SWA) Equipment Inspection	• Hydraulic failure	• Inspect equipment lines and fluid reservoirs	Operator
2	Rigging components – Inspection of load and rigging	• Attachment point failure	• Inspect attachment hook/ring for fractures, dents or abuse. • Certify load capability of attachment point.	Operator, Qualified Rigger and all field personnel involved in the operation
3	Rigging components – Continue inspection of load, rigging, and material to be lifted	• Rigging assembly failure	• Inspect rigging chains, wire rope, cables, hooks, slings, d-rings, splitters, spreaders and all other components for unusual shape, fractures, fraying, dents, abuse or abnormalities. • Insure components used have annual certification, proper load rating and are implemented as recommended by training and the manufacturer.	Operator, Labor and all field personnel involved in operation.
4	Rigging components	• Improper component attachment, lifting point usage, incorrect balance or component orientation	• Use the manufacturer's recommended lifting attachment points, slots or cable points to secure load to be rigged. • Use proper rigging components to assure load is evenly distributed, proper balance is achieved and place hoisting equipment and rigged components in proper orientation to assure placement logistics are correct.	Operator, Labor and all field personnel involved in operation.
5	Tag lines – Proper placement of taglines to ensure control of load. No one is to work under a suspended load	• Lift control failure	• Use of tag lines, as a lifting control measure is mandatory as appropriate for correct placement of rigged component. • Personnel assisting rigging or lift should never physically be in contact with rigged or lifted components as a measure of component control.	Operator, Labor and all field personnel involved in operation.
6	Pre-plan the lift and prepare the landing zone	• Objects/personnel in swing radius path; • Lifting outside of equipment's load safe load radius	• Pre-plan the lift to ensure swing radius does not impact other operations. • Ensure that load and load path stays within load radius of lifting equipment.	Rigger, And Operator
7	Component placement – Pick the load and place the item in the correct position.	• Improper preparation of location receiving rigged or lifted component resulting in need for multiple lifts.	• Preparation of the area receiving the rigged or lifted component to avoid and necessary re-lift or multiple lifts.	Operator, Labor and all field personnel involved in operation.
8	Maintain Control of Area	• Unauthorized personnel or equipment in rigging or lifting exclusion zone	• Area marking and clearance of all personnel and equipment to prevent interference during rigging or lifting activities. • Spotter action to terminate rigging or lifting if situational changes occur putting personnel or equipment at risk.	Operator, Labor and all field personnel involved in operation.
9	Control of communication between task personnel	• Multiple signals interfering with operator	• During lifting or rigging activities, a communication order must be established previous to any attempt to hoist load. • Spotters communicate to one load controller; load controller communicates to operator. • Operator must maintain visual contact with load controller at all times. • All operations are controlled by ground controller.	Operator, Labor and all field personnel involved in operation.
10	Trench entry in order to place materials and piping – see JSA for Excavation Activities	• Excavation Hazards (review of that JSA)	• Follow JSA for Excavation.	All Affected Personnel

Job Safety Analysis (JSA)
MATERIAL HANDLING ACTIVITIES – RIGGING AND PLACEMENT OF MATERIALS

[1] Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.

[2] A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

[3] Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
MOBILIZATION AND DEMOBILIZATION ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	July 2013	**JSA Type**	Mobilization and Demobilization Activities
Work Type	Construction	**Client**	General Electric Company and SI Group, INC.
Work Activity	Mobilization of Equipment and Supplies to and from the job site		
Work Site	Friedrichsohn Cooperage Site. Town of Waterford, New York		
Key Equipment			
Task-specific Training	PPE, HAZCOM, Motor Vehicle Safety, Mobile Equipment Operations		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: ________________*	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER* ____________________
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* ____________________	☐ OTHER* ____________________
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest - Class II			
Gloves - Leather			

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
MOBILIZATION AND DEMOBILIZATION ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Discuss STAR (Stop Think Assess & Review) and Stop Work Authority (SWA)	• Site personnel not aware of STAR & SWA	• Project team discusses importance of and documentation procedures for SWA during pre-job safety meeting. Use SWA to stop any work that is unsafe.	Personnel Taking Part in this Activity
2	Check weather	• Unexpected storm; Fog; Rain; Snow; Lightening/Thunder; • Heat/Cold stress	• Check local weather forecast. • Discuss weather issues and precautions to take while driving and on-site during the pre-job safety meeting. If weather conditions (e.g., fog, rain, snow, etc.) impair the ability/vision of the driver, exit at nearest safe location and assess the situation. • While on-site, at first sign of lightening/thunder utilize SWA and assess weather conditions. In extreme temperatures, ensure all personnel have proper clothing, hydration, and heat/cold protection (e.g., canopy, fan, and glove warmers).	Personnel Taking Part in this Activity
3	Load equipment into vehicle	• Back strain; • Cuts; • Pinch points; • Hand/Foot injury; • Forgotten equipment; • Damaged equipment	• Use proper lifting techniques and buddy system if needed. • Wear leather/cotton gloves and avoid placing hands/fingers in pinch point locations. Wear steel toe boots. • Verify requested equipment against warehouse form. • Load equipment in an organized manner to prevent shifting during transport or use cargo netting.	Personnel Taking Part in this Activity
4	Complete CRA Daily Operator Vehicle Checklist	• Damaged vehicle lights, tires, windows, mirrors, horn; Inadequate vehicle documents and/or safety items	• Check for fluid leaks under vehicle. • Test operation of headlights, front/rear turn signals, backup lights, brake lights, and emergency flashers. Visually check the pressure/wear of tires. Ensure the vehicle has a spare tire. Assure windshield and window glass is clean and free from obstructions. Test the windshield wipers and horn. Verify vehicle registration, insurance card, and inspection sticker is present and valid. • Ensure the vehicle contains a first aid kit, fire extinguisher, and road hazard kit.	Personnel Taking Part in this Activity
5	Check and adjust seat, steering wheel, headrest, and mirrors	• Back/body strain; • Blind spots; Impaired vision.	• Adjust seat, headrest, and steering wheel height so body is fully supported/comfortable and pedals are within easy reach. Ensure mirrors are properly adjusted.	Personnel Taking Part in this Activity
6	Fasten seat belt(s) and ensure passenger(s) seat belts are fastened	• Serious injury, ejection, or death from collision and/or traffic citation	• Verify driver and passenger(s) seat belts are in good condition and properly latched.	Personnel Taking Part in this Activity
7	Ensure vehicle doors are locked	• Serious injury, ejection, or death from collision; • Unwanted intrusion; Lost equipment	• Manually lock all doors to vehicle.	Personnel Taking Part in this Activity
8	Start engine and check gauges and warning lights	• Vehicle breakdown	• Verify sufficient fuel and other hazard lamps (e.g., battery, oil, and temperature) are not lit.	Personnel Taking Part in this Activity

Job Safety Analysis (JSA)
MOBILIZATION AND DEMOBILIZATION ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
9	Mobilize to site	• Arriving late; • Collision; • Injury or Death to occupants or other parties	• Do not use cell phones or perform other distracting activities while vehicle is in motion. • Constantly scan intersections, move eyes, check mirrors, and assess traffic lights (fresh vs. stale). • Maintain safety cushion around vehicle (front, sides, and rear) and 4 second following distance. • Utilize all driving defensive techniques.	Personnel Taking Part in this Activity
10	Arrive at site	• Pedestrian injury; • Collision	• Maintain awareness of pedestrian/vehicular traffic when entering site and traveling to work zone.	Personnel Taking Part in this Activity
11	Park vehicle	• Pedestrian injury; • Collision; • Property damage	• Maintain awareness of pedestrian/vehicular traffic. • Park vehicle in pull-through parking space or facing the exit. • Use caution and mirrors/spotter when backing vehicle.	Personnel Taking Part in this Activity
12	Demobilization	• Collision; • Injury or Death to occupants or other parties	• Perform perimeter vehicle check. • Maintain awareness of pedestrian/vehicular traffic when exiting site. • Utilize defensive driving techniques. • Complete post-departure checklist and report vehicle problems to company vehicle maintenance manager or rental car agency.	Personnel Taking Part in this Activity

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[3] Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
OVERSIGHT OF CONTRACTOR AND SUBCONTRACTOR ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	June 2013	**JSA Type**	Oversight of Contractor and Subcontractor Activities
Work Type	Construction	**Client**	General Electric Company and SI Group, INC.
Work Activity	Oversight of Contractor and Subcontractor Activities		
Work Site	Friedrichsohn Cooperage Site. Town of Waterford, New York		
Key Equipment			
Task-specific Training	40 HR and 8 HR HAZWOPER; PPE, HAZCOM, Mobil Equipment Safety Awareness Training.		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☐ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: ________________*	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER*
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* ____________________	☐ OTHER* ____________________
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest – Class II			
Gloves – For general Handling activities			

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)

OVERSIGHT OF CONTRACTOR AND SUBCONTRACTOR ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process and discuss Stop Work Authority (SWA) Perform Review of this JSA.	• Failing to identify hazardous conditions resulting in losses or near losses.	• Perform the STAR Process. • Assess the risks. • Determine the hazards of performing the task and survey the work area. • Consider weather conditions and review heat stress and cold stress information as applicable • Always consider the worst case scenario. • Analyze the hazards determined. • Decide a plan of action to eliminate or reduce the hazards and act on it.	CRA Site Representative
2	General inspection of contractor and subcontractor work activities	• Slip/Trip/Falls • Injury from Heat/Cold Stress or Inclement Weather • Working From Elevated Heights Greater Than 6 Feet • Noise • Potential direct and indirect contact with chemical contaminants and hazardous atmospheres. • Biological Hazards • Lifting Heavy Objects • Exposure to Vehicular traffic and Heavy Equipment • Failure to identify and remove all hazards including atmospheric hazards, water, electrical and biological. • Electrical hazards and potential physical injury from exposure to hazardous energy (i.e., hydraulic, pneumatic etc.) • Potential heat hazard (e.g., touching hot objects) that could cause a burn	• Walk work area to look for additional hazards. • Keep area free of excess materials and debris. • Remove all travel path hazards by keeping materials/objects organized and out of walkways. • Note and communicate areas of slick or uneven ground. • Take breaks as needed by monitoring the Daily Heat Index, as outlined in the HASP • Consume adequate food/beverages. Personnel should consume at least 8 ounces of cool water or electrolyte replacement drinks every 20-30 minutes. • Observe work-rest schedule to manage heat/cold stresses • When warranted, stay alert for rain, lightning, and high wind hazards, perform work in such weather as outlined in the HASP. • Do not stand directly next to open excavations > 6-ft. without fall protection • Access ladders or ramps if they were installed in the immediate work area, must be available to enter into and out of any excavation • Perform pre-entry air monitoring to verify acceptable conditions • Wear all of the PPE as identified on the first page of this JSA. • Hearing protection is required when working near operating equipment and machinery. • Do not lift or move objects by yourself if they weigh more than 50 pounds. • Check for contact hazards such as other boxes/objects in the vicinity as well as other people/equipment in the area. Check that there is ample room to squat, lift, turn, or maneuver without twisting the back or other muscles or joints. • Check travel path for, and remove, slip hazards such as tools puddles, and debris. • Wear Reflective Safety Vest in areas near operating equipment and vehicular traffic. • Maintain eye contact with equipment operators and do not walk into their path unless the operator motions for you to move. • Ensure that energy control procedures are in place when work is being done on equipment that has hazard energy present.	CRA Site Representative

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Job Safety Analysis (JSA)
OVERSIGHT OF CONTRACTOR AND SUBCONTRACTOR ACTIVITIES

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Job Safety Analysis (JSA)
SOIL SCREENING ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	July 2013	**JSA Type**	Soil Screening Activities
Work Type	Construction	**Client**	General Electric Company and SI Group, INC.
Work Activity	Soil Screening Activities		
Work Site	Friedrichsohn Cooperage Site. Town of Waterford, New York		
Key Equipment	Photoionization Detector		
Task-specific Training	40 HR and 8 HR HAZWOPER; PPE, Mobile Equipment Operations		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: ________________*	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☒ HEARING PROTECTION*	☒ PPE CLOTHING*	☐ OTHER*
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* ________________	☐ OTHER* ________________
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest – Class II PPE Clothing – Polycoated Tyvek® suits			
Gloves – Inner Nitrile gloves (e.g., Ndex)			

Reviewed By	Position/Title	Date	Reviewed By	Position/Title	Date

Job Safety Analysis (JSA)
SOIL SCREENING ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process and discuss Stop Work Authority (SWA) Perform Review of this JSA.	• Failing to identify hazardous conditions resulting in losses or near losses.	• Perform the STAR Process. • Assess the risks. • Determine the hazards of performing the task and survey the work area. • Consider weather conditions and review heat stress and cold stress information as applicable • Always consider the worst case scenario. • Analyze the hazards determined. • Decide a plan of action to eliminate or reduce the hazards and act on it.	Soil Screening Technician
2	Mob soil screening equipment to work area	• Potential back Injuries from moving equipment; • Potential exposure to onsite vehicle traffic • Slip/trip/fall; • Biological hazards.	• Follow proper lifting procedure identified in the HASP; • Wear the appropriate PPE that is identified in this JSA; • Practice STAR; • Use the Buddy System to watch over other project team members.	Soil Screening Technician
3	Conduct soil screening activities	• Struck by moving heavy equipment; • Slip/trip/fall; • Potential direct or indirect contact with soils that potentially may contain chemicals; • Biological hazards; • Weather hazards (thunder storms) • Heat Stress and Cold Stress.	• Wear hi-visibility safety vest, steel-toed boots, safety glasses, hard hat and respirator as required; • Do not use old or worn out PPE; • Make sure that proper PPE is being worn and is in good condition; • Notify nearby equipment operators of changes in you activities/movement through work area; • Inspect and properly decontaminate tools and screening equipment; • Watch for snakes, insects, animals, etc; avoid walking through contaminated areas; • Check weather prior to entering work area; • Should conditions be windy, wear spoggles (safety glass goggles) to prevent dirt and debris from getting into the eyes when air purifying respirators are not being worn; • Wear sunscreen, as required; • If thunder is heard o lightning seen, leave work area immediately and take shelter; do not re-enter work area until 30 minutes after last lightning strike is seen; • Proceed to the decontamination area at break time and upon completion of the assigned work task; • Follow the Decontamination Procedures.	Soil Screening Technician

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Job Safety Analysis (JSA)
SURVEYING ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	July 2013	**JSA Type**	Surveying Activities
Work Type	Construction	**Client**	General Electric Company and SI Group, INC.
Work Activity	Surveying Activities		
Work Site	Friedrichsohn Cooperage Site. Town of Waterford, New York		
Key Equipment	GPS, grade rod, stakes, hammer, wood lathe, ribbon		
Task-specific Training	Flagger safety; Traffic control devices; PPE, Mobile Equipment Operations		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: ________________*	☒ GLOVES* Leather
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER*
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* ____________________	☐ OTHER* ____________________________
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest – Class II			
Gloves - Leather gloves for mobilization and demobilization equipment			

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
SURVEYING ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process and discuss Stop Work Authority (SWA) Perform Review "General Site Activities" JSA.	• Failing to identify hazardous conditions resulting in losses or near losses.	• Perform the STAR Process STAR. • Assess the risks. • Determine the hazards of performing the task and survey the work area. • Consider weather conditions such as fog that could reduce visibility. • Always consider the worst case scenario. • Analyze the hazards determined. • Decide a plan of action to eliminate or reduce the hazards and act on it.	Survey Team
2	Mob equipment to surveying area	• Potential back Injuries loading equipment; • Pinch points; • Moving or flying projectiles inside vehicle while transporting equipment; • Slip/trip/fall; • Biological hazards.	• Follow proper lifting procedure identified in the HASP; • Wear leather gloves when moving equipment around; • Review JSA and HASP; • Practice STAR; • Properly secure all equipment inside the vehicle. • Contact the owner of any public roadway (State or City) to determine requirements for surveying on or along their roadway. • Develop a Temporary Traffic Control Plan (TTCP) if surveying activities will be taking place on or along the shoulder of a public highway. • Set up a Temporary Traffic Control Zone (TTCZ) if surveying activities will be taking place on or along the shoulder of a public highway. The TTCP will describe the set up of the TTCZ.	Survey Team
3	Setup in work zone	• Struck by oncoming traffic/heavy equipment; • Slip/trip/fall; • Biological hazards; • Potential back injuries from moving equipment; • Heat/Cold Stress;	• Communication with other personnel/heavy equipment operators to notify them of survey team presence; • Position a company truck with flashers on for added protection and to aid in the protection of the survey crew as they set up the TTCZ; • Follow hot/cold stress procedures presented in the HASP. Ensure fluid intake and clothing/PPE is appropriate for conditions.	Survey Team

Job Safety Analysis (JSA)
SURVEYING ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
4	Conduct survey activities	• Struck by oncoming traffic; • Slip/trip/fall; • Potential injuries from misuse of tools or use of tools in disrepair; • Splinters, eye injuries from broken stakes; • Utility strikes; • Biological hazards; • Weather.	• Wear hi-visibility safety vest, steel-toed boots, safety glasses, and hard hat; • Do not use old or faded PPE; • Make sure that proper PPE is being worn; • Notify nearby equipment of changes in you activities/movement through work area; • Inspect tools; • Repair/replace tools as necessary; • Visually inspect stakes prior to driving into ground. Do not use stakes that are cracked, split, have large knots, etc; • Perform utility clearance to with clients representative to verify presence of underground utilities to avoid driving grade stakes through any underground obstructions; • Watch for snakes, insects, animals, etc; avoid walking though tall grass and shrubs as much as possible; • Check weather prior to entering work area; • Should conditions be windy, wear spoggles (safety glass goggles) to prevent dirt and debris from getting into the eyes; • Wear sunscreen, as required; • If thunder is heard o lightning seen, leave work area immediately and take shelter; do not re-enter work area until 30 minutes after last lightning strike is seen	Survey Team
5	Exit work zone	• Struck by oncoming traffic; • Slip/trip/fall; • Biological hazards; • Weather.	• Walk through clear paths, especially when carrying equipment; watch for and avoid rough terrain as much as possible; • Note traffic patterns, make sure path to vehicle is clear and notify nearby equipment you are moving through their path; • Watch for snakes, insects, animals, etc; avoid walking though tall grass and shrubs as much as possible; • Check weather prior to entering work area; • Should conditions be windy, wear spoggles (safety glass goggles) to prevent dirt and debris from getting into the eyes; • Wear sunscreen, as required; • If thunder is heard o lightning seen, leave work area immediately and take shelter; do not re-enter work area until 30 minutes after last lightning strike is seen.	Survey Team

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3 Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
PERSONNEL AND SURVEY / SCREENING EQUIPMENT DECONTAMINATION ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	July 2013	**JSA Type**	Personnel and Survey/Screening Equipment Decontamination Activities
Work Type	Construction	**Client**	General Electric Company and SI Group, INC.
Work Activity	Personnel and Survey/Screening Equipment Decontamination Activities		
Work Site	Friedrichsohn Cooperage Site. Town of Waterford, New York		
Key Equipment	Alconox/Liquinox, buckets water, brushes and or sponges		
Task-specific Training	40 HR and 8 HR HAZWOPER; PPE and HAZCOM		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☐ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: ________________*	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☒ PPE CLOTHING*	☐ OTHER*
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* ____________________	☐ OTHER* ____________________
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest – Class II PPE Clothing – Polycoated Tyvek® suits			
Gloves – Inner Nitrile gloves (e.g., Ndex)			

Reviewed By	Position/Title	Date	Reviewed By	Position/Title	Date

Job Safety Analysis (JSA)

PERSONNEL AND SURVEY/SCREENING EQUIPMENT DECONTAMINATION ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process and discuss Stop Work Authority (SWA) Perform Review of this JSA.	• Failing to identify hazardous conditions resulting in losses or near losses.	• Perform the STAR Process. • Assess the risks. • Determine the hazards of performing the task and survey the work area. • Consider weather conditions and review heat stress and cold stress information as applicable • Always consider the worst case scenario. • Analyze the hazards determined. • Decide a plan of action to eliminate or reduce the hazards and act on it.	Decontamination Personnel
2	Decontamination of survey/screening equipment	• Contaminant exposure • Pinch points • Slip/trip/hit/fall hazards • Lifting hazards • Back injury • Manual material handling	• Set up decontamination station to capture any spills to avoid cross-contamination and manage wastes • Wear nitrile gloves • Scrub applicable equipment clean then rinse and verify it is clean and free of contamination. In the case of monitoring equipment or sensitive equipment, use appropriate wipes to clean the equipment. • Avoid putting hands in or near pinch points • Maintain good housekeeping and be aware of surroundings • Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical means, such as a dolly, cart, or a buddy lift) will be required • Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position • Refer to the HASP for additional lifting techniques	Decontamination Personnel
3	Decontamination of personnel	• Contaminant exposure • Slip/trip/hit/fall hazards	• Refer to the HASP for specific procedures but in general start with most contaminated article and remove until inner gloves are the last item left • Dispose of used PPE in accordance with site requirements • Wash hands and face before eating, drinking, or using tobacco products • Take care when removing PPE (boots, gloves, etc.); sit down to remove/change boots as necessary	Decontamination Personnel
4	Management of waste derived from decontamination activities	• Contaminant exposure • Lifting hazards • Back injury • Manual material handling	• Containerize decontamination waste (e.g., water, used PPE) as required • Wear medium duty gloves that meet the ANSI Cut and Abrasion Resistance Level 2 EN 388 3xx Testing Standard with nitrile gloves • Properly dispose of decontamination fluids (e.g., wash waters) • Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds (23 kg) then assistance (mechanical means, such as a dolly, cart, or a buddy lift) will be required • Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position • Refer to the HASP for additional lifting techniques	Decontamination Personnel

1 Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.

2 A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

3 Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)

PERSONNEL AND SURVEY/SCREENING EQUIPMENT DECONTAMINATION ACTIVITIES

APPENDIX B

PROJECT SAFETY FORMS

ACCIDENT REPORTING FORM

Report all accidents immediately to the Safety and Health Officer

Instructions: For Personal Injuries, Property Damage, and Near Miss Reports, Complete Sections 1 and 2. For Vehicle Accidents, Complete Sections 1, 2, and 4. Form must be completed within 24 hours.

SECTION 1

A. Employee Identification	**( ) Employee**	**( ) Temporary Employee**	**( ) Subcontractor**	
Employee No.	Last Name	First Name	Middle Name/Initial	M or F
Area Code ( ) Telephone Number	Address (Street, City, State, Province, Zip Code)			
Date of Hire / /	Position/Title	Supervisor	Employee's Company/Office Location	

B. General Information			
Where did the accident occur? ( ) Office ( ) Project Site	Type of Occurrence ( ) Near Miss ( ) Employee Injury ( ) Vehicle Accident ( ) Property Damage Only		
Date and Hour of Accident Month Day Year a.m. p.m.	Date and Hour Reported to Employer Month Day Year a.m. p.m.	Date and Hour Last Worked Month Day Year a.m. p.m.	Time Employee Began Work a.m. p.m.
Normal Work Hours on Last Day Worked From: a.m. To: p.m.	Witnesses? ( ) Yes ( ) No	Witness Name and Telephone Number	

C. Project Information (Project Related Accidents/Near Misses Only)				
Project #	Project Name	Project Manager	Site Telephone Number ( )	Employee Cell Number ( )
Was the Client Advised of the Accident? ( ) Yes ( ) No Name:	Project Address (Street, City, State, Province, Zip Code) Specific Location of Accident			

SECTION 2

A. Details of the Accident/Near Miss
1. What job/task was being performed when the accident occurred?
2. Describe the employee's specific activities at the time of the accident. Include details of equipment/materials being used, including the size and weights of objects being handled.
3. For injuries, identify the part of body injured, and specify left or right side.
4. Identify the object or substance that directly injured employee and how.
5. Identify Property Damaged (include owner of property, nature and source of damage, model and serial number, if appropriate).

B. Health Care/Medical Treatment	
Employee received health care? ( ) Yes ( ) No	Identify the type of health care provided and where it was performed. (Check all that apply). ( ) First Aid ( ) Medical treatment other than first aid (sutures, etc.) ( ) Hospitalized ( ) Clinic ( ) Hospital emergency room ( ) On location by self or co-worker) ( ) On site by EMT
Name of Health Care Provider, Physician's Name, Address (Street, City, Province/State, and Postal/Zip Code)	

Section 2 (Continued)

C. Accident Investigation		
H&S plan prepared and on site? ( ) Yes ( ) Not applicable	Did the safety plan identify and provide safety procedures for the specific tasks the employee was conducting when injured? ( ) Yes ( ) No If no, why not? (Explain).	
Did the employee have the proper safety training to conduct these tasks or use the equipment? ( ) Yes ( ) No If not, why not?		
Identify all of the potential contributing factors and how they led to the occurrence of the accident. (Lack of attention, wrong use of equipment, lack of training, etc.)		
What contributing factor above was the underlying root cause of the accident.		
Is any training or retraining recommended? If yes, describe.		
What actions have been or will be taken to correct this accident from reoccurring?		
Additional information: Attach photos, accident diagrams, as applicable.		
Report Date Month Day Year	Report Prepared by: (please print)	Report Prepared by: (signature)

VEHICLE ACCIDENT SECTION

(Complete this Section for all Vehicle Accidents)

SECTION 4

A. Vehicle

License Plate No.	State	Police Department City State	
Vehicle Year/Make/Model	Odometer Reading at Time of Accident	Police Report Number	Weather Conditions

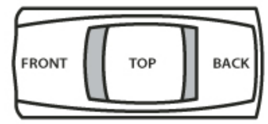
Name of Person Operating Vehicle

Address

City State/Province Zip Code

Telephone: Area Code ( )

"X" IN AREA OF VEHICLE DAMAGE



CIRCLE
0 No Damage
1 Light
2 Moderate
3 Heavy
4 Rolled
5 Burned

Vehicle Type: ( ) Personal ( ) Rental ( ) CRA-Own

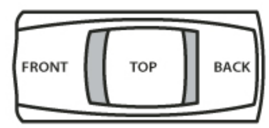
Description of Vehicle Damage:

B. Other Vehicles Involved

Name of Owner	Address	City/State/Zip	Area Code and Telephone Number ( )
Operator's Name (if different from above)	Address	City/State/Zip	Area Code and Telephone Number ( )

Year/Make/Model	Description of Property Damage:
Insurance Co. Name & Telephone	
License Plate No./State/Province	

"x" IN AREA OF VEHICLE DAMAGE



CIRCLE
0 No Damage
1 Light
2 Moderate
3 Heavy
4 Rolled
5 Burned

C. Injured Persons

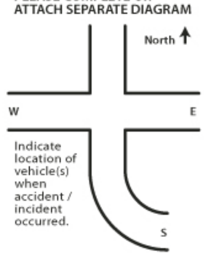
Name	Address Street, City, State/Zip Code	Phone Number	Nature of Injury	Indicate if Injured was a Vehicle Driver/ Passenger, Employee, Other, or Pedestrian
1.				
2.				
3.				

D. Witnesses

Name	Address Street, City, State/Prov./Zip Code	Area Code and Telephone Number
1.		( )
2.		( )

E. Description of Accident

PLEASE COMPLETE OR ATTACH SEPARATE DIAGRAM



Was Ticket Issued:
Other Operator ☐
Company Operator ☐

Reason: ____________________

Report Date Month Day Year	Report Prepared by: (please print)	Report Prepared by: (signature)

Note: If Additional Space is Required to Complete this Report, Use Separate Sheet of Paper and Attach.

DAILY SAFETY MEETING FORM

PROJECT: **FRIEDRICHSOHN COOPERAGE SITE**
LOCATION: **Waterford, New York**

DATE/TIME: ____________________________

1. Safety Issues or Topics Discussed:
2. Work Summary and Physical/Chemical Hazards of Concern:
Planned Activities:
Physical hazards:
Biological hazards:
Chemicals onsite:
3. Protective Equipment/Procedures:
4. Emergency Procedure:
MUSTERING POINT: Northwest corner of Intersection at Royal Avenue and 47th Street
In event of an emergency gather/proceed to mustering point(s). Review Contingency Plan
Emergency Procedures for Area(s) of activity.

5. Signatures of Attendees (Handwriting must be legible):	

NL

CONESTOGA-ROVERS & ASSOCIATES (CRA) NEAR LOSS REPORTING FORM

CRA Inc and Ltd – A Significant Near Loss must be called into Incident Hot Line: 1-866-529-4886
CRA Europe – Incidents must be called into the Head Office during working hours (0115 965 6700) and to the CRA Europe Incident Hotline afterhours (0773 076 2845)

CRA SMART PROGRAM – Safety Means Awareness Responsibility Teamwork

Instructions:
1) *Employee completes the Near Loss Report and submits to Supervisor.*
2) *Supervisor reviews and makes other comments.*
3) *Employee discusses Near Loss with Project Manager.*
4) *Submit to Regional Safety & Health Manager*

Report Status (insert date)	**Initial Report**	**Update Report**	**Final Report**	**Verification/Validation**	**Report Input into SMART Database**

SECTION 1

A. Employee Identification ☐ **CRA Employee** ☐ **Temporary Employee** ☐ **Subcontractor**

Employee No.	Last Name	First Name	Employee's Company - if Subcontractor
Date of Hire	Position/Title	Supervisor	Home Office Location - if CRA Employee

B. General Information

Where did the Near Loss occur? ☐ Office ☐ Project Site ☐ Other ______________ ☐ Canada ☐ United States ☐ UK	Type of Near Loss (Check all that apply) ☐ Employee Injury/Illness ☐ Vehicle Accident ☐ Property Damage ☐ Environmental
Address of Near Loss (City, State/Province/County, Postal/Zip Code)	Specific Location of Near Loss (e.g., where on site)

Date and Hour of Near Loss		Date and Hour Reported to CRA		Time Employee Began Work
Month Day Year	a.m. p.m.	Month Day Year	a.m. p.m.	a.m. p.m.
Witnesses? ☐ Yes ☐ No	Witness Name and Telephone Number			

C. Project Information (Project Related Near Loss Only): Project Related: ( ) Yes ( ) No

Project #	Project Name	CRA Project Manager	Client	Client Contact
Was the Client Advised of the Near Loss? ☐ Yes ☐ No ☐ N/A	Name:		Date and Time Month Day Year Time	

SECTION 2

A Details of the Near Loss

1. What job/task was being performed when the Near Loss occurred? (Example: collecting groundwater samples).

2. Provide a detailed description of the employee's specific activities at the time of the Near Loss. Include details of equipment/materials being used, including the size and weights of objects being handled, and weather conditions at time of the Near Loss. If necessary, attach additional pages to the report.

B. Near Loss Investigation

Conduct a 5-Why Root Cause Analysis Investigation. In addition, if there was the potential for a significant injury or loss, report the Near Loss to the Incident Hot Line (this will determine if a Tap Root Cause Analysis is necessary).

HASP prepared? ☐ Yes ☐ No ☐ N/A Submit a PDF of HASP to Investigation Team. If yes, was the HASP on site? ☐ Yes ☐ No	Did the safety plan identify and provide safety procedures for the specific tasks being performed when the Near Loss occurred? ☐ Yes ☐ No If no, why not? (Explain) ______________ Did the employee utilize the STAR process before initiating the task? ☐ Yes ☐ No If no, why not? (Explain) ______________

SECTION 2 (continued)

5-Why Root Cause:	Additional information: Attach photos, witness statement(s), affected employee statement, as applicable, to the end of this document.
1. Why did "above" happen?	
2. Why did "1" happen?	
3. Why did "2" happen?	
4. Why did "3" happen?	
	See Section 3 Below: Corrective Actions/ Verification and Validation
5. Why did "4" happen?	
6. Why did "5" happen?	

C. Accountability		
Initial Report Date Month Day Year	Initial Report Prepared by: (please print)	Initial Report Prepared by: (signature)
Investigation Team	Company	Position/Title
Final Report Date Month Day Year	Final Report Prepared by: (please print)	Final Report Prepared by: (signature)

D. Stewardship		
Will a Near Loss Summary be Prepared? ☐ Yes ☐ No If yes, by:		
Quality Review By:	Date:	Findings:

SECTION 3

Corrective Action					**Validation & Verification**		
CF	**Corrective Actions (Must match Causative Factor)**	**Responsible Party**	**Due Date**	**Date Completed**	**Verified By/ Validated By**	**Date**	**Details**
					Verified By		
					Validated By		
					Verified By		
					Validated By		
					Verified By		
					Validated By		

CRA 10 CAUSATIVE FACTORS (CF)

PERSONAL FACTORS		**COMPANY FACTORS**		**EXTERNAL FACTORS**	
1	Insufficient training for task	5	Incomplete or no procedures	10	Exposure to conditions
2	Hurrying to complete the task	6	Procedures not known or enforced		
3	Easier if proper process not followed	7	Improper PPE		
4	Took shortcuts without prior incident	8	Improper tools		
		9	Improper workplace layout		

SAFETY INSPECTION CHECKLIST FOR EXCAVATIONS
REFERENCED BY OSHA STANDARDS

This checklist is to be completed by the competent person at the start of work and as needed throughout the shift (i.e., after rain events, etc.). ***(A competent person has been trained in the current OSHA excavation standard, is knowledgeable about soil analysis and protective systems, and has the authority to shut down the job.)***

Site Location:		Project #:			
Date:	Time:	Competent Person:			
Were visual soil tests made? If Yes, what type?		YES	NO ☐	Type:	
Were manual soil tests made? If yes, what type?		YES ☐	NO ☐	Type:	
Soil Type:		Signature:			
Soil Classification:					
Excavation Depth:		Excavation Width:			
Protective System Used:					

In the following table, please place an Y for Yes, N for No, or N/A for Not Applicable in the right hand column for each item. If No, place the date of correction.

	Subject	Y, N, or NA	Date Corrected
GENERAL INSPECTION OF THE JOB SITE			
1.	Does the competent person have the authority to remove employees from the excavation immediately?	**Y**	
2.	**ARE SURFACE OBSTRUCTIONS REMOVED OR SUPPORTED?**	**Y**	
3.	Are employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation?	**Y**	
4.	Are hard hats worn by all employees?	**Y**	
5.	Are excavated soil, materials, and equipment placed at least 2 feet from the edge of the excavation?	**Y**	
6.	Are walkways and bridges over excavations 4 feet or more in depth equipped with standard guardrails and toe-boards?	**N/A**	
7.	Are warning vests or other highly visible clothing provided and worn by all employees exposed to public vehicular traffic?	**Y**	
8.	Are employees required to stand away from vehicles being loaded or unloaded?	**Y**	
9.	Is a warning system established and used when mobile equipment operates near the edge of the excavation?	**N/A**	
10.	Are employees prohibited from going beneath suspended loads?	**N/A**	
11.	Are employees prohibited from working on the faces of sloped or benched excavations above other employees?	**N/A**	
UTILITIES			
12.	Were utility companies contacted and/or utilities located?	**N/A**	
13.	Are the exact locations of the utilities marked?	**N/A**	
14.	Are underground installations protected, supported, or removed when excavation is opened?	**N/A**	
MEANS OF ENTERING AND EXITING THE TRENCH			
15.	Is the distance along the trench to an exit no greater than 25 feet in excavations 4 feet or more in depth?	N/A	
16.	**IS A SUPPORT SYSTEM, SUCH AS UNDERPINNING, BEING USED?**	N/A	
17.	Are ladders used in excavations secured and extended 3 feet above edge of the trench?	N/A	
18.	Are structural ramps used by employees designed by a competent person?	N/A	
19.	Are structural ramps used for equipment designed by a registered professional engineer?	N/A	
20.	Are employees protected from cave-ins when entering or exiting the excavation?	N/A	

	Subject	Y, N, or NA	Date Corrected
WET CONDITIONS			
21.	Is water removal equipment monitored by a competent person?	Y	
22.	Is surface water or run-off diverted or controlled to prevent accumulation in the excavation?	Y	
23.	Are inspections made after every rainstorm or other hazard-increasing occurrence?	Y	
HAZARDOUS ATMOSPHERE			
24.	Is the atmosphere within the excavation tested where there is a reasonable possibility of an oxygen deficiency, combustible, or other harmful contaminant exposing employees to a hazard?	N/A	
25.	Are adequate precautions taken to protect employees from exposure to an atmosphere containing less than 19.5% oxygen and/or other hazardous atmospheres?	N/A	
26.	Is ventilation provided to prevent employee exposure to an atmosphere containing flammable gas 10% above the lower explosive limit of a gas?	N/A	
27.	Is testing conducted often to ensure that the atmosphere remains safe?	N/A	
28.	Is emergency equipment, such as breathing apparatus, safety harness and lifeline, and/or basket stretcher readily available where hazardous atmospheres could or do exist?	N/A	
SUPPORT SYSTEMS			
29.	Are materials and/or equipment for support systems selected based on soil analysis, trench depth, and expected loads?	N/A	
30.	Are materials and equipment used for protective systems inspected and in good condition?	N/A	
31.	Are protective systems installed without exposing employees to the hazards of cave-ins (including end walls), collapses, or threat of being struck by materials or equipment?	N/A	
32.	Are excavations below the level of the base, or footing supported, approved by a registered professional engineer?	N/A	
33.	Does the removal of support systems progress from the bottom and members are released slowly? Note any indication of possible failure.	N/A	
34.	Is the excavation of material a level no greater than 2 feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth?	N/A	
35.	Is there a shield system placed to prevent lateral movement?	N/A	

TRAINING ACKNOWLEDGEMENT FORM

I have read or received instruction in the Site Health and Safety Plan and I understand the contents of the Site Health and Safety Plan. I have been informed whom to contact if I have any questions and I know where to report any additional health and safety hazards. I understand that I have "stop work" authority. I agree to work to the safety plan guidelines and understand that failure to do so could result in removal from the Site. **I will <u>S</u>top <u>T</u>hink <u>A</u>ct <u>R</u>eview prior to initiating a task.**

Date	*Printed Name*	*Signature*	*Company*

PROPERTY ACCESS/UTILITY CLEARANCE DATA SHEET

(QSF-019)

PROJECT NAME: ______________________ PROJECT NUMBER: __________

CRA REPRESENTATIVE: ______________________

CLIENT: __________ CLIENT REPRESENTATIVE: __________ PHONE: __________

ON-SITE PROPERTY ACCESS APPROVAL __________ (OWNER OR AUTHORIZED AGENT SIGNATURE)

OFF-SITE PROPERTY ACCESS APPROVAL (if applicable) __________ (OWNER OR AUTHORIZED AGENT SIGNATURE)

UTILITY CLEARANCE APPROVAL __________ (OWNER OR AUTHORIZED AGENT SIGNATURE)

CONTRACTOR VERIFICATION APPROVAL __________ (OWNER OR AUTHORIZED AGENT SIGNATURE)

UTILITIES (INDICATE THAT LOCATION/UTILITY PRESENCE WAS CHECKED) *												
Borehole/ Excavation Location	Date (m/d/y)	Telephone	Water	Storm Sewer	Sanitary Sewer	Process Sewer	Gas	Electrical	Cable	Overhead Utilities	Other	Comments/Warnings

Additional Comments:

____

____

____

* Note as appropriate, Contractor, Client or Owner, or Agent to sign, indicating no utilities are at the selected borehole/excavation locations.

THIS COMPLETED FORM IS A QUALITY RECORD

APPENDIX C

COMMUNITY AIR MONITORING PLAN

COMMUNITY AIR MONITORING PLAN
DEVELOPED IN ACCORDANCE WITH THE NEW YORK STATE DEPARTMENT OF HEALTH'S GENERIC COMMUNITY AIR MONITORING PLAN

Overview

This site-specific Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP will help to confirm that work activities do not spread contamination off site through the air.

Designated air monitoring station locations will be established around the perimeter of the site for use as monitoring locations. The site-specific CAMP presented below will be implemented during the soil removal and site restoration activities at the site. Each day that these activities are in progress one upwind and two downwind air monitoring stations will be set up to collect data. The instruments that will be used to collect the air monitoring data will have data logging capabilities. The data will be downloaded periodically, stored electronically and will be available to agency personnel for their review.

Reliance on this CAMP should not preclude simple, common sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Real-time air monitoring for VOCs and particulate levels at the perimeter of the designated work area will be necessary, as described below.

Continuous monitoring will be required during all ground intrusive activities in contaminated areas and soil stabilization activities that will be conducted at the Site. Ground intrusive activities include, but are not limited to, contaminated soil excavation and handling activities.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil samples. Periodic monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while overturning soil and then taking a reading prior to leaving a sample location.

VOC Monitoring, Response Levels, and Actions

VOCs will be monitored at the downwind perimeter of the designated work area (designated monitoring stations) on a continuous basis. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The specific type of air monitoring equipment that will be used at the Site for VOC monitoring will be a MiniRae 3000, or equivalent. The equipment will be calibrated in accordance with the manufacturer's guidelines. The equipment will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of VOCs at the downwind perimeter of the work area exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
2. If total organic vapor levels at the downwind perimeter of the work area persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the designated work area or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
3. If the organic vapor level is above 25 ppm at the perimeter of the designated work area, activities must be shutdown.
4. All 15-minute readings must be recorded and be available for State (New York State Department of Environmental Conservation [NYSDEC] and the New York State Department of Health [NYSDOH]) personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

Particulate/Fugitive Dust Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at one upwind and two downwind designated monitoring stations. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The particulate monitor that will be used will be a TSI 8520 DustTrak, or equivalent. The equipment will be equipped with an audible and/or visible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the designated work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the designated work area.
2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.
3. All readings must be recorded and be available for State (NYSDEC and NYSDOH) personnel to review.

The following fugitive dust suppression and corrective procedures will be employed at the Site.

1. Reasonable fugitive dust suppression techniques will be employed during all remedial activities, which may generate fugitive dust.
2. The following techniques are generally effective for the controlling of the generation and migration of dust during construction activities and may be employed as necessary:
   (a) Applying water on haul roads
   (b) Wetting equipment and excavation faces
   (c) Spraying water on buckets during excavation and dumping
   (d) Hauling materials in properly tarped or watertight containers
   (e) Restricting vehicle speeds to 10 mph

(f) Covering excavated areas and material after excavation activity ceases

(g) Reducing the excavation size and/or number of excavations

When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN

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TABLE OF CONTENTS

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LIST OF TABLES
(Following Text)

LIST OF ATTACHMENTS

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) presents the policies, organization, objectives, functional activities, and Quality Assurance (QA) and Quality Control (QC) activities designed to achieve the specific data quality goals associated with the Remedial Design/Remedial Action (RD/RA) and Groundwater Monitoring Plan (GWMP) for the Friedrichsohn Cooperage inactive hazardous waste site (the Site) located at 153-155 Saratoga Avenue in the Town of Waterford, New York. The RD/RA includes both the OU-1 and OU-3 upland areas and the OU-3 sediment. RD/RA work plans for the OU-1 and OU-3 Source Areas will be submitted separately from the RD/RA OU-3 Sediment work plan. This QAPP is intended to cover all sample collection activities for both RD/RA Work Plans and the Groundwater Monitoring Plan. This QAPP has been prepared in accordance with the following documents:

1) United States Environmental Protection Agency (USEPA) "Preparation Aids for the Development of Category III Quality Assurance Project Plans", EPA/600/8-91-005, February 1991.
2) New York State Department of Environmental Conservation (NYSDEC) Division of Hazardous Substance Regulation "RCRA Quality Assurance Project Plan Guidance", March 29, 1991
3) NYSDEC's "DER-10 Technical Guidance for Site Investigation and Remediation", May 3, 2010.

The objectives of the QAPP are to provide sufficiently thorough and concise descriptions of the measures to be applied during the RD/RA and groundwater monitoring programs such that the data generated will be of a known and acceptable level of precision and accuracy. The QAPP has been prepared to identify procedures for sample preparation and handling, sample chain-of-custody, laboratory sample analyses, and laboratory data reporting to be implemented during the remedial field activities to ensure the accuracy and integrity of the data generated.

Protocols for the collection of samples are presented in the Work Plans.

2.0 PROJECT DESCRIPTION

2.1 GENERAL

The objective is to satisfy the requirements of the Consent Order A5-0784-1202 (Order) executed on January 28, 2013 between NYSDEC and Respondents (General Electric Company and SI Group, Inc.).

The activities for the RD/RA and groundwater monitoring programs include the following:

- Predesign data collection including soil, sediment and groundwater sampling and analyses
- Routine groundwater monitoring for OU-2
- Active remediation including excavation of impacted soils and sediment
- Off-site transport and disposal of impacted soils and sediment
- Verification sampling following excavation
- Backfilling with clean imported soil
- Site restoration

2.2 SITE BACKGROUND

The Site location, description, and history are detailed in the Remedial Design/Remedial Action (RD/RA) Work Plan and the Groundwater Monitoring Plan.

3.0 PROJECT MANAGEMENT

The project management structure for QA/QC activities associated with the RD/RA and the groundwater monitoring program is discussed below, along with a brief description of the duties of the key personnel.

Keith Cowan/John Uruskyj - Project Manager

- Provides overall project management
- Participates in negotiations with the agencies involved
- Provides guidance to CRA's Project Manager

CRA Project Manager - Jamie Puskas

- Ensures professional services provided are cost effective and of the highest quality
- Ensures necessary resources are available on an as-required basis
- Participates in key technical negotiations with the agencies involved
- Provides managerial and technical guidance to the Project Engineer

CRA Design Coordinator - Jeff Daniel

- Provides day-to-day project management
- Provides managerial guidance to the project technical group
- Provides technical representation at meetings as appropriate
- Acts as liaison between the technical group and the client
- Acts as liaison with the agencies involved
- Prepares and reviews reports
- Conducts preliminary chemical data interpretation

CRA Quality Assurance/Quality Control Officer - Analytical Activities - Susan Scrocchi

- Overviews and reviews laboratory activities
- Determines laboratory data corrective action
- Performs analytical data validation and assessment
- Reviews laboratory QA/QC
- Assists in preparation and review of final report
- Provides technical representation for analytical activities

Quality Assurance/Quality Control Officer - Field Activities

- Provides immediate supervision of on-Site activities
- Provides field management of sample collection and field QA/QC
- Assists in preparation and review of final report
- Provides technical representation for field activities
- Is responsible for maintenance of the field equipment

Quality Assurance/Quality Control Site Coordinator - Field Activities

- The individual designated to be Site Coordinator will be specified prior to commencement of field activities
- Provides support to QA/QC Officer
- Conducts sample collection consistent with FSP and QAPP
- Manages subcontractors as directed by the QA/QC Officer

Laboratory Project Manager, Analytical Subcontractor

- Ensures resources of laboratory are available on an as-required basis
- Coordinates laboratory analyses
- Supervises laboratory's in-house chain of custody
- Schedules analyses of samples
- Oversees review of data
- Oversees preparation of analytical reports
- Approves final analytical reports prior to submission to CRA's QA/QC Officer

Laboratory Quality Assurance/Quality Control Officer, Analytical Subcontractor

- Overviews laboratory QA/QC
- Overviews QA/QC documentation
- Conducts detailed data review
- Decides laboratory corrective actions, if required
- Provides technical representation for laboratory QA/QC procedures

Laboratory Sample Custodian - Analytical Subcontractor

- Receives and inspects the sample containers
- Records the condition of the sample containers
- Signs appropriate documents

- Verifies chains of custody and their correctness
- Notifies laboratory project manager and laboratory QA/QC officer of sample receipt and inspection
- Assigns a unique laboratory identification number correlated to the field sample identification number, and enters each into the sample receiving log
- Initiates transfer of the samples to the appropriate lab sections with assistance from the laboratory project manager
- Controls and monitors access to and storage of samples and extracts

Primary responsibility for data quality rests with the QA/QC Officers. Ultimate responsibility for project quality rests with CRA's Project Manager. Independent QA will be provided by the laboratory's Project Manager and QA/QC Officer prior to release of the data to CRA.

The analytical laboratory chosen to perform the analyses will be certified by the New York State Department of Health (NYSDOH) through the environmental laboratory approval program for the appropriate categories of analysis. The name of the analytical laboratory and the laboratory QA/QC manual will be submitted to NYSDEC for review and approval prior to sample collection.

4.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective is to develop and implement procedures for sample collection and analyses of groundwater, soil and sediment which will provide data with an acceptable level of accuracy and precision.

The purpose of this Section is to define the QA goals required to meet the Data Quality Objectives (DQOs) of the project. QA goals for accuracy, precision, and sensitivity of analyses; and completeness, representativeness, and comparability of measurement data are established in the following sections.

The sampling and analysis program is summarized in Table 4.1.

4.1 LEVEL OF QA EFFORT

To assess the quality of data resulting from the field sampling program, field duplicate samples, field blank samples, samples for laboratory matrix spike/matrix spike duplicate (MS/MSD) analyses, trip blanks, and rinsate blank samples will be collected (where appropriate) and submitted to the contract laboratory.

For all field samples collected, field duplicate samples will be submitted at a frequency of one per 20 samples or in the event that a sampling round consists of less than 20 samples, one field duplicate will be collected. MS/MSD samples will be analyzed at a minimum frequency of one per 20 field samples. Rinsate blanks will be submitted at a frequency of one per 20 samples in the event that non-dedicated sampling equipment is used. Trip blanks will be submitted with each cooler containing aqueous samples for volatile organic compound (VOC) analyses.

The sampling and analysis program summarized in Table 4.1 lists the specific parameters to be measured, the number of samples to be collected and the level of QA effort required for each matrix.

Groundwaters, soil and sediment will be analyzed for VOCs, semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs) and metals. Sediment samples may also be analyzed for Total Organic Carbon (TOC). Some soil samples may also be analyzed for waste characterization.

Target quantitation limits for compounds to be tested are presented in Tables 4.2 and 4.3. TCLP regulatory limits and analytes to be tested are presented in Table 4.4.

MS and MSD samples will be analyzed as a check on the analytical method's accuracy and precision. Trip blank samples (for VOC determinations only) will be shipped by the laboratory to the Site and back to the laboratory without opening in the field. The trip blank will provide a measure of potential cross-contamination of samples resulting from shipment, handling and/or ambient conditions at the Site. Rinsate blank samples will be collected and analyzed as a check on the efficiency of the sampling device cleansing protocols.

4.2 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSES

The fundamental QA objective with respect to the accuracy, precision and sensitivity of analytical data is to meet the QC acceptance criteria of each analytical protocol. Laboratory analytical parameters and methods are listed in Table 4.1 and target quantitation limits are listed in Tables 4.2 and 4.3.

The method accuracy (percent recovery) for groundwater, soil and sediment samples will be determined by spiking selected samples (matrix spikes) with representative spiking compounds as specified in the analytical methods. Accuracy will be reported as the percent recovery of the spiking compounds and will be compared to the criteria specified in the appropriate methods as identified in Section 8.0.

The precision of the methods (reproducibility between duplicate analyses) will be determined based on the analysis of field duplicate samples and the duplicate analysis of MS samples. Precision will be reported as relative percent differences (RPDs) between duplicate analyses; acceptance criteria will be as specified in the appropriate analytical methods identified in Section 8.0.

4.3 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

A completeness requirement of 90 percent will be targeted for the RD/RA and the GWMP work (see Section 13.1.3 for a definition of completeness).

The quantity of samples to be collected has been determined in an effort to effectively represent the population being studied.

Analytical methods selected for this study are consistent with those used for previous studies (if applicable) to assure comparability of the data. All standards used by the laboratory will be traceable to reliable sources and will be checked with an independent standard.

5.0 SAMPLING PROCEDURES

All monitoring and sampling activities will be performed in accordance with the FSP and the Groundwater Monitoring Plan.

Sampling equipment will be decontaminated as specified in the FSP. Required sample containers, sample preservation methods, maximum holding times, and filling instructions are summarized in Table 5.1. Sample containers will be purchased from a USEPA-certified manufacturer and will be precleaned (I-Chem Series 200 or equivalent).

6.0 SAMPLE CUSTODY AND DOCUMENT CONTROL

The following documentation procedures will be used during sampling and analysis to provide chain-of-custody control during transfer of samples from collection through storage and analysis. Record keeping documentation will include use of the following:

- Field log books (bound with numbered pages) to document sampling activities in the field
- Labels to identify individual samples
- Chain-of-custody record sheets to document sample IDs and analyses to be performed
- Laboratory sample custody log books
- Evidentiary files

6.1 FIELD LOG BOOK

Log books will be used in the field to record information. The field log book will be bound and the information will be entered in indelible ink. Each field log book page will be signed by the sampler. Field measurements and observations will assist in the interpretation of analytical results obtained and it is important that these measurements and observations be as complete as possible.

For each sample collected, the following will be recorded in indelible ink in the field log book if applicable:

i) Site location identification
ii) Depth interval of sample
iii) Unique sample identification number
iv) Date and time (in 24:00-hour time format) of sample collection
v) Weather conditions
vi) Designation as to the type of sample (groundwater, soil, sediment, etc.)
vii) Designation as to the means of collection (split spoon, etc.)
viii) Brief description of the sample
ix) Name of sampler
x) Analyses to be performed on sample

xi) Departure from established QA/QC field procedures

xii) Instrument problems

xiii) Other relevant comments such as odor, staining, texture, size of area sampled, etc.

6.2 SAMPLE LABELS

Sample labels are necessary to identify and prevent misidentification of the samples. The labels will be affixed to the sample container (not the caps) prior to the time of sampling. The labels will be filled out in waterproof ink at the time of collection. The labels will include the following information:

i) Sample number/identification code

ii) Name of collector

iii) Date and time of collection

iv) client and geographic location

v) Project number

vi) Required analysis

vii) Type of preservation

A unique sample numbering system will be used to identify each collected sample. This system will provide a tracking number to allow retrieval and cross-referencing of sample information. The sample numbering system to be used is described as follows:

Example:	GW-80987-110513 - AA-XXX	
where:	GW - Designates sample type	
	(GW - Groundwater, SE - Sediment, S - Soil)	
80987	-	ID number unique to the project site
110513	-	date of collection (mm,dd,yy)
AA	-	sampler initials
xxx	-	unique sample number

QC samples will also be numbered with a unique sample number.

Sample container labels will include sample number, place of collection, and date and time of collection.

6.3 FIELD INSTRUMENT CALIBRATION AND USE LOGS

Standardized instrument calibration logs for each field instrument will be maintained during sampling activities to demonstrate properly functioning equipment. Included in the log should be documentation of time of instrument use, operator, and any maintenance performed.

6.4 CHAIN-OF-CUSTODY RECORDS

Chain-of-custody forms will be completed for samples collected during the program. chain-of-custody forms will be completed to document the transfer of sample containers.

The chain-of-custody record, completed at the time of sampling, will contain, but not be limited to, the sample number, date, and time of sampling, and the name of the sampler. The chain-of-custody document will be signed, timed, and dated by the sampler when transferring the samples.

The chain-of-custody form will consist of four copies which will be distributed to the shipper, the receiving laboratory, and two copies to CRA. The shipper will keep one copy while the other three copies will be enclosed in a waterproof envelope within the cooler with the samples. The laboratory, upon receiving the samples, will complete the three remaining copies. The laboratory will maintain one copy for their records; one copy will be returned to CRA upon receipt of the samples by the laboratory; one copy will be submitted to CRA with the data deliverables package.

6.5 SAMPLE SHIPMENT

All samples will be refrigerated using wet ice at <6°C. Custody seals will be placed around each cooler and the coolers will then be sealed with packing tape for shipment to the analytical laboratory within 24 to 48 hours of collection by either commercial courier or Subcontractor personnel.

6.6 LABORATORY SAMPLE CUSTODY LOG BOOKS

Upon receipt of the sample coolers at the laboratory, each sample cooler and the custody seal will be inspected by the designated sample custodian. The condition of the cooler and the custody seal will be noted on the chain-of-custody record sheet by the sample custodian.

The sample custodian will record the temperature of one sample (or temperature blank) from each cooler and the temperature will be noted on the chain-of-custody. If the shipping cooler seal is intact, the sample containers will be accepted for analyses. The sample custodian will document the date and time of receipt of the container, and sign the form.

If damage or discrepancies are noticed (including sample temperature exceedances), they will be recorded in the remarks column of the record sheet, dated and signed. Any damage or discrepancies will be reported to the lab supervisor who will inform the lab manager and QA Officer before samples are processed.

6.7 EVIDENTIARY FILES

The laboratory will be responsible for maintaining analytical log books and laboratory data as well as a sample (on hand) inventory for submittal to CRA on an as-required basis. Raw laboratory data produced from the analysis of samples submitted for this program will be inventoried and maintained by the laboratory for a period of 5 years at which time CRA will advise the laboratory regarding the need for additional storage.

Evidentiary files for the entire project will be inventoried and maintained by CRA and will consist of the following:

i) Project-related plans
ii) Project log books
iii) Field data records
iv) Sample identification documents
v) Chain-of-custody records
vi) Report notes, calculations, etc.
vii) Laboratory data, etc.
viii) References, copies of pertinent literature

ix) Miscellaneous - photos, maps, drawings, etc.

x) Copies of final reports pertaining to the project

The evidentiary file materials will be the responsibility of CRA's Project Manager with respect to maintenance and document removal.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

7.1 INSTRUMENT CALIBRATION AND TUNING

Calibration of instrumentation is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet established reporting limits. Each instrument is calibrated with standard solutions appropriate to the type of instrument and the linear range established for the analytical method. The frequency of calibration and the concentration of calibration standards is determined by the manufacturers' guidelines, the analytical method, or the requirements of special contracts.

A bound notebook will be kept with each instrument requiring calibration in which will be recorded activities associated with QA monitoring and repairs programs. These records will be checked during periodic equipment review and internal and external QA/QC audits.

7.1.1 GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

It is necessary to establish that a given GC/MS meets the standard mass spectral abundance criteria prior to initiating any ongoing sample analyses and data collection. This is accomplished through the analyses of tuning compounds as specified in the analytical methods.

Calibration of the GC/MS system will be performed daily at the beginning of the day or with each 12 hours of instrument operating time when more than 12 hours of instrument operating time is needed in 1 day.

All method-specified calibration criteria will be met prior to sample analyses. All calibrations will be performed using either average response factors or first-order linear regression (with a correlation coefficient requirement of 0.995). Higher order fits will not be allowed unless the laboratory can demonstrate that the instrument is working properly, and that the instrument response over the concentration range of interest is second-order.

Quantification of samples that are analyzed by GC/MS will be performed by internal standard calibration. For quantitation, the nearest internal standard **free of interferences** will be used.

7.1.2 GAS CHROMATOGRAPHY (GC)

Quantification for samples that are analyzed by GC with element selective detectors will be performed by external standard calibration. Standards containing the compounds of interest will be analyzed at a minimum of three concentrations to establish the linear range of the detector. Single point calibration will be performed at the beginning of each day and at every tenth injection. The response factors from the single point calibration will be checked against the average response factors from multi-level calibration. If deviations in response factors are greater than those allowed by the analytical method protocols, then system recalibration will be performed. Alternatively, fresh calibration standards will be prepared and analyzed to verify instrument calibration.

All method-specified calibration criteria will be met prior to sample analyses. All calibrations will be performed using either average response factors or first-order linear regression (with a correlation coefficient requirement of 0.995). Higher order fits will not be allowed unless the laboratory can demonstrate that the instrument is working properly, and that the instrument response over the concentration range of interest is second-order.

7.1.3 INSTRUMENTATION FOR INORGANIC ANALYSES

All method-specified calibration procedures will be performed and acceptance criteria will be met prior to sample analyses. Standard curves derived from data consisting of one reagent blank and a minimum of three concentrations [one reagent blank and one concentration for ion coupled plasma (ICP)] will be prepared for each inorganic analyte. Calibrations will be performed using either average response factors, or first-order linear regression (with a correlation coefficient requirement of 0.995).

The standard curve will be used with each subsequent analysis provided the standard curve is verified by using at least one reagent blank and one standard at a level normally encountered or expected in such samples. If the results of the verification are not within ±10 percent of the original curve, a new standard will be prepared and analyzed. If the results of the second verification are not within ±10 percent of the original standard curve, the analysis will be stopped, and the analyst will reject any data obtained after the last acceptable verification standard. A reference standard will be used to determine if the discrepancy is with the standard or with the instrument. Once the cause is identified, a new calibration curve will be performed before sample analyses can continue.

New standards will also be prepared on a quarterly basis at a minimum. All data used in drawing or describing the curve will be so indicated on the curve or its description. A record will be made of the verification.

7.1.4 FIELD INSTRUMENTATION

Field equipment used during the RD/RA or groundwater monitoring program will be calibrated both prior to and following the day's utilization in accordance with the manufacturer's instructions. The equipment will also be operated in accordance with the manufacturer's instructions. Records of calibrations of field equipment will be recorded in a bound field notebook.

8.0 ANALYTICAL PROCEDURES

8.1 ANALYTICAL METHODS

All groundwater, soil and sediment samples will be analyzed for the parameters listed in Tables 4.2,4.3 and 4.4 using the methods cited in Table 4.1. These methods have been selected to meet the DQOs for each sampling activity.

Data deliverables for this program will be as specified in Section 9.2.

8.2 COMPOUND IDENTIFICATION

Compounds which will be analyzed by GC/MS will be identified by comparison of the sample mass spectrum with the mass spectrum of a standard of the suspected compound (standard reference spectrum). Mass spectra for standard references should be obtained on the user's GC/MS within the same 12 hours as the sample analysis. These standard reference spectra may be obtained through analysis of the calibration standards. The following criteria will be satisfied to verify identification:

i) Elution of the sample component at the same GC relative retention time (RRT) as the standard component

ii) Correspondence of the sample component and the standard component mass spectrum

For GC determinations of specific analytes, the RRT of the unknown will be compared with that of an authentic standard. Since a true identification by GC is not possible, an analytical run for compound confirmation will be followed according to the specifications in the methods. Peaks will elute within daily retention time windows established for each indicator parameter to be declared a tentative or confirmed identification. Retention time windows are determined using standard protocols defined in each method.

8.3 QUANTITATION

The procedures for quantitation of analytes are discussed in the appropriate analytical methods. Sample results are calculated using either an external standard or an internal standard technique. External standard techniques directly compare the response from the sample to the response of the target analyte in the calibration standards. Internal standard technique utilizes the addition of a compound that resembles the target compound but is not commonly found in nature. This compound is added to all standards, samples, and QC samples. Quantitation is based on the ratio of the target compound in the sample to the response of the internal standard in the sample compared to a similar ratio derived for each calibration standard.

8.4 QUANTITATION LIMIT REQUIREMENTS

Targeted quantitation limits will be consistent with those presented in Tables 4.2 and 4.3. When matrix interferences are noted during sample analysis, actions will be taken by the laboratory to achieve the specified quantitation limits. Samples will not be diluted by more than a factor of five to reduce matrix effects. The laboratory will re-extract and/or use any of the cleanup techniques presented in the analytical methods to eliminate matrix interferences.

Samples may be diluted to a greater extent if the concentrations of analytes of concern exceed the calibration range of the instrument. In such cases, the laboratory QA/QC Officer will assure that the laboratory demonstrates good analytical practices and that such practices are documented in order to achieve the specified quantitation limits.

Soil and sediment results will be reported based on dry weight. The dry weight conversion will raise the targeted quantitation limit.

9.0 DATA REDUCTION, VALIDATION, ASSESSMENT, AND REPORTING

9.1 GENERAL

The contract laboratory will perform analytical data reduction and validation in-house under the direction of the laboratory QA Officer. The laboratory's QA Officer will be responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other qualifications based on the QC criteria outlined in the analytical methods, which would caution the data user of possible unreliability. Data reduction, validation, and reporting by the laboratory will be conducted as detailed in the following:

- Raw data produced and checked by the responsible analysts is turned over for independent review by another analyst
- The area supervisor reviews the data for attainment of quality control criteria presented in the referenced analytical methods
- Upon completion of reviews and acceptance of the raw data by the laboratory operations manager, a computerized report will be generated and sent to the laboratory QA Officer
- The laboratory QA Officer will complete a thorough inspection of reports
- The laboratory QA officer and area supervisor will decide whether any sample reanalysis is required
- Upon acceptance of the preliminary reports by the laboratory QA officer, final reports will be generated and signed by the laboratory Project Manager

Validation of the analytical data pertaining to the monitoring wells will be performed by CRA's QA/QC Officer for analytical activities. The data validation will be performed utilizing guidance contained in the following documents: "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", EPA 540/R-08-01, June 2008 and "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review", EPA 540/R-10-011, January 2010. Data analyzed using methods not covered in these documents will be validated using the general principles used in these documents, and the analytical requirements specified in the methods.

Assessment of analytical and in-house data will include checks on data consistency by looking for comparability of duplicate analyses, comparability to previous data from the same sampling location (if available), adherence to accuracy and precision control criteria detailed in this QAPP and anomalously high or low parameter values. Verification of 100 percent of QC sample results (both qualitative and quantitative) will be performed. Verification of the identification of 100 percent of sample results (both positive hits and non-detects) will be performed and 10 percent of investigative sample results will be recalculated.

A Data Usability Summary Report (DUSR) will be prepared and will present the results of the data validation, including a summary assessment of laboratory data packages, sample preservation and chain-of-custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. The DUSR will be submitted to CRA's Project Manager.

Data from field measurements and sample collection activities that are used in project reports will be appropriately identified and appended to the report. Where data have been reduced or summarized, the method of reduction will be documented in the report. Field data will be audited for anomalously high or low values that may appear to be inconsistent with other data.

The qualifications of CRA's QA/QC Officer are presented in Attachment A.

9.2 LABORATORY REPORTING

Reporting and deliverables will be in accordance with NYSDEC Analytical Services Protocol (ASP) Category B. The minimum deliverables required by the laboratory are summarized in Table 9.1. Reporting and deliverables for waste characterization samples (Toxicity Characteristic Leaching Procedure [TCLP] and Resource Conservation and Recovery Act [RCRA] analyses) shall include, but not be limited to, all items listed in Table 9.2. The laboratory will also include an electronic data deliverable in EQuis 4-file format.

All sample data and corresponding QA/QC data as specified in the analytical methods will be maintained accessible to CRA either in hard copy or on magnetic tape or disk.

10.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

10.1 QC FOR FIELD MEASUREMENTS

Quality control procedures for field measurements will be limited to a check of the reproducibility of the measurement in the field by obtaining multiple readings and by calibrating the instrument (where appropriate).

10.2 QC FOR LABORATORY ANALYSES

Specific procedures related to internal laboratory QC samples are described in the following subsections.

10.2.1 REAGENT BLANKS

A reagent blank will be analyzed by the laboratory at a frequency of one blank per analytical batch. The reagent blank, an aliquot of analyte-free water or solvent, will be carried through the entire analytical procedure.

10.2.2 MS/MSD ANALYSES

An MS/MSD sample will be analyzed for all methods at the frequency specified in Table 4.1. Acceptable criteria and analytes that will be used for matrix spikes are identified in the analytical methods. Percent spike recoveries will be used to evaluate analytical accuracy while percent relative standard deviation or the relative percent difference (RPD) between duplicate analyses will be used to assess analytical precision.

10.2.3 SURROGATE ANALYSES

Surrogates are organic compounds which are similar to the analytes of interest, but which are not normally found in environmental samples. Surrogates are added to samples to monitor the effect of the matrix on the accuracy of the analysis. Every blank, standard and environmental sample analyzed by GC or GC/MS, including MS/MSD samples, will be spiked with surrogate compounds prior to sample preparation.

The compounds that will be used as surrogates and the levels of recommended spiking are specified in the methods. Surrogate spike recoveries will fall within the control limits specified in the analytical methods. If surrogate recoveries are excessively low (<10 percent), the laboratory will contact CRA's QA/QC Officer for further instructions.

Dilution of samples to bring the analyte concentration into the linear range of calibration may dilute the surrogates out of the quantitation limit. Reanalysis of these samples is not required. Assessment of analytical quality in these cases will be based on the MS/MSD sample analysis results.

10.2.4 LCS SAMPLES

LCS samples (also known as QC Check Samples) will be analyzed to determine the accuracy of the analytical methods. LCS samples generally are prepared from standards that are from a different source than the calibration standards or are standard reference materials. The percent recoveries will be calculated and compared to the acceptance criteria. In most cases, sample analyses cannot proceed if the LCS acceptance criteria is not achieved. Corrective actions for outlying LCS data will be consistent with those specified in the methods.

10.3 QC FOR SAMPLING PROTOCOL

To assess the quality of data resulting from the field sampling program, field duplicate and field blank samples will be collected (where appropriate) and submitted to the analytical laboratory as samples.

10.3.1 FIELD DUPLICATE SAMPLES

Field duplicate samples will be collected at the frequency of one per 20 samples. These samples will be submitted "blind" to the laboratory for analysis, the results will be compared, and RPD values will be assessed against control limits of 50 percent for water samples and 100 percent for soil samples.

10.3.2 FIELD BLANK SAMPLES

Trip blanks for VOCs will be prepared by the laboratory using analyte-free water and submitted with the sample collection containers. The trip blanks will be kept unopened in the field with sample bottles. One trip blank will be transported to the laboratory with each cooler of aqueous VOC samples. The laboratory will analyze trip blanks as samples.

Rinsate blanks will be used to assess decontamination procedures of collection equipment used for multiple samples. The rinse blank will be prepared using analyte-free deionized water when non-dedicated equipment is used in the field. The rinse blanks will be analyzed by the laboratory as samples. Rinse blanks will be prepared at the frequency of one per 20 samples in the event that non-dedicated sampling equipment is used.

11.0 PERFORMANCE AND SYSTEM AUDITS AND FREQUENCY

11.1 LABORATORY

For the purpose of external evaluation, performance evaluation check samples are analyzed periodically by the laboratory. Internally, the evaluation of data from these samples is done on a continuing basis over the duration of a given project.

CRA's QA/QC Officer may carry out performance and/or systems audits to insure that data of known and defensible quality are consistently produced during this program.

Systems audits are qualitative evaluations of all components of field and laboratory quality control measurement systems. They determine if the measurement systems are being used appropriately. The audits may be carried out before systems are operational, during the program, or after completion of the program. Such audits typically involve a comparison of the activities given in the laboratory's QA/QC plan described herein, with activities actually scheduled or performed. A special type of systems audit is the data management audit. This audit addresses only data collection and management activities.

The performance audit is a quantitative evaluation of the measurement systems used for a monitoring program. It requires testing the measurement systems with samples of known composition or behavior to quantitatively evaluate precision and accuracy. A performance audit may be carried out by or under the auspices of the laboratory's QA/QC Officer without the knowledge of the analyst during each sampling event for this program.

It should be noted, however, that any additional external QA audits will only be performed if deemed necessary.

11.2 FIELD

Audits of field techniques will be conducted by CRA's Field QA/QC Officer. These audits will include review of the sample collection and instrument calibration logbooks and chain-of-custody documents. Field inspections will also be performed to review: sample collection and handling techniques; on-Site supplies of sampling equipment and standards availability of relevant project documents.

12.0 PREVENTIVE MAINTENANCE

Analytical instruments to be used in this project will be serviced by laboratory personnel at regularly scheduled intervals in accordance with the manufacturers' recommendations. Instruments may also be serviced at other times due to failure. Requisite servicing beyond the abilities of laboratory personnel will be performed by the equipment manufacturer or their designated representative.

Daily checks of each instrument will be performed by the analyst who has been assigned responsibility for that instrument. Manufacturers' recommended procedures will be followed in every case.

Maintenance procedures and schedules and instrument logbooks will be documented in bound notebooks and made available to CRA's project QA/QC Officer upon request.

13.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

13.1 QA MEASUREMENT QUALITY INDICATORS

13.1.1 PRECISION

Precision will be assessed by comparing the analytical results between duplicate spike or duplicate sample analyses. Precision as RPD will be calculated as follows for values significantly greater than the associated detection limit:

Matrix Spike/Matrix Spike Duplicate

$$\text{Precision} = \frac{\{D_2 - D_1\}}{\{D_1 + D_2/2\}} \times 100$$

D_1 = matrix spike recovery
D_2 = matrix spike duplicate recovery

Sample Duplicates

$$\text{Precision} = \frac{\{D_2 - D_1\}}{\{D_1 + D_2/2\}} \times 100$$

D_1 = original sample result
D_2 = duplicate sample result

For results near the associated detection limits, precision will be assessed based on the following criteria:

Precision = original result - duplicate result <Contract Required Detection Limits (CRDL)

13.1.2 ACCURACY

Accuracy will be assessed by comparing a set of analytical results to the accepted or "true" values that would be expected. In general, MS/MSD and check sample recoveries will be used to assess accuracy. Accuracy as percent recovery will be calculated as follows:

$$\text{Accuracy} = \frac{A-B}{C} \times 100$$

A	=	The analyte determined experimentally from the spike sample
B	=	The background level determined by a separate analysis of the unspiked sample
C	=	The amount of spike added

13.1.3 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under normal conditions.

To be considered complete, the data set will contain QC check analyses verifying precision and accuracy for the analytical protocol. In addition, data are reviewed in terms of stated goals in order to determine if the database is sufficient.

When possible, the percent completeness for each set of samples will be calculated as follows:

$$\text{Completeness} = \frac{\text{valid data obtained}}{\text{total data planned}} \times 100 \text{ percent}$$

13.1.4 EXCEEDANCES

Procedures discussed previously will be followed for documenting deviations. In the event that a result deviates significantly from method established control limits, this deviation will be noted and its effect on the quality of the remaining data assessed and documented.

14.0 CORRECTIVE ACTION

The need for corrective action may be identified by system or performance audits or by standard QC procedures. The essential steps in the corrective action system will be:

- Checking the predetermined limits for data acceptability beyond which corrective action is required
- Identifying and defining problems
- Assigning responsibility for investigating the problem
- Investigating and determining the cause of the problem
- Determination of a corrective action to eliminate the problem (this may include reanalysis or resampling and analyses)
- Assigning and accepting responsibility for implementing the corrective action
- Implementing the corrective action and evaluating the effectiveness
- Verifying that the corrective action has eliminated the problem
- Documenting the corrective action taken

For each measurement system, the laboratory QA Officer will be responsible for initiating the corrective action and the laboratory supervisor will be responsible for implementing the corrective action.

15.0 QUALITY ASSURANCE REPORT TO MANAGEMENT

The CRA QA/QC Officer will receive reports on the performance of the measurement system and the data quality following each sampling round and at the conclusion of the project.

Minimally, these reports will include:

- Assessment of measurement quality indicator (i.e., data accuracy, precision, and completeness);
- Results of system audits
- QA problems and recommended solutions.

CRA's QA/QC Officer will be responsible within the organizational structure for preparing these periodic reports. The final report for the project will also include a separate QA section which will summarize data quality information contained in the periodic QA/QC reports to management, and present an overall data assessment and validation in accordance with the data quality objectives outlined in this QAPP.

16.0 REFERENCES

"Preparation Aids for the Development of Quality Assurance Project Plans", United States Environmental Protection Agency, Office of Research and Development, EPA/600/8-91/005, February 1991.

"RCRA Quality Assurance Project Plan Guidance", NYSDEC, August 1989.

"USEPA Region II CERCLA Quality Assurance Manual", Revision 1, October 1989.

"Test Methods for Evaluating Solid Waste" USEPA Office of Solid Waste, SW846 Third Edition, November 1986 (with revisions).

"DER-10 Technical Guidance for Site Investigation and Remediation", New York State Department of Environmental Conservation, May 2010.

TABLE 4.1

SAMPLING AND ANALYSIS SUMMARY
REMEDIAL DESIGN/REMEDIAL ACTION
FRIEDRICHSOHN COOPERAGE SITE
TOWN OF WATERFORD, NEW YORK

Sample Matrix	*Analytical Parameters*	*Analytical Method*[1]	*Investigative Samples*	*Field Duplicates*	*Rinsate Blanks*	*Trip Blanks*	*MS/MSD*
Groundwater	TCL Volatiles plus TICs	SW-846 8260	TBD	1/20	1/20	1/Cooler	1/20
	TCL Semi-Volatiles plus TICs	SW-846 8270	TBD	1/20	1/20	-	1/20
	PCBs	SW-846 8082	TBD	1/20	1/20	-	1/20
	TAL Metals	SW-846 6010/7470	TBD	1/20	1/20	-	1/20
Soil	TCL Volatiles plus TICs	SW-846 8260	TBD	1/20	1/20	-	1/20
	TCL Semi-Volatiles plus TICs	SW-846 8270	TBD	1/20	1/20	-	1/20
	PCBs	SW-846 8082	TBD	1/20	1/20	-	1/20
	TAL Metals	SW-846 6010/7471	TBD	1/20	1/20	-	1/20
	TCLP Volatiles	SW-846 1311/8260	TBD	1/20	1/20	-	1/20
	TCLP Semi-Volatiles	SW-846 1311/8270	TBD	1/20	1/20	-	1/20
	TCLP Metals	SW-846 1311/6010/7471	TBD	1/20	1/20	-	1/20
	Ignitability	SW-846 1010	TBD	1/20	1/20	-	1/20
	Cyanide, Reactive (as Total)	SW-846 9014	TBD	1/20	1/20	-	1/20
	Corrosivity by pH (S. U.)	SW-846 9045	TBD	1/20	1/20	-	1/20
	Sulfide, Reactive (as Total)	SW-846 9030	TBD	1/20	1/20	-	1/20
Sediment	TCL Volatiles plus TICs	SW-846 8260	TBD	1/20	1/20	-	1/20
	TCL Semi-Volatiles plus TICs	SW-846 8270	TBD	1/20	1/20	-	1/20
	PCBs	SW-846 8082	TBD	1/20	1/20	-	1/20
	TAL Metals	SW-846 6010/7471	TBD	1/20	1/20	-	1/20
	TOC	Lloyd Kahn	TBD	1/20	1/20	-	1/20

Notes:

(1) Methods referenced from "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods", SW-846, Third Edition, 1986 (Revised 9/94). Analysis of Water and Wastes", EPA-600/4-79-020, March 1983; for chloride, sulfate, nitrate-nitrite
MS Matrix Spike.
MSD Matrix Spike Duplicate.
PCBs Polychlorinated Biphenyls.
TAL Target Analyte List.
TCL Target Compound List.
TICs Tentatively Identified Compounds.
\- Not applicable.
TCLP Toxicity Characterization Leaching Procedure.

TABLE 4.2

ORGANIC COMPOUND LIST AND
PRACTICAL QUANTITATION LIMIT (PQL)
REMEDIAL DESIGN/REMEDIAL ACTION
FRIEDRICHSOHN COOPERAGE SITE
TOWN OF WATERFORD, NEW YORK

		Quantitation Limits	
	CAS Number	*Water (µg/L)*	*Soil/Sediment (µg/Kg)*
TCL Volatiles			
1,1,2,2-Tetrachloroethane	79-34-5	10	10
1,1,2-Trichloroethane	79-00-5	10	10
1,1-Dichloroethane	75-34-3	10	10
1,1-Dichloroethylene	75-35-4	10	10
1,2-Dibromo-3-chloropropane	96-12-8	10	10
1,2-Dibromoethane	106-93-4	10	10
1,2-Dichloroethane	107-06-2	10	10
1,2-Dichloropropane	78-87-5	10	10
Bromodichloromethane	75-27-4	10	10
Bromoform	75-25-2	10	10
Carbon tetrachloride	56-23-5	10	10
Chlorobenzene	108-90-7	10	10
Chloroethane	75-00-3	10	10
Chloroform	67-66-3	10	10
cis-1,3-Dichloropropene	10061-01-5	10	10
Dibromochloromethane	124-48-1	10	10
Dichlorodifluoromethane	75-71-8	10	10
m-Dichlorobenzene	541-73-1	10	10
Bromomethane	74-83-9	10	10
Chloromethane	74-87-3	10	10
Methylene chloride	75-09-2	10	10
o-Dichlorobenzene	95-50-1	10	10
p-Dichlorobenzene	106-46-7	10	10
Tetrachloroethylene	127-18-4	10	10
trans-1,2-Dichloroethylene	156-60-5	10	10
trans-1,3-Dichloropropene	10061-02-6	10	10
Trichloroethylene	79-01-6	10	10
Trichlorofluoromethane	75-69-4	10	10
Vinyl chloride	75-01-4	10	10
4-Methyl-2-pentanone	108-10-1	10	10
2-Butanone	78-93-3	10	10
Benzene	71-43-2	10	10
Ethylbenzene	100-41-4	10	10
Styrene	100-42-5	10	10
Toluene	108-88-3	10	10
Xylene(total)	1330-20-7	10	10
1,1,1-Trichloroethane	71-55-6	10	10
2-Hexanone	591-78-6	10	10
Acetone	67-64-1	10	10
Carbon disulfide	75-15-0	10	10
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	10	10
Methyl Acetate	79-20-9	10	10
Methyl tert-Butyl Ether	1634-04-4	10	10
cis-1,2-Dichloroethene	156-59-2	10	10
Cyclohexane	110-82-7	10	10
Methylcyclohexane	108-87-2	10	10
Isopropylbenzene	98-82-8	10	10
1,2,4-Trichlorobenzene	120-82-1	10	10
TCL Semi-Volatiles			
2,4,6-Trichlorophenol	88-06-2	10	330
2,4-Dichlorophenol	120-83-2	10	330
2,4-Dimethylphenol	105-67-9	10	330
2,4-Dinitrophenol	51-28-5	25	830
2-Chlorophenol	95-57-8	10	330
4,6-Dinitro-o-cresol	534-52-1	25	830
o-Nitrophenol	88-75-5	10	330

TABLE 4.2

ORGANIC COMPOUND LIST AND
PRACTICAL QUANTITATION LIMIT (PQL)
REMEDIAL DESIGN/REMEDIAL ACTION
FRIEDRICHSOHN COOPERAGE SITE
TOWN OF WATERFORD, NEW YORK

	CAS Number	*Quantitation Limits*	
		Water (µg/L)	*Soil/Sediment (µg/Kg)*
p-Chloro-m-cresol	59-50-7	10	330
Pentachlorophenol	87-86-5	25	830
Phenol	108-95-2	10	330
p-Nitrophenol	100-02-7	25	830
Bis(2-ethylhexyl) phthalate	117-81-7	10	330
Butyl benzyl phthalate	85-68-7	10	330
Diethyl phthalate	84-66-2	10	330
Dimethyl phthalate	131-11-3	10	330
Di-n-butyl phthalate	84-74-2	10	330
Di-n-octyl phthalate	117-84-0	10	330
2,4-Dinitrotoluene	121-14-2	10	330
2,6-Dinitrotoluene	606-20-2	10	330
Isophorone	78-59-1	10	330
Nitrobenzene	98-95-3	10	330
Acenaphthene	83-32-9	10	330
Acenaphthylene	208-96-8	10	330
Anthracene	120-12-7	10	330
Benzo[a]anthracene	56-55-3	10	330
Benzo[a]pyrene	50-32-8	10	330
Benzo[b]fluoranthene	205-99-2	10	330
Benzo[ghi]perylene	191-24-2	10	330
Benzo[k]fluoranthene	207-08-9	10	330
Chrysene	218-01-9	10	330
Dibenz[a,h]anthracene	53-70-3	10	330
Fluoranthene	206-44-0	10	330
Fluorene	86-73-7	10	330
Indeno(1,2,3 cd)pyrene	193-39-5	10	330
Naphthalene	91-20-3	10	330
Phenanthrene	85-01-8	10	330
Pyrene	129-00-0	10	330
2-Chloronaphthalene	91-58-7	10	330
Hexachlorobenzene	118-74-1	10	330
Hexachlorobutadiene	87-68-3	10	330
Hexachlorocyclopentadiene	77-47-4	10	330
Hexachloroethane	67-72-1	10	330
2,4,5-Trichlorophenol	95-95-4	25	830
2-Methylnaphthalene	91-57-6	10	330
3,3'-Dichlorobenzidine	91-94-1	10	330
4-Chlorophenyl phenyl ether	7005-72-3	10	330
Bis(2-chloroethoxy)methane	111-91-1	10	330
Bis(2-chloroethyl)ether	111-44-4	10	330
Dibenzofuran	132-64-9	10	330
m-Nitroaniline	99-09-2	25	830
N-Nitrosodiphenylamine	86-30-6	10	330
N-Nitrosodipropylamine	621-64-7 1	10	330
o-Cresol	95-48-7	10	330
o-Nitroaniline	88-74-4	25	830
p-Chloroaniline	106-47-8	10	330
p-Cresol	106-44-5	10	330
p-Nitroaniline	100-01-6	25	830
Benzaldehyde	100-52-7	10	330
2,2'-oxybis(1-Chloropropane)	108-60-1	10	330
Acetophenone	98-86-2	10	330
Caprolactam	105-60-2	10	330
1,1'-Biphenyl	92-52-4	10	330
4-Bromophenyl-phenylether	101-55-3	10	330
Atrazine	1912-24-9	10	330
Carbazole	86-74-8	10	330

TABLE 4.2

ORGANIC COMPOUND LIST AND
PRACTICAL QUANTITATION LIMIT (PQL)
REMEDIAL DESIGN/REMEDIAL ACTION
FRIEDRICHSOHN COOPERAGE SITE
TOWN OF WATERFORD, NEW YORK

	CAS Number	Quantitation Limits Water (µg/L)	Soil/Sediment (µg/Kg)
PCBs			
Aroclor-1016	12674-11-2	1.0	33
Aroclor-1221	11104-28-2	1.0	67
Aroclor-1232	11141-16-5	1.0	33
Aroclor-1242	53469-21-9	1.0	33
Aroclor-1248	12672-29-6	1.0	33
Aroclor-1254	11097-69-1	1.0	33
Aroclor-1260	11096-82-5	1.0	33
Aroclor-1262	37324-23-5	1.0	33
Aroclor-1268	11100-14-4	1.0	33

Notes:

PCBs - Polychlorinated Biphenyls.
TCL - Target Compound List.

TABLE 4.3

INORGANIC COMPOUND LIST AND
PRACTICAL QUANTITATION LIMIT (PQL)
REMEDIAL DESIGN/REMEDIAL ACTION
FRIEDRICHSOHN COOPERAGE SITE
TOWN OF WATERFORD, NEW YORK

Parameters	*CAS Number*	*Quantitation Limits* *Water (µg/L)*	*Soil/Sediment (µg/Kg)*
TAL Metals			
Aluminum	7429-90-5	200	20
Antimony	7440-36-0	60	6.0
Arsenic	7440-38-2	10	1.0
Barium	7440-39-3	200	20
Beryllium	7440-41-7	5.0	0.5
Cadmium	7440-43-9	5.0	0.5
Calcium	7440-70-2	5000	500
Chromium	7440-47-3	10	1.0
Cobalt	7440-48-4	50	5.0
Copper	7440-50-8	25	2.5
Iron	7439-89-6	100	10
Lead	7439-92-1	5.0*	0.5
Magnesium	7439-95-4	5000	500
Manganese	7439-96-5	15	1.5
Mercury	7439-97-6	0.2	0.1
Nickel	7440-02-0	40	4.0
Potassium	7440-09-7	5000	500
Selenium	7782-49-2	5.0	0.5
Silver	7440-22-4	10	1.0
Sodium	7440-23-5	5000	500
Thallium	7440-28-0	10	1.0
Vanadium	7440-62-2	50	5.0
Zinc	7440-66-6	20	2.0
General Chemistry			
TOC	7440-44-0	-	1.0

Note:

TOC Total Organic Carbon.
TAL Target Analyte List.

TABLE 4.4

WASTE CHARACTERIZATION COMPOUND LIST AND REGULATORY LIMITS
REMEDIAL DESIGN/REMEDIAL ACTION
FRIEDRICHSOHN COOPERAGE SITE
TOWN OF WATERFORD, NEW YORK

Parameters	*Regulatory Limits*
TCLP Volatiles (mg/L)	
Vinyl chloride	0.2
1,1-Dichloroethene	0.7
Chloroform	6.0
1,2-Dichloroethane	0.5
2-Butanone	200
Carbon Tetrachloride	0.5
Trichloroethene	0.5
Benzene	0.5
Tetrachloroethene	0.7
Chlorobenzene	100
TCLP Semi-Volatiles (mg/L)	
Pyridine	5.0
1,4-Dichlorobenzene	7.5
2-Methylphenol	200
3- and/or 4-Methylphenol	200
Hexachloroethane	3.0
Nitrobenzene	2.0
Hexachlorobutadiene	0.5
2,4,6-Trichlorophenol	2.0
2,4,5-Trichlorophenol	400
2,4-Dinitrotoluene	0.13
Hexachlorobenzene	0.13
Pentachlorophenol	100
TCLP Metals (mg/L)	
Silver	5.0
Arsenic	5.0
Barium	100
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Selenium	1.0
RCRA Characteristics	
Ignitability (° F)	<140
Cyanide, Reactive (as Total) (mg/Kg)	250
Corrosivity by pH (S. U.)	2.0-12.5
Sulfide, Reactive (as Total) (mg/Kg)	500
Total Polychlorinated Biphenyls (µg/Kg)	
Aroclor-1016	33
Aroclor-1221	67
Aroclor-1232	33
Aroclor-1242	33
Aroclor-1248	33
Aroclor-1254	33
Aroclor-1260	33
Aroclor-1262	33
Aroclor-1268	33

Note:

TCLP Toxicity Characteristic Leaching Procedures.
RCRA Resource Conservation and Recovery Act.

TABLE 5.1

SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIME PERIODS
REMEDIAL DESIGN/REMEDIAL ACTION
FRIEDRICHSOHN COOPERAGE SITE
TOWN OF WATERFORD, NEW YORK

Matrix	*Analyses*	*Sample Containers* (1)	*Preservation*	*Maximum Holding Time*	*Notes*
Water					
	TCL VOCs	Three 40 mL Teflon lined septum vials	Cool <6°C, HCl to pH<2	14 Days to analyses	Fill completely, no air bubbles
	TCL SVOCs	Two 1 liter amber glass bottles per analysis	Cool <6°C	7 Days to extraction 40 days from extraction to analysis	Fill to neck of bottles
	PCBs	Two 1 liter amber glass bottles per analysis	Cool <6°C	7 Days to extraction 40 days from extraction to analysis	Fill to neck of bottles
	TAL Metals (Except Mercury)	One 1 liter plastic bottle	HNO_3 to pH<2, Cool <6°C	6 Months from collection to analysis	Fill to neck of bottles
	Mercury	One 1 liter plastic bottle	HNO_3 to pH<2, Cool <6°C	28 Days to analysis	Fill to neck of bottles
				-	
Soil/Sediment					
	TCL VOCs	Three terracores (or equivalent)(2) One 2oz jar(3)	Cool <6°C	48 Hours for preservation 14 Days to analyses	Fill per directions
	TCL SVOCs	One 4 oz. glass jar	Cool <6°C	14 Days to extraction 40 days from extraction to analysis	Fill to neck of bottles
	PCBs	One 4 oz. glass jar	Cool <6°C	14 Days to extraction 40 days from extraction to analysis	Fill to neck of bottles
	TAL Metals (Except Mercury)	One 4 oz. glass jar	Cool <6°C	6 Months from collection to analysis	Fill to neck of bottles
	Mercury	One 4 oz. glass jar	Cool <6°C	28 Days to analysis	Fill to neck of bottles
	TOC	One 4 oz. glass jar	Cool <6°C	28 Days to analysis	Fill to neck of bottles
Soil Waste Characterization					
	TCLP VOCS	Three 40 mL Teflon lined septum vials	Cool <6°C	7 days from collection to leaching 7 days from leaching to analysis	Fill completely, no air bubbles
	TCLP SVOCS	1 L Amber	Cool <6°C	5 days from receipt to leaching 7 days from leaching to extraction 40 days from extraction to analysis	Fill to neck of bottles
	TCLP Metals (except Mercury)	1-500 ml HDPE	Cool <6°C	180 days from receipt to leaching 180 days from leaching to analysis	Fill to neck of bottles
	TCLP Mercury	1-500 ml HDPE	Cool <6°C	5 days from receipt to leaching 28 days from leaching to analysis	Fill to neck of bottles
	RCRA Characteristics	2-500ml HDPE	Cool <6°C	Analyze immediately	Fill to neck of bottles

Notes:

(1) Multiple parameters on a single sample with identical preservation requirements may be combined into one single sample container.
(2) Sediment samples may be too wet for Terracores and should be collected as a bulk sample.
(3) For dry weight determination and sediment collection, if necessary.
PCBs Polychlorinated Biphenyls.
TAL Target analyte list.
TCL Target compound list.
SVOC Semi-Volatile Organic Compound.
VOC Volatile Organic Compound.
TCLP Toxicity Characteristic Leaching Procedure.
RCRA Resource Conservation and Recovery Act.

TABLE 9.1

LABORATORY REPORTING DELIVERABLES - FULL
REMEDIAL DESIGN/REMEDIAL ACTION
FRIEDRICHSOHN COOPERAGE SITE
TOWN OF WATERFORD, NEW YORK

A detailed report narrative should accompany each submission, summarizing the contents and results.

A. Chain of Custody Documentation and Detailed Narrative [(1)]

B. Sample Information
- i) date collected
- ii) date extracted or digested
- iii) date analyzed
- iv) analytical method and reference

C. Data (including all raw data and CLP-like summary forms)
- i) samples
- ii) laboratory duplicates [(2)] `
- iii) method blanks
- iv) spikes; spike duplicates [(2) (3)]
- v) surrogate recoveries [(2)]
- vi) internal standard recoveries
- vii) calibration
- viii) any other applicable QC data (e.g., serial dilutions)
- ix) TICs (if applicable)

D. Miscellaneous
- i) method detection limits and/or instrument detection limits
- ii) percent solids (where applicable)
- iii) metals run logs
- iv) standard preparation logs
- v) sample preparation logs

All sample data and its corresponding QA/QC data shall be maintained accessible to CRA either in hard copy or on magnetic tape or disc (computer data files). All solid sample results must be reported on a dry-weight basis.

Notes:

(1) Any quality control (QC) outliers must be addressed and corrective action taken must be specified.
(2) Laboratory must specify applicable control limits for all quality control sample results.
(3) A blank spike must be prepared and analyzed with each sample batch.
TICs Tentatively Identified Compounds.

TABLE 9.2

LABORATORY REPORTING DELIVERABLES - STANDARD
REMEDIAL DESIGN/REMEDIAL ACTION
FRIEDRICHSOHN COOPERAGE SITE
TOWN OF WATERFORD, NEW YORK

A detailed report narrative should accompany each submission, summarizing the contents and results.

A. Chain of Custody Documentation and Detailed Narrative [(1)]

B. Sample Information
1. date collected
2. date extracted or digested
3. date analyzed
4. analytical method and reference

C. Final Results
1. samples
2. laboratory duplicates [(2)]
3. method blanks
4. spikes, spike duplicates [(2)] [(3)]
5. surrogate recoveries [(2)]
6. internal standard recoveries
7. tentatively identified compounds (TICs) (if applicable)

D. Miscellaneous
1. method detection limits and/or instrument detection limits
2. percent solids (where applicable)
3. metals run logs
4. sample preparation logs

All sample data and its corresponding quality assurance/quality control (QA/QC) data shall be maintained accessible to CRA either in hard copy or on magnetic tape or disc (computer data files). All solid sample results must be reported on a dry-weight basis.

Notes:

(1) Any QC outliers must be addressed and corrective action taken must be specified.
(2) Laboratory must specify applicable control limits for all QC sample results.
(3) A blank spike must be prepared and analyzed with each sample batch.

ATTACHMENT A

QA/QC OFFICER QUALIFICATIONS

SUSAN SCROCCHI, B.S.

EDUCATION

B.S. Chemistry, Canisius College, 1983

Other Training

USEPA Region II Training Course for CLP Organic Data Validation,
Westchester Community College, Dr. John Samuelian, March 1997
40-Hour HAZWOPER OSHA Training (per 29 CFR 1910.120), 2000
8-Hour HAZWOPER Refresher OSHA Training (per 29 CFR 1910.120), Annually

EMPLOYMENT HISTORY

2000-Present	Conestoga-Rovers & Associates, Niagara Falls, NY
1996-00	Project Chemist, CRA Services
1983-96	Senior Organic Chemist, Advanced Environmental Services, Inc., Niagara Falls, NY

PROFESSIONAL REGISTRATIONS/AFFILIATIONS

Member, American Chemical Society

PROFILE OF PROFESSIONAL ACTIVITIES

- Stack Testing:
  - set up field gas chromatograph for on-site analyses
  - help develop methods for detection of various compounds in the field
- Innovative Technologies
  - Set up Gas Chromatographs (GCs) for the CRA Treatability Laboratory
  - Developed and conducted GC analyses for treated and untreated samples to monitor the removal of organic compounds
  - Performed training and oversight of organic extractions involving various matrices
- Project Chemist:
  - Oversight and review of analytical testing in support of NPDES projects
  - Assessment and validation of ASP, CLP, and SW-846 analytical data
  - Liaison with analytical laboratories in support of various investigative and remedial projects
  - Preparation of analytical laboratory bidding documents
  - Preparation of analytical Quality Assurance Project Plans (QAPPs)
  - Preparation of site sampling and analysis plans
  - Performance of laboratory audits and assessments

  - Prepared a Laboratory Quality Control Manual for an application for National Environmental Laboratory Accreditation Program (NELAP) approval
  - Training of plant personnel to perform required analytical methods for NELAP approval
- Senior Organic Chemist:
  - Provided administrative support for all department chemists and technicians
  - Provided a quality control check of all analytical data prior to submission
  - Prepared and maintained all analytical Standard Operating Procedures
  - Provided technical support for clients and agency personnel
  - Evaluated and developed new methods as needed
  - Technically proficient in all areas of organic testing, including sample extraction techniques and operation of gas chromatographs (GC) and gas chromatograph/mass spectrometers (GC/MS)
  - Proficient at performing routine maintenance and repairs on GC and GC/MS systems
- Database:
  - Basic training in database using Microsoft Access
  - Able to generate flat files
  - Import data and maintain the Shell database
- ISO Internal Auditor:
  - Internal ISO 9001 Auditor performing quality system checks on filing, document control, and other internal quality system guidelines

APPENDIX D

FIELD SAMPLING PLAN

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LIST OF ATTACHMENTS
(Following Text)

1.0 INTRODUCTION

This Appendix presents the Field Sampling Plan (FSP) for implementation of pre-design field activities associated with the Remedial Design/Remedial Action (RD/RA) Work Plan for Operable Unit (OU)-1 and the upland source soils in OU-3 at the Friedrichsohn Cooperage Site (Site) in the Town of Waterford, New York. This report outlines the field sampling protocols that will be implemented during the following pre-design and remediation activities:

- Installation of geotechnical borings for the collection of soil and bedrock core samples
- Installation of soil borings and the collection of soil samples for chemical analysis
- Installation of groundwater monitoring wells
- Sampling of existing groundwater monitoring wells
- In-situ hydraulic conductivity tests
- Packer-pumping or –injection tests
- Equipment cleaning
- Waste handling

2.0 GENERAL SAMPLING PROTOCOLS

The following general sampling procedures will be conducted for all sampling activities presented in this FSP.

1) Prior to sampling at each location, all sampling instruments and equipment will be cleaned in accordance with the protocols presented in Section 6.0.
2) Disposable gloves will be worn by samplers and changed between sampling points. Additional glove changes will be undertaken as necessary.
3) All sampling generated wastes such as gloves, Tyvek, etc., will be collected and consolidated with the waste material for proper disposal.
4) Samples will be labeled noting the location and/or interval, analysis required, preservative added, date, time and sampler's initials. A hardcover bound field book will be maintained to record all samples and sampling events. Details regarding recordkeeping and labeling are presented in the Quality Assurance Project Plan (QAPP).
5) Sample containers will be packed loosely in laboratory-supplied coolers to allow for placement of cushioning materials (i.e., vermiculite) between bottles to prevent breakage.
6) Following packing of the sample cooler, the completed chain-of-custody (see Section 7.0) will be placed in a watertight plastic bag and attached to the inside of the cooler lid.
7) A signed custody seal will be placed across the cooler closure and the cooler will then be sealed with packing tape. The packing tape will not completely cover the seal.
8) Samples will be handled and shipped in accordance with the protocols described in the QAPP.
9) All samples will be delivered to the laboratory via an overnight courier.
10) At the laboratory, all samples will be stored at 4 degrees Celsius (C) ±2 degrees C.

3.0 SUBSURFACE SAMPLING

As presented in the RD/RA Work Plan, drilling is required for geotechnical boreholes and groundwater monitoring wells. Soil borings are required to provide geotechnical information for the design of the excavation shoring. Additional monitoring wells are also required to assist in evaluating the groundwater quality at the groundwater-surface water interface near the canal. The borehole and monitoring well locations are presented in the RD/RA Work Plan and are summarized below:

1. **Geotechnical Soil Borings**

   Two geotechnical borings will be installed to bedrock at the locations identified on Figure 5.3. The geotechnical borings will be advanced 15 feet into bedrock using an HQ size core barrel.

   A total of six overburden samples (three from above the water table and three saturated samples from below the water table) will be collected and submitted for geotechnical testing. Each geotechnical sample will be analyzed for the parameters:

   - Grain size distribution - hydrometer (ASTM422)
   - Water Content (ASTM D2216)
   - Unit weight determination (ASTM D653)
   - Specific Gravity (ASTM D584)

   Four bedrock samples will be collected from the geotechnical borings and submitted for point load testing and unconfined compression testing.

   The purpose of the geotechnical testing is to generate the necessary data to allow remedial contractors to develop an appropriate shoring plan for the OU-3 source area excavation. The northern extent of the proposed OU-3 source area excavation is approximately 12 feet from the adjacent sidewalk and roadway, and the depth to bedrock is purportedly 16 to 20 feet below grade in this area. As a result, shoring of the OU-3 excavation will be necessary.

2. **Delineation of Greater than 50 mg/kg PCB Material in OU-3 Source Area**

   Thirteen soil borings will be installed in the area surrounding soil borings SB-74 and SB-76 to delineate the presence of PCBs above 50 parts per million (ppm) detected at these locations. The soil boring locations are identified on Figure 5.1 Each soil boring will be advanced to bedrock. A soil sample will be collected consistent with section 5.1 of the RA/RD Work Plan. Each sample will be submitted to the analytical laboratory for PCB analysis. The PCB analyses will provide a vertical profile of the presence of greater than 50 mg/kg PCB material between the current soil boring results and the sediment sample results from the northern bank of the canal.

3. **PCB Characterization Sampling OU-3 Source Area**

Fourteen soil borings will be installed in the area at six locations where no PCB data is available (SB-31, SB-32, SB-33, SB-36, SB-37 and SB-38) as well as between the southernmost soil borings identified on Figure 5.2 and the sediment samples collected to characterize the northern bank of the canal. Each soil boring will be advanced to bedrock. A soil sample will be collected from each 5-foot interval. Each sample will be submitted to the analytical laboratory for PCB analysis. The PCB analyses will provide a vertical profile of the presence of greater than 50 mg/kg PCB material between the current soil boring results and the sediment sample results from the northern bank of the canal.

4. **Monitoring Well Installation/Sampling**

Two overburden groundwater monitoring wells at the locations identified on Figure 5.4 will be installed to evaluate groundwater quality at the groundwater-surface water interface.

Following well installation, each well will be developed using a submersible pump. A sample and duplicate of the well development water will be collected and analyzed for TCLP VOCs, TCLP SVOCs, TCLP metals, and Total PCBs for waste characterization. The well development water sample will be used as an indication of the groundwater quality likely to be encountered during bulk dewatering during the OU-3 excavation activities.

A total of three groundwater samples (one sample from each new well plus one duplicate) will be collected using low-flow groundwater sampling techniques consistent with NYSDEC DER-10. Samples will be analyzed for TAL VOCs, TAL SVOCs, TAL metals, and TAL PCBs. In addition to the newly installed wells, existing overburden monitoring locations MW-10 and PES-1 will be sampled to evaluate the exceedances of VOCs, SVOCs, and PCBs as identified in the Feasibility Study groundwater dataset. One sample will be collected from each of MW-10 and PES-1, and submitted for analysis.

5. **In-situ Hydraulic Conductivity Testing**

In-situ hydraulic conductivity test data for the overburden aquifer and the bedrock aquifer will be collected. The hydraulic conductivity data is necessary for the OU-3 source area as excavation may be conducted below the water table to bedrock in this area. The in-situ hydraulic conductivity testing will allow for an order-of-magnitude estimate to be calculated of the volume of water that will require management during the excavation activities. Following the installation of the overburden monitoring wells discussed above, there will be four monitoring wells installed in the OU-1 and OU-3 excavation area. A slug test will be performed on each of the four monitoring wells. Initial groundwater elevations, drawdown and recharge at all three locations will be recorded with in-Situ Level TROLL 700's (a data logging pressure transducer) equipped with vented cables. The vented cables enable the transducer to cancel the effects of atmospheric pressure changes, eliminating the need to collect background atmospheric pressures.

The bedrock will contribute water to the OU-3 excavation. There is one bedrock monitoring well (MW-09) in the OU-3 source area. Depending on the dimensions of the well and core hole, either a Packer injection test or a Packer pumping test will be conducted to estimate the hydraulic properties of the bedrock.

Borehole drilling procedures are described in Section 3.1, and subsurface soil sampling is described in Section 3.2. Monitoring well installation and sampling is discussed in Section 4.0.

3.1 GEOTECHNICAL BOREHOLE DRILLING PROCEDURES

Geotechnical Soil and Bedrock Borings

Two boreholes will be installed to the indicated depths for soil logging and for the collection of soil samples for physical analysis, as appropriate, using hollow-stem augers with a minimum inside diameter of 4 1/4 inches. Continuous split-spoon sampling will be performed during augering until contacting the bedrock unit. The split-spoon sampler will then be advanced as follows.

The 2-foot split-spoon sampler will be attached to the drill rod and driven into the soil the full depth (24 inches) using a 140-pound hammer free-falling 30 inches. The driving resistance (number of hammer blows) will be recorded for each 6-inch increment of penetration. If the soil is loose, wet, or in any way unconsolidated, clean basket retainers will be used to retain the soil in the split spoon. Between samples, the split spoon will be cleaned as described in Section 6.0.

Each split-spoon sample will be visually examined for chemical presence and logged for geologic stratigraphy. The number and type of geotechnical samples to collect are discussed in Section 3.0. Geotechnical samples for unit weight determination, however, will be collected using a 2-inch diameter 2-foot long Shelby tube (described in Section

3.3.2). All soil samples collected from the split-spoons will be visually described and classified according to the USCS by an experienced field geologist or engineer.

Once the top of the bedrock (weathered or not) unit has been contacted, further drilling will be conducted using HQ core barrel. Rock cores will be placed in partitioned wooden core boxes to keep each core run separate with depths of recovery clearly marked. Colored pictures of all core samples in boxes will be taken. Rock core samples will be selected for geotechnical analyses as discussed in Section 3.0.

Logs and field notes of the Shelby tube samples will be maintained as samples are collected and correlated to the sampling location map. The following information will be included in this log:

1. Location of each boring location
2. Date and time of collection of each core sample
3. Names of field supervisor and person(s) collecting and logging the sample
4. Observations made during sample collection including: weather conditions, complications, and other details associated with the sampling effort
5. Length and depth intervals of the tube section as measured from ground surface
6. Qualitative notation of the apparent resistance of soils to coring

Logs and field notes of the HQ rock core samples will be maintained as samples are collected and correlated to the sampling location map. The following information will be included in this log:

1. Location of each boring location
2. Date and time of collection of each core sample
3. Names of field supervisor and person(s) collecting and logging the sample
4. Observations made during sample collection including: weather conditions, complications, and other details associated with the sampling effort
5. Length and depth intervals of the rock core section as measured from ground surface
6. Percentage recovery
7. Rock Quality Designation (RQD)
8. The amount of water loss/return
9. Presence of voids or cavities in the bedrock

Following completion, geotechnical boreholes will be backfilled with cement/bentonite grout tremied in place from the bottom of the borehole to ground surface using the positive displacement method. The cement/bentonite grout will consist of a mixture of Type 1 Portland cement complying with ASTM C150, with 3 percent by volume of bentonite clay added, and not more than 6 gallons of potable water added per 94 pounds of cement.

The drill rig and all drilling equipment will be cleaned before initiating drilling and after drilling at each borehole location.

3.2 SUBSURFACE SOIL SAMPLE COLLECTION

3.2.1 SPLIT-SPOON SAMPLING

During the continuous split-spoon sampling, photoionization detector (PID) readings will be taken and recorded in the field logbook as each split-spoon is opened (as an indication of volatile organic compounds (VOCs), if any. The continuous cores will also be examined for the visual presence of chemicals.

The samples for physical analyses (grain size, water content, specific gravity) will be collected from the middle of the split-spoon sample core using a decontaminated stainless steel trowel or spoon. The samples will be placed directly into the sample jars.

3.2.2 SHELBY TUBE SAMPLING

Field samples will be collected for bulk density analysis using Shelby tubes. Procedures for conducting thin-walled tube sampling are provided in ASTM D1587, and are briefly described below:

- The soil deposit being sampled must be cohesive in nature, and relatively free of sand, gravel, and cobble materials, as contact with these materials will damage the sampler.
- Clean out the borehole to the sampling elevation using whatever method is preferred that will ensure the material to be sampled is not disturbed. If groundwater is encountered, maintain the liquid level in the borehole at or above groundwater level during the sampling operation.

- Bottom discharge bits are not permitted. Side discharge bits may be used, with caution. Jetting through an open-tube sampler to clean out the borehole to sampling elevation is not permitted. Remove loose material from the center of a casing or hollow-stem auger as carefully as possible to avoid disturbance of the material to be sampled.
- Place the sample tube so that its bottom rests on the bottom of the hole. Advance the sampler into the formation without rotation by a continuous and relatively rapid motion; usually hydraulic pressure is applied to the top of the drill rods.
- Determine the length of advance by the resistance and condition of the formation, but the length shall never exceed 5 to 10 diameters of the tube in sands and 10 to 15 diameters of the tube in clays.
- In no case should the length of advance be greater than the sample-tube length minus an allowance for the sampler head and a minimum of 3 inches for cuttings.
- The tube may be rotated to shear the bottom of the sample 2 to 3 minutes after pressing in, and prior to retrieval to ensure the sample does not slide out of the tube. Lift the weight of the rods off of the tube prior to rotating.
- Withdraw the sampler from the formation as carefully as possible in order to minimize disturbance of the sample.

Remove any sloughed material from the top of the sample using a knife or similar long bladed instrument. If it is not possible to distinguish sloughed soil from intact soil, do not remove. Following removal of sloughed material, measure the tube length and the air space in the tube above the sample and record the difference as the sample recovery. In the unusual circumstance that there is also air space at the bottom of the sample, subtract this as well and record this latter measurement as a separate entry. Seal the top and bottom of the sample with wax. First pour the liquefied wax into the top of the sample to a thickness of about 1 inch. Once this is cooled, remove approximately 1/2 inch of soil from the bottom of sample (unless there is already a cavity at the bottom of sample) and seal similarly. Fill the remaining air space above the sample with loose soil to prevent the sample from shifting in the tube, and then cap both ends of the sample with plastic caps. Tape the caps on using duct tape. Write the sample identification number on the cap using an indelible marker. Shelby tubes containing soft clays and wet silts need to be handled with care to avoid damage to the sample. Keep samples in an upright position at all times and transport either in a specifically designed cushioned box.

4.0 GROUNDWATER MONITORING WELL INSTALLATION AND SAMPLING

4.1 MONITORING WELL CONSTRUCTION

All groundwater overburden monitoring wells will be installed with well screens straddling the top of the water table (or within the upper portion of the water table) in order to assess the groundwater quality at the groundwater-surface water interface.

The monitoring well pipe and screens will be constructed of polyvinyl chloride (PVC). All well screens will be bedded with silica sand over the available depth of the water table. The length and slot size of the well screens and the sand pack design will be determined in accordance with the results of the geotechnical borings. A bentonite plug will be placed above the sand pack and the remainder of the borehole annulus will be grouted to the surface with bentonite-cement grout, tremied in place using the positive displacement method.

Following the installation of each monitoring well, the well location and riser pipe elevation will be surveyed.

4.2 WELL DEVELOPMENT AND SAMPLING

4.2.1 WATER LEVEL MEASUREMENTS

Water level measurements will be taken prior to and after well development, purging, and sampling as described further in the following subsections.

Water level measurements at each existing or new well will be taken at the survey mark on the riser pipe. The water levels will be obtained by measuring the distance from the top of the well riser (at the survey mark) to the top of the water column using an electronic water level meter or a chain-and-plopper. Measurements will be obtained to ±0.01-foot accuracy.

Prior to taking measurements, water levels will be allowed to stabilize for a minimum of 24 hours after well development. Full recovery may take longer for low-yield wells.

Water level measuring equipment that comes in contact with well water will be cleaned in accordance with Section 6.0 to ensure that cross-contamination does not occur between wells.

4.2.2 WELL DEVELOPMENT

Any existing well that is not functioning properly due to silt buildup in the well screen will be re-developed. All newly installed groundwater monitoring wells will be developed to a silt-free condition of 50 nephelometric turbidity units (NTUs) or less, if possible, prior to conducting the pre-design in-situ hydraulic conductivity tests and groundwater sampling, in accordance with the following protocol:

1) All field personnel involved in well development will wear protective clothing including Tyvek coveralls, rubber boots, rubber gloves, and safety goggles.
2) All wells will be developed to a silt-free condition of 50 NTUs or less, if possible, by bailing, pumping, or air lift pumping.
3) Water levels in all wells will be measured to ±0.01 foot prior to development utilizing an electronic water level meter or a chain-and-plopper, as previously described in Section 4.1.
4) After each well volume is removed, a sample will be collected and analyzed for turbidity, temperature, pH, and conductivity. Development will continue until two consecutive and consistent readings of temperature, pH, and conductivity are obtained and the turbidity is less than 50 NTUs, if possible. Readings will be considered consistent if consecutive conductivity, temperature, and pH values are within 10 percent of each other. In the event that these field conditions cannot be met, development will continue to a silt-free condition of less than 50 NTUs or until a maximum of ten well volumes have been removed.
5) In wells where recharge is insufficient to conduct the well development protocol described in Item 4 above, such wells will be pumped/bailed to dryness on 3 consecutive days.
6) Acceptable methods of water extraction during development include bailers, peristaltic pumps, bladder pumps, Waterra pumps, centrifugal pumps, and submersible pumps. The development method selected will be based upon the well depth, the water level in the well, and the recharge characteristics.
7) All water extraction equipment will be cleaned before use at each well in accordance with the protocols presented in Section 6.0.
8) All development water will be collected, stored, analyzed, and disposed of in accordance with State of New York and United States Federal regulations.

4.2.3 WELL PURGING

Prior to the collection of groundwater samples, monitoring wells will be purged according to the following protocols.

1) All personnel involved in well purging will wear protective clothing including Tyvek coveralls, rubber boots, rubber gloves, and safety goggles.
2) Purging will be conducted utilizing low-flow purging and sampling methods presented in Section 4.4, during which samples will be collected and measured for turbidity, temperature, pH, and conductivity. Purging will be considered complete when three consecutive consistent readings of temperature, pH and conductivity are obtained and the turbidity is less than 50 NTUs, if possible. Readings will be considered consistent if all of the readings are within 10 percent of each other. In the event that consistent readings are not obtained, purging will continue until a maximum of five well volumes are evacuated.
3) In the event that recharge is insufficient to conduct the low-flow purging protocol described in Item 2 above, the well will be pumped to dryness and samples will be collected when the well has sufficiently recovered.
4) All water extraction during purging for groundwater sample collection will be conducted using bladder pumps consistent with low-flow sampling protocols.
5) All water extraction equipment will be cleaned before use at each well in accordance with the protocols presented in Section 5.0.
6) All purge water will be collected and disposed of off site following waste characterization sampling.

4.2.4 WELL SAMPLING

Monitoring well sampling will be carried out according to the following low-flow sampling protocols.

1) Groundwater sampling will be conducted using low-flow purge and sampling methods as described in EPA/540/S-95/504, dated April 1996 (see Attachment D-1 to this Appendix). During purging of the well, turbidity will be measured in the field with a nephelometer and the field indicator parameters temperature, conductivity, and pH will be measured by a multi-meter monitor.
2) Prior to use in the initial and each subsequent monitoring well, the pump will be cleaned as specified in Section 6.0.

3) VOC sample bottles must be filled completely with no air bubbles. Other sample bottles must be filled to the levels specified in the QAPP (Appendix C of the RD/RA Work Plan).

4) Sufficient groundwater will be collected for chemical analysis. Groundwater samples will be collected in containers as specified in the QAPP, filling the VOC containers first. Samples will be analyzed for the Target Compound List (TCL)/Target Analyte List (TAL) parameters. The order for collection of samples is as follows:

   - VOCs
   - SVOCs
   - PCBs
   - Total metals
   - Dissolved metals (Dissolved metals will only be collected if excess turbidity, greater the 50 NTU, is present in the sample to evaluate the distribution of metals between the dissolved phase and metals adsorbed to particulate in the sample)

5) Sample preservation details are presented in the QAPP. Sample containers will be prepared using washing procedures that meet or exceed the requirements of the specified methods. Sample containers will be shipped to the Site in sealed containers.

6) Samples submitted for dissolved metals, in the case where excess turbidity (greater than 50 NTU is present in the sample) will be filtered using in-line high capacity 0.45 micron non-metallic water filters (Geogard or equivalent). The filter apparatus will be attached directly to the discharge line on the sampling pump. A new filter will be used for each sample.

7) Field measurements of turbidity, temperature, pH (using a Fisher Model MDL-107 pH meter or equivalent), and conductivity will be taken during well development and purging. A field temperature reading (using a YSI Model 33 SCT meter or equivalent) will be taken immediately prior to sample collection. Calibration of field instruments will be in accordance with the manufacturer's instructions.

8) One blind duplicate sample will be collected at a frequency of 1 in 20 investigative samples.

9) A rinse water sample (rinsate blank) will be collected at a frequency of one per 20 samples in the event that non-dedicated sampling equipment is used per type of sampling equipment used. The rinse water sample will consist of distilled or deionized water poured into, and then sampled out of, the sampling instrument

cleaned under the protocol outlined in Section 6.0. This will provide a quality assurance check on the field decontamination procedures employed during sampling.

5.0 SINGLE WELL RESPONSE TESTING

Response testing of all new overburden groundwater monitoring wells will be undertaken to determine the in-situ hydraulic conductivity of the screened materials. Response testing of the existing bedrock well MW-09 will also be conducted to determine the hydraulic conductivity within the core hole. Protocols are described below.

5.1 OVERBURDEN MONITORING WELLS

This testing involves the displacement of well water by a slug of known volume. Water level measurements are taken as the system stabilizes. Falling head tests are those which monitor a declining water level with time following the introduction of a slug. Following removal of the slug, the water level rises. This comprises a rising head test. Only rising head tests will be conducted for water table wells where the screened interval straddles the water table.

Prior to the introduction of the slug into a well, the slug will be decontaminated in accordance with the method described in Section 6.0.

Prior to beginning the test the following information must be recorded into the field log book:

- Well identification number
- Elevation and water depth
- Time of test
- Atmospheric conditions
- Well depth, screen length, well pipe radius, radius of the filter pack, grain size of the filter pack, and borehole depth
- Name of aquifer tested
- Volume of the slug added to the well
- Type of measuring equipment used
- Names of personnel conducting the test

The general field procedure for the rising head single well response test is as follows:

1) The transducer probe will be lowered to a depth below the static water level in excess of the length of the slug. The cable of the transducer probe will be secured to the riser pipe to ensure its position in the well is constant. The transducer will be selected so that it can measure the range of water level changes expected during the single well response tests.
2) The static water level will be determined by measuring the water level periodically for several minutes and taking the average.
3) The slug will be of sufficient volume to cause sufficient displacement to ensure the aquifer is stressed during the test. The slug will be lowered into the well, and the water level will be allowed to recover until it reaches 95 percent of the original static water level.
4) When 95 percent of the original static water level is reached the slug will be quickly withdrawn from the well.
5) Recorded information will consist of depth and time of recording. Depths will be measured to the nearest 0.01 foot and 0.01-second intervals. The depth and time measurements will continue until the residual water level reaches 95 percent of the original static water level.

Several methods have been developed for determination of hydraulic conductivity values from response test data. These methods consider well construction details, hydrogeologic setting, and time lag response as factors to calculate the in situ hydraulic conductivity. The method of Hvorslev (1951) is commonly used to analyze the results of response tests. Other methods which may be employed include Cooper et al. (1967), Papadopulos et al. (1973), and Bouwer and Rice (1976).

The following information will be included in the test report:

1) All single well response test variables
2) The depth-time measurements
3) The graphic curve matching analyses

5.2 BEDROCK MONITORING WELLS

The method of hydrogeologic testing commonly used in bedrock is packer-pumping testing, consisting of either pumping tests, where water is removed from the formation, or packer-injection testing where potable water is injected into the formation. This method allows determination of the formation parameters for individual intervals of the formation. Typically, the interval length is on the order of 15 feet.

Prior to the start of the packer test or the injection test, the following information must be recorded into the field log book:

- Well identification number
- Elevation and water depth
- Time of test
- Atmospheric conditions
- Well depth, screen length, well pipe radius, radius of the filter pack, grain size of the filter pack, and borehole depth
- Name of aquifer tested
- Volume of the slug added to the well
- Type of measuring equipment used
- Names of personnel conducting the test

5.2.1 PACKER-PUMPING TEST

A typical packer-pumping test is performed for a 1-hour time period. The packer-pumping equipment includes the packer with tubing through the middle, pressure transducer, test pump, and sampling pump (if sample collection is required). Advantages of the packer-pumping test include that it provides an indication of the water-bearing capacity of the interval being tested, and after the packer-pumping test is completed, a groundwater sample can be submitted for chemical analysis without additional purging of the formation as required if an injection test were performed. Disadvantages include the handling/disposal of significant volumes of potentially contaminated groundwater. Equipment set-up and test procedures are described in the following subsections.

5.2.1.1 CHECKING PRESSURE TRANSDUCER OPERATION

Check the operation of the pressure transducer. This is accomplished by measuring the static water level and then inserting the packer-pumping test assembly to the bottom of the core hole. The pressure recorded by the pressure transducer is then checked prior to inflation of the packer with the theoretical water pressure due to the column of water above the pressure transducer (Note: 1 foot of water = 0.433 psi).

If the observed and theoretical values do not correspond, it is still possible to use the packer-pumping test assembly if the pressure transducer monitors pressure changes correctly. This is easily checked by raising the assembly and checking the change in observed pressure (i.e., raising the assembly 10 feet would correspond to a pressure decrease of 4.33 psi).

If the pressure transducer does not perform either of the above correctly, check the pressure transducer connections and/or calibration or replace the pressure transducer.

5.2.1.2 PACKER INFLATION PRESSURE

The packer must be inflated to a sufficient degree to prevent the bypass flow of formation water from the portions of the formation not being tested to the tested interval.

Inflate the packers to 30± psi above the greater of either the static water column above the top packer or the manufacturer's maximum prescribed injection pressure. Make sure that the packer is not inflated beyond its design capacity. To determine if water from the formation is bypassing the packers, water level measurements above the top packer can be obtained.

5.2.1.3 PUMPING GROUNDWATER

The procedure for pumping of water is as follows:

1) Determine maximum allowable drawdown to prevent damage to testing pump (i.e., some pumps require a minimum depth of water above the pump intake to prevent pump damage).
2) Start pumping the water slowly and increase to the pumping rate until either the maximum pumping rate of the equipment has been achieved (typically on the order of 20± gpm) or the allowable draw-down has been achieved, whichever is the lesser.
3) Once the pumping rate has stabilized, continue pumping for 1 hour, recording the data for each 5-minute interval. This is backup should the pressure transducer/datalogger system fail.

4) Perform a recovery test.

5) (if Required) After the pumping/recovery test is complete, collect groundwater sample(s), using the sample collection pump.

6) Deflate the packer and remove the packer-pumping test assembly.

All generated water will be containerized and disposed of in accordance with State and Federal regulations.

5.2.2 PACKER-INJECTION TEST

A typical injection test consists of injecting potable water at four to five different pressures or flow rates for a total time duration of approximately 1 hour. The equipment used for the packer-injection test is the same as for the packer-pump test, with the exception of the sampling pump. Equipment set-up and test procedures are described in the following subsections.

5.2.2.1 MAXIMUM ALLOWABLE INJECTION PRESSURE DETERMINATION

Prior to performing the injection test, the maximum injection pressure allowed to prevent hydrofracturing of the formation must be determined. One method of calculating the maximum allowable injection pressure is that it must not exceed 0.7 psi per foot of overlying overburden and bedrock as measured from the ground surface to the top of the interval to be tested. Another method is to use 1 psi for each foot of unsaturated formation plus 0.57 psi for each foot of saturated formation. If the groundwater table is close to ground surface and the borehole is relatively deep, the second method provides a more conservative (safer) value. Do not exceed the calculated hydrofracturing pressure during the test.

5.2.2.2 CHECKING PRESSURE TRANSDUCER OPERATION

The procedures for checking the pressure transducer operation are described in Section 5.2.1.1 and are applicable to injection testing.

5.2.2.3 DETERMINING INJECTION PRESSURE/FLOW RATE STEPS

Typically, an injection test consists of injecting potable water into the formation in four to five steps, up to either the maximum allowable injection pressure or the maximum flow rate obtainable from the pump used (typically 20± gpm). The determination whether to use the calculated pressure steps or the flow rate steps (i.e., 4, 8, 12, 16, and 20 gpm) will depend on the formation characteristics. Typically, the calculated pressure steps will be used for a low permeable formation (i.e., the formation cannot accept the specified injection rate for that test without exceeding the calculated hydrofracturing pressure for that step), while the specified injection rate will be used for a highly permeable formation (i.e., the formation can readily accept the injected water). The pressure steps are calculated using the following equation:

$$P_i = P_o + i \times P_\Delta$$

Where:

P_o = Static borehole pressure with the packer(s) inflated (psi)
i = The value of the step (i = 1, 2, 3, 4, or 5)
P_Δ = Hydrofracturing Pressure ÷ 5 (for a 5-step test)

5.2.2.4 PACKER INFLATION PRESSURE

The procedures to determine packer inflation pressure are described in Section 5.2.1.2 and are applicable to injection testing with the following modifications:

1) In addition to preventing the bypass of formation water from the portions of the formation not being tested, the packers must also stop the bypass flow of injected water from the tested interval to the portions not being tested.
2) To determine if water from the injection test is bypassing the packers, a pressure transducer below the bottom packer can be used and water level measurement above the top packer can be obtained.

5.2.2.5 WATER INJECTION

The injection rate should be controlled by means of a gate valve in the injection line and is measured using an in-line flow meter.

The procedure for water injection is as follows:

1) Start injecting the water slowly up to either the prescribed pressure or flow rate value for the first step, whichever is achieved first.
2) Once the pressure or flow rate has stabilized, continue water injection for 10 minutes recording the data for each minute. This is backup should the pressure transducer/datalogger system fail.
3) Increase the flow rate until either the calculated pressure or flow rate for the second step is achieved.
4) Repeat the above procedure until all five pressure/flow rate steps have been completed.
5) Deflate the packer(s), raise the packer/injection assembly

6.0 SAMPLING EQUIPMENT CLEANING

Prior to mobilization of the drill rig it shall be thoroughly cleaned to remove oil, grease, mud, and other foreign matter. Subsequently, before initiating drilling at each borehole, samplers, drill steel, hollow-stem auger sections, and associated equipment will be cleaned to prevent cross-contamination from the previous drilling location. Cleaning will be accomplished by flushing and wiping the components to remove all visible particulates and other solid material followed by a thorough high pressure water wash. Special attention will be given to the threaded sections of the drill rods and the soil sampling equipment.

Equipment not used for collection of samples for chemical analyses will be cleaned as follows:

1) Clean off any gross contamination with a stiff brush
2) Wash and scrub using laboratory grade non-phosphate detergent
3) Rinse with potable water

Reusable equipment used for the collection of samples to be submitted for chemical laboratory analyses will be cleaned between sampling events using the following rinse sequence.

1) Wash and scrub with potable water and low phosphate detergent.
2) Rinse with potable water.
3) Rinse with 10 percent ultrapure HNO_3, (dilute to 1 percent HNO_3 if carbon samplers utilized).
4) Rinse with potable water.
5) Rinse with methanol.
6) Thoroughly rinse with deionized demonstrated analyte-free water. The volume of water used must be at least five times the volume of solvent used in step 5).
7) Air dry for 15 minutes.
8) Following the final rinse, sampling equipment will be visually inspected to verify that it is free of particulates and other solid material which may contribute to possible sample cross-contamination. Fluids used for cleaning will not be recycled. Washwater, rinse water, and decontamination fluids will be collected and disposed of off site following waste characterization sampling.

7.0 CHAIN-OF-CUSTODY

Samples will remain in coolers under the control of the sampling personnel in the field until relinquished to the delivery firm or directly to the laboratory. Chain-of-custody documents will be completed for each sample cooler. The original and two copies of each chain-of-custody will be placed within the cooler. The fourth copy will be retained by the sampler. In addition, Field Sampling Data Sheets and a sample log of samples collected and shipped off Site will be maintained on Site.

8.0 WASTE HANDLING

All coveralls, gloves, etc. will be collected in plastic bags for disposal off Site.

ATTACHMENT D-1

LOW STRESS (LOW FLOW) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS JULY 30, 1996

United States Environmental Protection Agency | Office of Research and Development | Office of Solid Waste and Emergency Response | EPA/540/S-95/504 April 1996

EPA Ground Water Issue

LOW-FLOW (MINIMAL DRAWDOWN) GROUND-WATER SAMPLING PROCEDURES

by Robert W. Puls[1] and Michael J. Barcelona[2]

Background

The Regional Superfund Ground Water Forum is a group of ground-water scientists, representing EPA's Regional Superfund Offices, organized to exchange information related to ground-water remediation at Superfund sites. One of the major concerns of the Forum is the sampling of ground water to support site assessment and remedial performance monitoring objectives. This paper is intended to provide background information on the development of low-flow sampling procedures and its application under a variety of hydrogeologic settings. It is hoped that the paper will support the production of standard operating procedures for use by EPA Regional personnel and other environmental professionals engaged in ground-water sampling.

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I. Introduction

The methods and objectives of ground-water sampling to assess water quality have evolved over time. Initially the emphasis was on the assessment of water quality of aquifers as sources of drinking water. Large water-bearing units were identified and sampled in keeping with that objective. These were highly productive aquifers that supplied drinking water via private wells or through public water supply systems. Gradually, with the increasing awareness of subsurface pollution of these water resources, the understanding of complex hydrogeochemical processes which govern the fate and transport of contaminants in the subsurface increased. This increase in understanding was also due to advances in a number of scientific disciplines and improvements in tools used for site characterization and ground-water sampling. Ground-water quality investigations where pollution was detected initially borrowed ideas, methods, and materials for site characterization from the water supply field and water analysis from public health practices. This included the materials and manner in which monitoring wells were installed and the way in which water was brought to the surface, treated, preserved and analyzed. The prevailing conceptual ideas included convenient generalizations of ground-water resources in terms of large and relatively homogeneous hydrologic *units*. With time it became apparent that conventional water supply generalizations of *homogeneity* did not adequately represent field data regarding pollution of these subsurface resources. The important role of *heterogeneity* became increasingly clear not only in geologic terms, but also in terms of complex physical,

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chemical and biological subsurface processes. With greater appreciation of the role of heterogeneity, it became evident that subsurface pollution was ubiquitous and encompassed the unsaturated zone to the deep subsurface and included unconsolidated sediments, fractured rock, and *aquitards* or low-yielding or impermeable formations. Small-scale processes and heterogeneities were shown to be important in identifying contaminant distributions and in controlling water and contaminant flow paths.

It is beyond the scope of this paper to summarize all the advances in the field of ground-water quality investigations and remediation, but two particular issues have bearing on ground-water sampling today: aquifer heterogeneity and colloidal transport. Aquifer heterogeneities affect contaminant flow paths and include variations in geology, geochemistry, hydrology and microbiology. As methods and the tools available for subsurface investigations have become increasingly sophisticated and understanding of the subsurface environment has advanced, there is an awareness that in most cases a primary concern for site investigations is characterization of contaminant flow paths rather than entire aquifers. In fact, in many cases, plume thickness can be less than well screen lengths (e.g., 3-6 m) typically installed at hazardous waste sites to detect and monitor plume movement over time. Small-scale differences have increasingly been shown to be important and there is a general trend toward smaller diameter wells and shorter screens.

The hydrogeochemical significance of colloidal-size particles in subsurface systems has been realized during the past several years (Gschwend and Reynolds, 1987; McCarthy and Zachara, 1989; Puls, 1990; Ryan and Gschwend, 1990). This realization resulted from both field and laboratory studies that showed faster contaminant migration over greater distances and at higher concentrations than flow and transport model predictions would suggest (Buddemeier and Hunt, 1988; Enfield and Bengtsson, 1988; Penrose et al., 1990). Such models typically account for interaction between the mobile aqueous and immobile solid phases, but do not allow for a mobile, reactive solid phase. It is recognition of this third *phase* as a possible means of contaminant transport that has brought increasing attention to the manner in which samples are collected and processed for analysis (Puls et al., 1990; McCarthy and Degueldre, 1993; Backhus et al., 1993; U. S. EPA, 1995). If such a phase is present in sufficient mass, possesses high sorption reactivity, large surface area, and remains stable in suspension, it can serve as an important mechanism to facilitate contaminant transport in many types of subsurface systems.

Colloids are particles that are sufficiently small so that the surface free energy of the particle dominates the bulk free energy. Typically, in ground water, this includes particles with diameters between 1 and 1000 nm. The most commonly observed mobile particles include: secondary clay minerals; hydrous iron, aluminum, and manganese oxides; dissolved and particulate organic materials, and viruses and bacteria. These reactive particles have been shown to be mobile under a variety of conditions in both field studies and laboratory column experiments, and as such need to be included in monitoring programs where identification of the *total* mobile contaminant loading (dissolved + naturally suspended particles) at a site is an objective. To that end, sampling methodologies must be used which do not artificially bias *naturally* suspended particle concentrations.

Currently the most common ground-water purging and sampling methodology is to purge a well using bailers or high speed pumps to remove 3 to 5 casing volumes followed by sample collection. This method can cause adverse impacts on sample quality through collection of samples with high levels of turbidity. This results in the inclusion of otherwise immobile artifactual particles which produce an overestimation of certain analytes of interest (e.g., metals or hydrophobic organic compounds). Numerous documented problems associated with filtration (Danielsson, 1982; Laxen and Chandler, 1982; Horowitz et al., 1992) make this an undesirable method of rectifying the turbidity problem, and include the removal of potentially mobile (contaminant-associated) particles during filtration, thus artificially biasing contaminant concentrations low. Sampling-induced turbidity problems can often be mitigated by using low-flow purging and sampling techniques.

Current subsurface conceptual models have undergone considerable refinement due to the recent development and increased use of field screening tools. So-called hydraulic *push* technologies (e.g., cone penetrometer, Geoprobe®, QED HydroPunch®) enable relatively fast screening site characterization which can then be used to design and install a monitoring well network. Indeed, alternatives to conventional monitoring wells are now being considered for some hydrogeologic settings. The ultimate design of any monitoring system should however be based upon adequate site characterization and be consistent with established monitoring objectives.

If the sampling program objectives include accurate assessment of the magnitude and extent of subsurface contamination over time and/or accurate assessment of subsequent remedial performance, then some information regarding plume delineation in three-dimensional space is necessary prior to monitoring well network design and installation. This can be accomplished with a variety of different tools and equipment ranging from hand-operated augers to screening tools mentioned above and large drilling rigs. Detailed information on ground-water flow velocity, direction, and horizontal and vertical variability are essential baseline data requirements. Detailed soil and geologic data are required prior to and during the installation of sampling points. This includes historical as well as detailed soil and geologic logs which accumulate during the site investigation. The use of borehole geophysical techniques is also recommended. With this information (together with other site characterization data) and a clear understanding of sampling objectives, then appropriate location, screen length, well diameter, slot size, etc. for the monitoring well network can be decided. This is especially critical for new in situ remedial approaches or natural attenuation assessments at hazardous waste sites.

In general, the overall goal of any ground-water sampling program is to collect water samples with no alteration in water chemistry; analytical data thus obtained may be used for a variety of specific monitoring programs depending on the regulatory requirements. The sampling methodology described in this paper assumes that the monitoring goal is to sample monitoring wells for the presence of contaminants and it is applicable whether mobile colloids are a concern or not and whether the analytes of concern are metals (and metalloids) or organic compounds.

II. Monitoring Objectives and Design Considerations

The following issues are important to consider prior to the design and implementation of any ground-water monitoring program, including those which anticipate using low-flow purging and sampling procedures.

A. Data Quality Objectives (DQOs)

Monitoring objectives include four main types: detection, assessment, corrective-action evaluation and resource evaluation, along with *hybrid* variations such as site-assessments for property transfers and water availability investigations. Monitoring objectives may change as contamination or water quality problems are discovered. However, there are a number of common components of monitoring programs which should be recognized as important regardless of initial objectives. These components include:

1) Development of a conceptual model that incorporates elements of the regional geology to the local geologic framework. The conceptual model development also includes initial site characterization efforts to identify hydrostratigraphic units and likely flow-paths using a minimum number of borings and well completions;

2) Cost-effective and well documented collection of high quality data utilizing simple, accurate, and reproducible techniques; and

3) Refinement of the conceptual model based on supplementary data collection and analysis.

These fundamental components serve many types of monitoring programs and provide a basis for future efforts that evolve in complexity and level of spatial detail as purposes and objectives expand. High quality, reproducible data collection is a common goal regardless of program objectives.

High quality data collection implies data of sufficient accuracy, precision, and completeness (i.e., ratio of valid analytical results to the minimum sample number called for by the program design) to meet the program objectives. Accuracy depends on the correct choice of monitoring tools and procedures to minimize sample and subsurface disturbance from collection to analysis. Precision depends on the repeatability of sampling and analytical protocols. It can be assured or improved by replication of sample analyses including blanks, field/lab standards and reference standards.

B. Sample Representativeness

An important goal of any monitoring program is collection of data that is truly representative of conditions at the site. The term *representativeness* applies to chemical and hydrogeologic data collected via wells, borings, piezometers, geophysical and soil gas measurements, lysimeters, and temporary sampling points. It involves a recognition of the statistical variability of individual subsurface physical properties, and contaminant or major ion concentration levels, while explaining extreme values. Subsurface temporal and spatial variability are facts. Good professional practice seeks to maximize representativeness by using proven accurate and reproducible techniques to define limits on the distribution of measurements collected at a site. However, measures of representativeness are dynamic and are controlled by evolving site characterization and monitoring objectives. An evolutionary site characterization model, as shown in Figure 1, provides a systematic approach to the goal of consistent data collection.

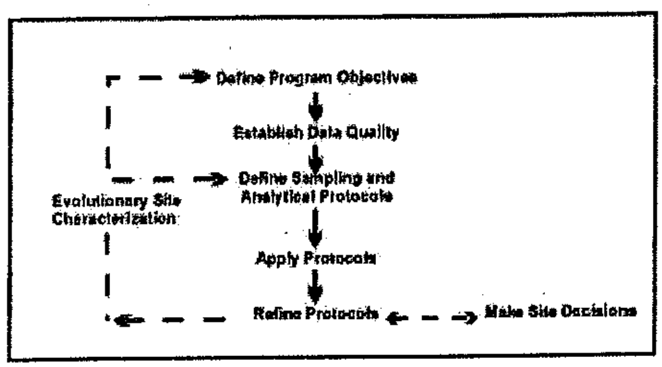

Figure 1. Evolutionary Site Characterization Model

The model emphasizes a recognition of the causes of the variability (e.g., use of inappropriate technology such as using bailers to purge wells; imprecise or operator-dependent methods) and the need to control avoidable errors.

1) Questions of Scale

A sampling plan designed to collect representative samples must take into account the potential scale of changes in site conditions through space and time as well as the chemical associations and behavior of the parameters that are targeted for investigation. In subsurface systems, physical (i.e., aquifer) and chemical properties over time or space are not statistically independent. In fact, samples taken in close proximity (i.e., within distances of a few meters) or within short time periods (i.e., more frequently than monthly) are highly auto-correlated. This means that designs employing high-sampling frequency (e.g., monthly) or dense spatial monitoring designs run the risk of redundant data collection and misleading inferences regarding trends in values that aren't statistically valid. In practice, contaminant detection and assessment monitoring programs rarely suffer these *over-sampling* concerns. In corrective-action evaluation programs, it is also possible that too little data may be collected over space or time. In these cases, false interpretation of the spatial extent of contamination or underestimation of temporal concentration variability may result.

2) Target Parameters

Parameter selection in monitoring program design is most often dictated by the regulatory status of the site. However, background water quality constituents, purging indicator parameters, and contaminants, all represent targets for data collection programs. The tools and procedures used in these programs should be equally rigorous and applicable to all categories of data, since all may be needed to determine or support regulatory action.

C. Sampling Point Design and Construction

Detailed site characterization is central to all decision-making purposes and the basis for this characterization resides in identification of the geologic framework and major hydro-stratigraphic units. Fundamental data for sample point location include: subsurface lithology, head-differences and background geochemical conditions. Each sampling point has a proper use or uses which should be documented at a level which is appropriate for the program's data quality objectives. Individual sampling points may not always be able to fulfill multiple monitoring objectives (e.g., detection, assessment, corrective action).

1) Compatibility with Monitoring Program and Data Quality Objectives

Specifics of sampling point location and design will be dictated by the complexity of subsurface lithology and variability in contaminant and/or geochemical conditions. It should be noted that, regardless of the ground-water sampling approach, few sampling points (e.g., wells, drive-points, screened augers) have zones of influence in excess of a few feet. Therefore, the spatial frequency of sampling points should be carefully selected and designed.

2) Flexibility of Sampling Point Design

In most cases *well-point* diameters in excess of 1 7/8 inches will permit the use of most types of submersible pumping devices for low-flow (minimal drawdown) sampling. It is suggested that *short* (e.g., less than 1.6 m) screens be incorporated into the monitoring design where possible so that comparable results from one device to another might be expected. *Short*, of course, is relative to the degree of vertical water quality variability expected at a site.

3) Equilibration of Sampling Point

Time should be allowed for equilibration of the well or sampling point with the formation after installation. Placement of well or sampling points in the subsurface produces some disturbance of ambient conditions. Drilling techniques (e.g., auger, rotary, etc.) are generally considered to cause more disturbance than *direct-push* technologies. In either case, there may be a period (i.e., days to months) during which water quality near the point may be distinctly different from that in the formation. Proper development of the sampling point and adjacent formation to remove fines created during emplacement will shorten this water quality *recovery* period.

III. Definition of Low-Flow Purging and Sampling

It is generally accepted that water in the well casing is non-representative of the formation water and needs to be purged prior to collection of ground-water samples. However, the water in the screened interval may indeed be representative of the formation, depending upon well construction and site hydrogeology. Wells are purged to some extent for the following reasons: the presence of the air interface at the top of the water column resulting in an oxygen concentration gradient with depth, loss of volatiles up the water column, leaching from or sorption to the casing or filter pack, chemical changes due to clay seals or backfill, and surface infiltration.

Low-flow purging, whether using portable or dedicated systems, should be done using pump-intake located in the middle or slightly above the middle of the screened interval. Placement of the pump too close to the bottom of the well will cause increased entrainment of solids which have collected in the well over time. These particles are present as a result of well development, prior purging and sampling events, and natural colloidal transport and deposition. Therefore, placement of the pump in the middle or toward the top of the screened interval is suggested. Placement of the pump at the top of the water column for sampling is only recommended in unconfined aquifers, screened across the water table, where this is the desired sampling point. Low-flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval.

A. Low-Flow Purging and Sampling

Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface which can be affected by flow regulators or restrictions. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practical taking into account established site sampling objectives. Typically, flow rates on the order of 0.1 - 0.5 L/min are used, however this is dependent on site-specific hydrogeology. Some extremely coarse-textured formations have been successfully sampled in this manner at flow rates to 1 L/min. The effectiveness of using low-flow purging is intimately linked with proper screen location, screen length, and well construction and development techniques. The reestablishment of natural flow paths in both the vertical and horizontal directions is important for correct interpretation of the data. For high resolution sampling needs, screens less than 1 m should be used. Most of the need for purging has been found to be due to passing the sampling device through the overlying casing water which causes mixing of these stagnant waters and the dynamic waters within the screened interval. Additionally, there is disturbance to suspended sediment collected in the bottom of the casing and the displacement of water out into the formation immediately adjacent to the well screen. These disturbances and impacts can be avoided using dedicated sampling equipment, which precludes the need to insert the sampling device prior to purging and sampling.

Isolation of the screened interval water from the overlying stagnant casing water may be accomplished using low-flow minimal drawdown techniques. If the pump intake is located within the screened interval, most of the water pumped will be drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone. However, if the wells are not constructed and developed properly, zones other than those intended may be sampled. At some sites where geologic heterogeneities are sufficiently different within the screened interval, higher conductivity zones may be preferentially sampled. This is another reason to use shorter screened intervals, especially where high spatial resolution is a sampling objective.

B. Water Quality Indicator Parameters

It is recommended that water quality indicator parameters be used to determine purging needs prior to sample collection in each well. Stabilization of parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and turbidity should be used to determine when formation water is accessed during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by oxidation-reduction potential, dissolved oxygen and turbidity. Temperature and pH, while commonly used as purging indicators, are actually quite insensitive in distinguishing between formation water and stagnant casing water; nevertheless, these are important parameters for data interpretation purposes and should also be measured. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. Instruments are available which utilize in-line flow cells to continuously measure the above parameters.

It is important to establish specific well stabilization criteria and then consistently follow the same methods thereafter, particularly with respect to drawdown, flow rate and sampling device. Generally, the time or purge volume required for parameter stabilization is independent of well depth or well volumes. Dependent variables are well diameter, sampling device, hydrogeochemistry, pump flow rate, and whether the devices are used in a portable or dedicated manner. If the sampling device is already in place (i.e., dedicated sampling systems), then the time and purge volume needed for stabilization is much shorter. Other advantages of dedicated equipment include less purge water for waste disposal, much less decontamination of equipment, less time spent in preparation of sampling as well as time in the field, and more consistency in the sampling approach which probably will translate into less variability in sampling results. The use of dedicated equipment is strongly recommended at wells which will undergo routine sampling over time.

If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization. Turbidity is always the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. It should be noted that natural turbidity levels in ground water may exceed 10 nephelometric turbidity units (NTU).

C. Advantages and Disadvantages of Low-Flow (Minimum Drawdown) Purging

In general, the advantages of low-flow purging include:

- samples which are representative of the *mobile* load of contaminants present (dissolved and colloid-associated);
- minimal disturbance of the sampling point thereby minimizing sampling artifacts;
- less operator variability, greater operator control;

- reduced stress on the formation (minimal drawdown);
- less mixing of stagnant casing water with formation water;
- reduced need for filtration and, therefore, less time required for sampling;
- smaller purging volume which decreases waste disposal costs and sampling time;
- better sample consistency; reduced artificial sample variability.

Some disadvantages of low-flow purging are:

- higher initial capital costs,
- greater set-up time in the field,
- need to transport additional equipment to and from the site,
- increased training needs,
- resistance to change on the part of sampling practitioners,
- concern that new data will indicate a *change in conditions* and trigger an *action.*

IV. Low-Flow (Minimal Drawdown) Sampling Protocols

The following ground-water sampling procedure has evolved over many years of experience in ground-water sampling for organic and inorganic compound determinations and as such summarizes the authors' (and others) experiences to date (Barcelona et al., 1984, 1994; Barcelona and Helfrich, 1986; Puls and Barcelona, 1989; Puls et. al. 1990, 1992; Puls and Powell, 1992; Puls and Paul, 1995). High-quality chemical data collection is essential in ground-water monitoring and site characterization. The primary limitations to the collection of *representative* ground-water samples include: mixing of the stagnant casing and *fresh* screen waters during insertion of the sampling device or ground-water level measurement device; disturbance and resuspension of settled solids at the bottom of the well when using high pumping rates or raising and lowering a pump or bailer; introduction of atmospheric gases or degassing from the water during sample handling and transfer, or inappropriate use of vacuum sampling device, etc.

A. Sampling Recommendations

Water samples should not be taken immediately following well development. Sufficient time should be allowed for the ground-water flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and methods of installation but often exceeds one week.

Well purging is nearly always necessary to obtain samples of water flowing through the geologic formations in the screened interval. Rather than using a general but arbitrary guideline of purging three casing volumes prior to sampling, it is recommended that an in-line water quality measurement device (e.g., flow-through cell) be used to establish the stabilization time for several parameters (e.g. , pH, specific conductance, redox, dissolved oxygen, turbidity) on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

The following are recommendations to be considered before, during and after sampling:

- use low-flow rates (<0.5 L/min), during both purging and sampling to maintain minimal drawdown in the well;
- maximize tubing wall thickness, minimize tubing length;
- place the sampling device intake at the desired sampling point;
- minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion;
- make proper adjustments to stabilize the flow rate as soon as possible;
- monitor water quality indicators during purging;
- collect unfiltered samples to estimate contaminant loading and transport potential in the subsurface system.

B. Equipment Calibration

Prior to sampling, all sampling device and monitoring equipment should be calibrated according to manufacturer's recommendations and the site Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP). Calibration of pH should be performed with at least two buffers which bracket the expected range. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

C. Water Level Measurement and Monitoring

It is recommended that a device be used which will least disturb the water surface in the casing. Well depth should be obtained from the well logs. Measuring to the bottom of the well casing will only cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure well depth after sampling is completed. The water level measurement should be taken from a permanent reference point which is surveyed relative to ground elevation.

D. Pump Type

The use of low-flow (e.g., 0.1-0.5 L/min) pumps is suggested for purging and sampling all types of analytes. All pumps have some limitation and these should be investigated with respect to application at a particular site. Bailers are inappropriate devices for low-flow sampling.

1) General Considerations

There are no unusual requirements for ground-water sampling devices when using low-flow, minimal drawdown techniques. The major concern is that the device give consistent results and minimal disturbance of the sample across a range of *low* flow rates (i.e., < 0.5 L/min). Clearly, pumping rates that cause minimal to no drawdown in one well could easily cause *significant* drawdown in another well finished in a less transmissive formation. In this sense, the pump should not cause undue pressure or temperature changes or physical disturbance on the water sample over a reasonable sampling range. Consistency in operation is critical to meet accuracy and precision goals.

2) Advantages and Disadvantages of Sampling Devices

A variety of sampling devices are available for low-flow (minimal drawdown) purging and sampling and include peristaltic pumps, bladder pumps, electrical submersible pumps, and gas-driven pumps. Devices which lend themselves to both dedication and consistent operation at definable low-flow rates are preferred. It is desirable that the pump be easily adjustable and operate reliably at these lower flow rates. The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and some volatiles loss. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid.

Clearly, bailers and other *grab* type samplers are ill-suited for low-flow sampling since they will cause repeated disturbance and mixing of *stagnant* water in the casing and the *dynamic* water in the screened interval. Similarly, the use of inertial lift foot-valve type samplers may cause too much disturbance at the point of sampling. Use of these devices also tends to introduce uncontrolled and unacceptable operator variability.

Summaries of advantages and disadvantages of various sampling devices are listed in Herzog et al. (1991), U. S. EPA (1992), Parker (1994) and Thurnblad (1994).

E. Pump Installation

Dedicated sampling devices (left in the well) capable of pumping and sampling are preferred over <u>any</u> other type of device. Any portable sampling device should be slowly and carefully lowered to the middle of the screened interval or slightly above the middle (e.g., 1-1.5 m below the top of a 3 m screen). This is to minimize excessive mixing of the stagnant water in the casing above the screen with the screened interval zone water, and to minimize resuspension of solids which will have collected at the bottom of the well. These two disturbance effects have been shown to directly affect the time required for purging. There also appears to be a direct correlation between size of portable sampling devices relative to the well bore and resulting purge volumes and times. The key is to minimize disturbance of water and solids in the well casing.

F. Filtration

Decisions to filter samples should be dictated by sampling objectives rather than as a *fix* for poor sampling practices, and field-filtering of certain constituents should not be the default. Consideration should be given as to what the application of field-filtration is trying to accomplish. For assessment of truly dissolved (as opposed to operationally *dissolved* [i.e., samples filtered with 0.45 µm filters]) concentrations of major ions and trace metals, 0.1 µm filters are recommended although 0.45 µm filters are normally used for most regulatory programs. Alkalinity samples must also be filtered if significant particulate calcium carbonate is suspected, since this material is likely to impact alkalinity titration results (although filtration itself may alter the CO_2 composition of the sample and, therefore, affect the results).

Although filtration may be appropriate, filtration of a sample may cause a number of unintended changes to occur (e.g. oxidation, aeration) possibly leading to filtration-induced artifacts during sample analysis and uncertainty in the results. Some of these unintended changes may be unavoidable but the factors leading to them must be recognized. Deleterious effects can be minimized by consistent application of certain filtration guidelines. Guidelines should address selection of filter type, media, pore size, etc. in order to identify and minimize potential sources of uncertainty when filtering samples.

In-line filtration is recommended because it provides better consistency through less sample handling, and minimizes sample exposure to the atmosphere. In-line filters are available in both disposable (barrel filters) and non-disposable (in-line filter holder, flat membrane filters) formats and various filter pore sizes (0.1-5.0 µm). Disposable filter cartridges have the advantage of greater sediment handling capacity when compared to traditional membrane filters. Filters must be pre-rinsed following manufacturer's recommendations. If there are no recommendations for rinsing, pass through a minimum of 1 L of ground water following purging and prior to sampling. Once filtration has begun, a filter cake may develop as particles larger than the pore size accumulate on the filter membrane. The result is that the effective pore diameter of the membrane is reduced and particles smaller than the stated pore size are excluded from the filtrate. Possible corrective measures include prefiltering (with larger pore size filters), minimizing particle loads to begin with, and reducing sample volume.

G. Monitoring of Water Level and Water Quality Indicator Parameters

Check water level periodically to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 m) during purging. This goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience. In-line water quality indicator parameters should be continuously monitored during purging. The water quality indicator parameters monitored can include pH, redox potential, conductivity, dissolved oxygen (DO) and turbidity. The last three parameters are often most sensitive. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every three to five minutes if the above suggested rates are used. Stabilization is achieved after all parameters have stabilized for three successive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or DO. Three successive readings should be within ± 0.1 for pH, ± 3% for conductivity, ± 10 mv for redox potential, and ± 10% for turbidity and DO. Stabilized purge indicator parameter trends are generally obvious and follow either an exponential or asymptotic change to stable values during purging. Dissolved oxygen and turbidity usually require the longest time for stabilization. The above stabilization guidelines are provided for rough estimates based on experience.

H. Sampling, Sample Containers, Preservation and Decontamination

Upon parameter stabilization, sampling can be initiated. If an in-line device is used to monitor water quality parameters, it should be disconnected or bypassed during sample collection. Sampling flow rate may remain at established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates less than 0.5 L/min are appropriate. The same device should be used for sampling as was used for purging. Sampling should occur in a progression from least to most contaminated well, if this is known. Generally, volatile (e.g., solvents and fuel constituents) and gas sensitive (e.g., Fe^{2+}, CH_4, H_2S/HS^-, alkalinity) parameters should be sampled first. The sequence in which samples for most inorganic parameters are collected is immaterial unless filtered (dissolved) samples are desired. Filtering should be done last and in-line filters should be used as discussed above. During both well purging and sampling, proper protective clothing and equipment must be used based upon the type and level of contaminants present.

The appropriate sample container will be prepared in advance of actual sample collection for the analytes of interest and include sample preservative where necessary. Water samples should be collected directly into this container from the pump tubing.

Immediately after a sample bottle has been filled, it must be preserved as specified in the site (QAPP). Sample preservation requirements are based on the analyses being performed (use site QAPP, FSP, RCRA guidance document [U. S. EPA, 1992] or EPA SW-846 [U. S. EPA, 1982]). It may be advisable to add preservatives to sample bottles in a controlled setting prior to entering the field in order to reduce the chances of improperly preserving sample bottles or introducing field contaminants into a sample bottle while adding the preservatives.

The preservatives should be transferred from the chemical bottle to the sample container using a disposable polyethylene pipet and the disposable pipet should be used only once and then discarded.

After a sample container has been filled with ground water, a Teflon™ (or tin)-lined cap is screwed on tightly to prevent the container from leaking. A sample label is filled out as specified in the FSP. The samples should be stored inverted at 4°C.

Specific decontamination protocols for sampling devices are dependent to some extent on the type of device used and the type of contaminants encountered. Refer to the site QAPP and FSP for specific requirements.

I. Blanks

The following blanks should be collected:

(1) field blank: one field blank should be collected from each source water (distilled/deionized water) used for sampling equipment decontamination or for assisting well development procedures.

(2) equipment blank: one equipment blank should be taken prior to the commencement of field work, from each set of sampling equipment to be used for that day. Refer to site QAPP or FSP for specific requirements.

(3) trip blank: a trip blank is required to accompany each volatile sample shipment. These blanks are prepared in the laboratory by filling a 40-mL volatile organic analysis (VOA) bottle with distilled/deionized water.

V. Low-Permeability Formations and Fractured Rock

The overall sampling program goals or sampling objectives will drive how the sampling points are located, installed, and choice of sampling device. Likewise, site-specific hydrogeologic factors will affect these decisions. Sites with very low permeability formations or fractures causing discrete flow channels may require a unique monitoring approach. Unlike water supply wells, wells installed for ground-water quality assessment and restoration programs are often installed in low water-yielding settings (e.g., clays, silts). Alternative types of sampling points and sampling methods are often needed in these types of environments, because low-permeability settings may require extremely low-flow purging (<0.1 L/min) and may be technology-limited. Where devices are not readily available to pump at such low flow rates, the primary consideration is to avoid dewatering of the well screen. This may require repeated recovery of the water during purging while leaving the pump in place within the well screen.

Use of low-flow techniques may be impractical in these settings, depending upon the water recharge rates. The sampler and the end-user of data collected from such wells need to understand the limitations of the data collected; i.e., a strong potential for underestimation of actual contaminant concentrations for volatile organics, potential false negatives for filtered metals and potential false positives for unfiltered metals. It is suggested that comparisons be made between samples recovered using low-flow purging techniques and samples recovered using passive sampling techniques (i.e., two sets of samples). Passive sample collection would essentially entail acquisition of the sample with no or very little purging using a dedicated sampling system installed within the screened interval or a passive sample collection device.

A. Low-Permeability Formations (<0.1 L/min recharge)

1. Low-Flow Purging and Sampling with Pumps

a. "portable or non-dedicated mode" - Lower the pump (one capable of pumping at <0.1 L/min) to mid-screen or slightly above and set in place for minimum of 48 hours (to lessen purge volume requirements). After 48 hours, use procedures listed in Part IV above regarding monitoring water quality parameters for stabilization, etc., but do not dewater the screen. If excessive drawdown and slow recovery is a problem, then alternate approaches such as those listed below may be better.

b. "dedicated mode" - Set the pump as above at least a week prior to sampling; that is, operate in a dedicated pump mode. With this approach significant reductions in purge volume should be realized. Water quality parameters should stabilize quite rapidly due to less disturbance of the sampling zone.

2. Passive Sample Collection

Passive sampling collection requires insertion of the device into the screened interval for a sufficient time period to allow flow and sample equilibration before extraction for analysis. Conceptually, the extraction of water from low yielding formations seems more akin to the collection of water from the unsaturated zone and passive sampling techniques may be more appropriate in terms of obtaining "representative" samples. Satisfying usual sample volume requirements is typically a problem with this approach and some latitude will be needed on the part of regulatory entities to achieve sampling objectives.

B. Fractured Rock

In fractured rock formations, a low-flow to zero purging approach using pumps in conjunction with packers to isolate the sampling zone in the borehole is suggested. Passive multi-layer sampling devices may also provide the most "representative" samples. It is imperative in these settings to identify flow paths or water-producing fractures prior to sampling using tools such as borehole flowmeters and/or other geophysical tools.

After identification of water-bearing fractures, install packer(s) and pump assembly for sample collection using low-flow sampling in "dedicated mode" or use a passive sampling device which can isolate the identified water-bearing fractures.

VI. Documentation

The usual practices for documenting the sampling event should be used for low-flow purging and sampling techniques. This should include, at a minimum: information on the conduct of purging operations (flow-rate, drawdown, water-quality parameter values, volumes extracted and times for measurements), field instrument calibration data, water sampling forms and chain of custody forms. See Figures 2 and 3 and "Ground Water Sampling Workshop – A Workshop Summary" (U. S. EPA, 1995) for example forms and other documentation suggestions and information. This information coupled with laboratory analytical data and validation data are needed to judge the "useability" of the sampling data.

VII. Notice

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Figure 2. **Ground Water Sampling Log**

Project ______________ **Site** ______________ **Well No.** ____________ **Date** ______________________

Well Depth ____________ **Screen Length** __________ **Well Diameter** _________ **Casing Type** ____________

Sampling Device _______________ **Tubing type** _____________________ **Water Level** ________________

Measuring Point __________________ **Other Infor** ____

____

Sampling Personnel ____

Time	pH	Temp	Cond.	$Dis.O_2$	Turb.	[ ]Conc			Notes

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi\ r^3$

Figure 3. **Ground Water Sampling Log** (with automatic data logging for most water quality parameters)

Project ______________ **Site** ______________ **Well No.** ____________ **Date** ____________________

Well Depth ___________ **Screen Length** _________ **Well Diameter** ________ **Casing Type** __________

Sampling Device ______________ **Tubing type** ____________________ **Water Level** _______________

Measuring Point __________________ **Other Infor** ____

____

Sampling Personnel ____

Time	Pump Rate	Turbidity	Alkalinity	[ ] Conc	Notes

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi r^3$

APPENDIX E

WASTE MANAGEMENT PLAN

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1.0 WASTE MANAGEMENT PLAN

1.1 OBJECTIVES AND SCOPE OF WORK

The following sections describe procedures and protocols for handling waste materials generated during the RD/RA activities. Potential types of wastes that may be generated include, but may not be limited to the following:

- Concrete/asphalt
- Excavated soils
- Drill cuttings
- Construction materials/debris (e.g., pipe)
- Waste water including well development water
- Personal Protection Equipment (PPE)

The following activities will be conducted as part of the Site RD/RA work plan:

- Concrete/asphalt removal and off site disposal
- Excavation and backfilling
- Installation of shoring structures in deep excavation
- Temporary stockpiling of excavated soil
- Off-Site disposal of excavated soil unsuitable as backfill
- Collection and off-Site disposal of drill cuttings and general waste (e.g., PPE)
- Installation of a cap with potential for excavation of soil from proposed cap area
- Installation of monitoring wells and groundwater sample collection
- Installation of geotechnical boreholes and collection of soil/geotechnical samples
- In-situ hydraulic conductivity tests in overburden wells
- Packer-pumping or packer-injection tests in bedrock well

1.2 SITE PREPARATION

Prior to commencement of pre-design and construction activities, several temporary support facilities will be established at the Site. These additional support facilities will include:

Equipment Decontamination Area

An equipment decontamination area will be constructed prior to initiating ground intrusive work. Equipment and vehicles will be routed through this facility for decontamination and inspection prior to exiting the Site. A low-volume, high-pressure washer will be located at the decontamination facility for equipment cleaning. Liquid waste water generated from decontamination activities shall be collected in drums and temporarily stored in the waste staging area prior to off-Site disposal.

Waste Staging Area

A waste staging area will be constructed with an impermeable base and perimeter spill containment berm. The waste staging area will be used for temporary storage of drummed or containerized waste prior to off-Site disposal. In addition, the waste staging area will also function as a loading zone for drums/containers. Rainwater that comes in contact with contaminated material will be collected and disposed off Site.

Exclusion Zone

An exclusion zone (EZ) will be established around all areas where potentially impacted materials are to be excavated, handled or temporarily stored, and all areas where contaminated equipment or personnel travel. Work areas included within the EZ will be: excavation areas, waste staging area, and the decontamination area.

Demarcation of the EZ perimeter will be made by means of temporary construction fencing and/or barrier rope and colored tape which will be fixed at regular intervals to T-bars driven into the ground. Access to the EZ will be provided from the decontamination facility only.

Contaminant Reduction Zone

The contaminant reduction zone (CRZ) will be located at the interface of the EZ and Clean Zone and will provide for the decontamination of vehicles/equipment that have contacted potentially contaminated materials prior to leaving the EZ, the decontamination of personnel and removal of PPE prior to entering the Clean Zone and for the physical segregation of the Clean Zone and EZ.

Clean Zone

The clean zone (CZ) is the portion of the Site defined as being the area outside the zone of significant air and waste contamination. The function of the CZ includes:

- Site entry for personnel, material and equipment
- Parking for personal vehicle
- The equipment compound

Site activities and controls shall be designed to prevent migration of contamination into the CZ from the EZ.

1.3 CONCRETE/ASPHALT AND SOILS

Excavation will be conducted utilizing a conventional track mounted hydraulic backhoe. Concrete and asphalt will first be cut, removed and brushed clean to remove loose soil. The concrete and asphalt will be placed in roll offs for waste characterization sampling and off site disposal/recycling. Excavated soils suitable for backfilling shall be temporarily stockpiled in the waste staging area for future use as backfill. Material that cannot be used for backfill will be loaded directly into roll-off waste bins and characterized for proper off-Site disposal. Drill cuttings will be placed directly into roll-off waste bins or drums and characterized for proper off-Site disposal.

Waste characterization samples will be analyzed for TCLP metals, TCLP VOCs, TCLP SVOCs, PCBs, and RCRA characteristics.

1.4 WASTEWATER AND LIQUIDS

All liquids contacting waste materials (wastewater) will be collected in drums and stored in the waste staging area prior to being disposed off Site at a licensed liquid waste disposal facility. Wastewaters are anticipated to include well development water and decontamination water. Wastewater waste characterization samples will be analyzed for metals, SVOCs, PCBs, VOCs and RCRA characteristics.

1.5 CONSTRUCTION MATERIALS/DEBRIS/PPE

Clean construction waste (e.g., cut pieces of piping, wrappings, bags, etc) will be placed in a separate roll off box and disposed off Site as a non-hazardous solid waste. Construction waste that has contacted potentially contaminated soils and used PPE will be placed in roll off containers along with the unsuitable excavated soils and drill cuttings and disposed off Site with that waste stream. Alternatively, if appropriate, the construction waste may be decontaminated and disposed off Site with the clean construction waste stream.