REMEDIAL INVESTIGATION WORK PLAN

BCP Site # C734148

The Smith Restaurant Building
500 Erie Boulevard East
City of Syracuse, Onondaga County, New York

Prepared for:

Smith Building, LLC
225 Wilkinson Street
Syracuse, New York 13204

September 2020

REVISION	DATE	SUMMARY OF REVISION

Asbestos & Environmental Consulting Corporation
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East Syracuse, New York 13057
(315) 432-9400

CERTIFICATION

I, H. Nevin Bradford, certify that I am currently a NYS registered professional engineer and that this Remedial Investigation Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

HENRY NEVIN BRADFORD III
No. 086008

H. Nevin Bradford
NYS Professional Engineer
(#086008)

September 9, 2020
Date

Signature / Stamp

It is a violation of Article 130 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 130, New York State Education.

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

COMMON ACRONYMS AND ABBREVIATIONS

AAI – All Appropriate Inquiries
ACM – Asbestos-Containing Material
AST – Aboveground Storage Tank
ASTM – American Society for Testing Materials International
BER – Business Environmental Risk
bgs – Below Ground Surface
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
CESQG – Conditionally Exempt Small Quantity Generator
CFR – Code of Federal Regulations
CP-51 – (NYSDEC) Commissioner’s Policy #51 (Soil Cleanup Guidance)
CREC – Controlled Recognized Environmental Condition
DEC – Department of Environmental Conservation
EDR – Environmental Data Resources (Company)
ESA – Environmental Site Assessment
FOIA/FOIL – Freedom of Information Act/Law
GIS – Geographic Information Systems
GWS – Groundwater Standard
HREC – Historical Recognized Environmental Condition
LBP – Lead-Based Paint
LQG – Large Quantity Generator
N/A – Not Applicable
NRCS – Natural Resource Conservation Service
NYSDEC – New York State Department of Environmental Conservation
PAH – Polycyclic Aromatic Hydrocarbons
PCB – Poly-Chlorinated Biphenyls
pCi/L – Picocuries per Liter
ppb – Parts Per Billion
ppm – Parts Per Million
RCRA – Resource Conservation and Recovery Act
REC – Recognized Environmental Condition
RSCO – Restricted Soil Cleanup Objective
SCO – Soil Cleanup Objective
SQG – Small Quantity Generator
SVOC – Semi-Volatile Organic Compound
TOGS – Technical & Operational Guidance Series 1.1.1 (NYSDEC)
USDA – United States Department of Agriculture
USEPA – United States Environmental Protection Agency
USGS – United States Geological Survey
UST – Underground Storage Tank
VOC – Volatile Organic Compound

1.0 SITE AND PROJECT BACKGROUND

1.1 SITE LOCATION AND DESCRIPTION

The Smith Restaurant Building property (Site) is located at 500 Erie Boulevard East in the City of Syracuse (see Figure 1).

1.1.1 Location

The Site is located on 0.334 acres. The BCP area comprises the entire property.

The Site is bordered to the north, northwest and northeast by Erie Boulevard and the Interstate 81/690 corridor, to the east by the Interstate 81/690 corridor, to the southeast by Water Street and a parking lot, to the south by Water Street and an abandoned parcel (recently demolished building), to the southwest by a Goodyear Tire Center (including auto repair), and to the west by a bank.

The Site is situated at an elevation of approximately 400 feet above mean sea level, and is generally flat. The surrounding area is also relatively flat. The nearest surface water feature is Onondaga Creek, located approximately 3,300 feet to the west of the Site.

1.1.2 Site Features

The existing building, which encompasses the majority of the Site, is comprised of two contiguous parts (totaling approximately 31,196 square feet):

- a three-story, timber framed (with exterior brick mass walls) section
- a six-story, steel framed (with concrete mass walls) section

In addition, two asphalt parking lots are located on the Site:

- a 2,000 square foot alcove to the north of the building, along Erie Boulevard East
- a 4,500 square foot lot in the eastern section of the Site, along Water Street

1.1.3 Current Zoning and Land Use

The Site is zoned Central Business District – Office and Service District Restricted (CBD-OSR). The current and proposed uses are in accordance with existing zoning. The surrounding parcels are currently utilized for commercial purposes. The nearest residential area is located more than 1,000 feet from the Site (on the opposite side of the Interstate 690 corridor).

1.2 OWNERSHIP AND USE

The subject site has historically been a restaurant supply company since at least 1946, when it was purchased by the current owner. Prior to (and in some cases, during) the current use, portions of the subject site had been used as a restaurant, laundry and cleaners facility, gasoline filling station, used car lot, mattress factory, toy warehouse, and other various industrial uses.

Prior to 1967, the Site was owned by Smith Restaurant Supply Co and Penfield Manufacturing. In 1967, the Site was combined into one property owned by Smith Restaurant Supply Co. From that time until 2019, the Site was owned by Smith Restaurant Supply Co. and/or its affiliates (the Serling's and Kupperman's). Smith Building, LLC (the BCP Volunteer) purchased the Site in 2019.

1.3 GEOLOGIC SETTING

According to New York State Geological Survey, the bedrock in the area of the Site is shale and dolostone (on border of Syracuse & Vernon Formation – Upper Silurian in age).

According to the USDA online soil survey database, the soil at the Site is considered 'Urban Land'. The term 'Urban Land' indicates that a significant portion of the Site is covered by impervious surface (i.e., buildings, pavement), or that soil has been significantly altered by past development activities. The characterization of Site soils as 'Urban Land' is not unexpected given the urban history of the Site and vicinity.

Previous investigation at the Site included the use of Geoprobe drilling techniques that encountered soil consisting of silt and clay, with alternating layers of fine to coarse sand and gravel. The Geoprobe investigation included eight boring locations and encountered refusal (estimated as bedrock or a similarly restrictive layer) at depths ranging from 20' to 24' below ground surface (bgs) at seven of the eight boring locations. Refusal was encountered at 13' bgs at one location on the Site.

Groundwater was encountered at depths ranging from approximately 12' - 16' bgs during previous investigation, and was determined to flow in a general east to west direction across the Site. Based on local topography, it is assumed that broader groundwater flow is to the west and northwest towards Onondaga Creek, en route to Onondaga Lake.

As the Site is situated in a dense urban environment, there are no surface waters or wetlands on or in the vicinity of the Site.

1.4 SITE ENVIRONMENTAL HISTORY

1.4.1 Past Uses of the Site

The Site supports a historical factory building which was constructed in 1853. A restaurant supply company and storage space has occupied the building since at least 1963. Prior to (and in some cases, during) the current use, portions of the building have been used as a restaurant, laundry and cleaner facility, gasoline filling station, used car lot, mattress factory, toy warehouse, and other various commercial and industrial uses. The eastern portion of the original building was demolished during the construction of the Interstate 81/690 corridor. The Site's existing eastern parking lot is located within the footprint of the demolished section of the building. The former Erie Canal was located along the northern property border of the Site (it was subsequently filled to create Erie Boulevard). Specific uses that appear to have led to contamination at the Site include:

- A gasoline filling station was located on the northern portion of the subject site as shown in historical Sanborn Maps (1951 map) and recorded in city directory records (listed as Lent Edgar H Gas Station in 1939). The gasoline filling station, which included three USTs, was constructed by 1939 and closed between 1951 and 1953.
- Patrick's 2-Hour Cleaning and Laundry was located in the one-story extension building on the northeast portion of the Site and operated at least between 1949 and 1955 based on city directory records.

As part of environmental due diligence, the Requestor procured a Phase I and Phase II ESA to be completed at the Site. No remedial actions have been completed at the Site. It is possible that the USTs associated with the gasoline filling station have been removed (no records were provided prior to the issuance of the ESA reports).

1.4.2 Prior On-Site Investigations

Note: When reviewing this section, it is recommended that the reader refer to the Summary of Analytical Exceedances drawings attached to this RIWP (Figures 3A, 3B, and 3C).

Phase I Environmental Site Assessment (ESA)

Recognized Environmental Conditions (RECs) associated with the Site were documented in a Phase I ESA Report prepared by EA Engineering, P.C. in 2019. In summary, the following RECs were identified:

- Approximately 30 ft to the southwest of the subject property, unknown quantities of contaminants were discovered during routine water main maintenance in 1996.
- A gas station operated at the subject property between at least 1939 and 1951, with three underground storage tanks. No closure documentation was identified.
- A dry-cleaning and laundry facility operated on the subject property between at least 1949 and 1955.
- A gas station operated approximately 100 ft to the east, from 1951 until at least 1961.
- Three underground storage tanks were associated with this facility, and no closure documentation was identified.
- A gas station operated approximately 100 ft to the northwest, in the 1950s and early 1960s.

Phase II Environmental Site Assessment (ESA)

To investigate these RECs, in September 2019, EA Engineering, P.C. performed field activities associated with a Phase II Environmental Site Assessment (ESA) of the Site. The scope of the Phase II ESA included a geophysical (ground-penetrating radar) survey, the advancement of 8 borings to a depth of approximately 20 feet, installation of temporary groundwater monitoring wells within each of the borings, the installation of two sub-slab vapor points in the northeast basement (area of former laundry), and the installation of an exterior soil vapor point in the northern parking lot (area of historic USTs). It was later determined that two of the borings/wells (SB/TW-04 and SB/TW-05) were actually located off-site.

Shallow soil samples (typically collected 1-4 feet below grade) and deep soil samples (typically ranging from 4-12 feet below grade) were collected and analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), Target Analyte List (TAL) metals, diesel-range organics (DRO), oil-range organics (ORO), gasoline-range organics (GRO), and asbestos.

Groundwater collected from 7 of the 8 monitoring wells (TW-08 was dry at the time of sampling) was analyzed for the same compounds as the soils (except asbestos).

Soil vapor was collected using a Summa canister and was analyzed for volatile organic compounds.

The requestor did not test for PCBs, pesticides, herbicides, 1,4-dioxane, or PFAS since these contaminants were not expected to be of primary concern.

Based on EA's November 2019 Phase II ESA report, the primary contaminants of concern are:

- Soils: Polycyclic Aromatic Hydrocarbons (PAHs), lead, GRO, DRO, and ORO. Asbestos was not detected in the soil samples.

- Groundwater: Chlorinated solvents (chloroform and tetrachloroethene) and lead

- Soil Vapor: Chlorinated solvents (chloroform, tetrachloroethene,, trichloroethene, etc.) and petroleum (benzene, ethylbenzene, naphthalene, etc.)

Within soils, the following contaminants were detected above Restricted Residential Soil Cleanup Objectives (SCOs):

- Individual PAHs (Benzo[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, etc.) exceeded their respective SCOs by a factor of approximately 2 in the south-central and northwestern portion of the Site, and by a factor of approximately 10 - 20 in the north-central portion of the Site.

- Lead exceeded its respective SCO by a factor of approximately 1.2 - 7 in the northern portion of the Site.

- Also of note, DRO and/or ORO were detected in soils across the Site; and staining, odors, and GRO were detected in the north-central portion of the Site. Note that GRO, DRO, and ORO do not have applicable standards / SCOs, but their presence may be indicative of weathered / degraded petroleum contamination.

Within groundwater, the following contaminants were detected above applicable TOGS 1.1.1 groundwater standards:

- Chloroform (10-11 ppb) exceeded the groundwater standard of 7 ppb in the central and northwestern portions of the Site

- Tetrachloroethene (7.6-9.6 ppb) exceeded the groundwater standard of 5 ppb in the east-central and south-central portions of the Site

- Lead (110 ppb) exceeded the groundwater standard of 25 ppb in one sample from the northwest corner of the Site.

Soil vapor and sub-slab vapor sampling were limited to the north-central and northeastern portions of the Site. Within soil vapor, the following contaminants were detected above applicable NYSDOH standards (i.e. – “Mitigate” levels):

- Trichloroethene (70 - 350 ug/m^3)

- Tetrachloroethene (7,400 ug/m^3)

The results of the soil, groundwater, and soil vapor testing correspond to the locations of historical gasoline USTs in the northern portion of the Site, historical drycleaning operations in the central portion of the Site, and typical urban fill used throughout the Site.

The geophysical survey did not detect anomalies at the location of the historic USTs, and therefore, it is assumed that the USTs were previously removed.

Hazardous Materials Pre-Renovation Survey

A Hazardous Materials Pre-Renovation Survey was completed by AECC in June 2019, in accordance with applicable Federal and State regulations. The scope of the survey included asbestos-containing building materials, lead-based paint, PCBs in caulk, and an inventory of miscellaneous / hazardous wastes. Several asbestos-containing building materials, lead-based paints, and PCB caulks were identified. The presence of asbestos debris required a subsequent asbestos contamination assessment, which revealed that asbestos fibers were limited to the visual debris field. The presence of the asbestos-containing building materials, asbestos debris, lead-based paint, PCBs in caulk, and miscellaneous / hazardous wastes will not impact the RI activities.

2.0 WORK PLAN

The objective of this Work Plan is to describe the steps associated with the Remedial Investigation (RI) activities to further characterize soils and groundwater in specific areas on the Site. The previous assessments and investigations conducted by AECC serve as the basis for conducting the RI activities as described in the following section of this Work Plan. The purposes of the RI activities are to further delineate the limits of impacted soil and groundwater that were identified during previous environmental investigations, and to further assess the potential for off-site migration of constituents from the Site.

See the Section 3.0 - Sampling and Analysis Plan for additional details.

2.1 GENERAL PROTOCOLS

2.1.1 Site Preparation

All sample location points are easily accessed by a standard truck- or track-mounted drilling rig.

Once the sample locations are accepted by the NYSDEC, the coordinates of the locations will be logged in the field.

In order to collect near-surface soil samples (i.e. – soil immediately beneath the existing asphalt/concrete), and excavator will be used to break up the asphalt/concrete at the sample location.

2.1.2 Soil Screening Methods

Visual and instrument-based soil screening will be performed by an environmental professional when advancing borings, test pits, etc. into known or potentially contaminated material.

When applicable, soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal, material that requires testing, and material that can be returned to the subsurface.

2.1.3 Investigation-Derived Waste Management

Investigation-Derived Waste (IDW) is expected to be placed in sealed drums or containers. However, in case material needs to be stockpiled, the following protocols will be followed:

- Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

- Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

- Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by NYSDEC.

2.1.4 Materials Excavation and Load Out

An environmental professional or person under their supervision will oversee intrusive work and the excavation and load-out of containerized / stockpiled material.

The owner of the Site and the contractors performing the work are solely responsible for safe execution of all intrusive and other work performed under this Plan.

The 2019 geophysical report will be reviewed by the contractors performing the work to determine the presence of utilities and easements. It will be determined whether a risk or impediment to the planned work is posed by utilities or easements on the site.

Egress points for truck and equipment transport will be inspected daily to verify they are clean of dirt and other materials derived from the site during intrusive excavation activities. As the Site is currently covered with asphalt/concrete, a truck wash will be not be necessary. However, if conditions change and the asphalt/concrete cover is removed to a significant degree, an environmental professional will be responsible for ensuring that outbound equipment / trucks are washed at a truck wash before leaving the site, until the activities performed under this section are complete. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

2.1.5 Materials Transport Off-Site

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

Transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

2.1.6 Materials Disposal Off-Site

Soil/fill/solid waste excavated and removed from the site will be treated as contaminated and regulated material, and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from this site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will provided to NYSDEC. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C&D recycling facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2, unless otherwise authorized by the NYSDEC. Material that does not meet Track 1 unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

2.1.7 Materials Re-Use On-Site

No re-use of IDW is anticipated during the Remedial Investigation.

2.1.8 Fluids Management

All liquids to be removed from the site, including excavation dewatering and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the site, but will be managed off-site.

2.1.9 Backfill From Off-Site Sources

Backfill is not expected to be necessary during the Remedial Investigation. However, in case backfill needs to be imported, the following protocols will be followed:

- All materials proposed for import onto the site will be approved by the NYSDEC and qualified environmental professional and will be in compliance with NYSDEC provisions prior to receipt at the site.

- Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

- All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Based on an evaluation of the land use, protection of groundwater and protection of ecological resources criteria, the resulting soil quality standards are the Commercial Use RSCOs listed in the table presented in 6NYCRR375-6.8(b). Soils that meet ‘exempt’ fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Solid waste will not be imported onto the site.

- Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

2.1.10 Stormwater Pollution Prevention

Since the area being disturbed during the Remedial Investigation will not exceed 1 acre in size, a Storm Water Pollution Prevention Plan (SWPPP) that conforms to the requirements of NYSDEC Division of Water guidelines and NYS regulations is not necessary. However, the following “Best Management Practices” will be followed if sediment is observed leaving the Site:

- Barriers, silt fencing, or hay bales will be installed and inspected once a week and after every storm event. All necessary repairs shall be made immediately.
- Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.
- All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.
- Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.
- Erosion and sediment control measures shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

2.1.11 Contingency Plans

If underground tanks or other previously unidentified contaminant sources are found during the investigation, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment, and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a comprehensive list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and herbicides, TCL PCBs, 1,4-dioxane, and PFAS), unless the site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC’s Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Remedial Investigation report.

2.1.12 Odor Control Plan

This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include covering odorous soils with polyethylene sheeting or similar tarp/cover. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the qualified environmental professional, and any measures that are implemented will be discussed in the Remedial Investigation report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

2.1.13 Dust Control Plan

Based on the nature of the proposed work, it is not expected that the Remedial Investigation activities will result in dust generation that would require suppression. However, should conditions be observed during the work that suggest that off-site migration of dust is occurring or may potentially occur, the following dust mitigation provisions will be implemented:

- Dust suppression will be achieved through the use of a dedicated on-site water truck. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.

- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.

- Gravel will be used on highly trafficked areas to provide a clean and dust-free road surface.

- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

2.1.14 Noise

The contractor shall ensure compliance with local noise control ordinances.

2.2 REMEDIAL INVESTIGATION (RI) ACTIVITIES

Note that as part of the 2019 Phase II ESA, the laboratory provided a Category B deliverable, the data was validated, and a Data Usability Summary Report was prepared. Therefore, the data generated during the 2019 Phase II ESA can be relied upon for the RI.

2.2.1 Soil and Groundwater Investigation

The purpose of the proposed soil and groundwater investigation is to supplement the data collected during the 2019 Phase II ESA at the Site.

To this end, the 6 previous on-site boring/well locations will be “re-drilled”, and two additional boring/well locations will be installed within the interior of the building (see Figure 2).

See Section 3.0 – Sampling and Analysis Plan for details regarding the tasks associated with the following scope items.

Previous Boring/Well Locations

Borings will be advanced adjacent to the following borings advanced during the 2019 Phase II ESA: SB-01, SB-02, SB-03, SB-06, SB-07, and SB-08.

Near-surface soil samples will be collected from each boring, at a depth immediately below the existing asphalt/concrete cover. Each near-surface soil sample will be analyzed for TCL VOCs, TCL SVOCs (including 1,4-dioxane), TAL metals, Hexavalent Chromium (Hex Cr), TCL PCBs, TCL pesticides, and TCL herbicides.

Shallow soil samples (typically 1-4 feet below grade) and deep soil samples (typically ranging from 4-12 feet below grade) collected as part of the RI will be collected at the same depths as the 2019 Phase II ESA samples. Since the shallow and deep soils collected during the 2019 Phase II ESA were analyzed for TCL VOCs, TCL SVOCs, and TAL metals, the soil samples collected as part of the RI will be analyzed for Hex Cr, TCL PCBs, TCL pesticides, and TCL herbicides. Soils from two borings (to be determined in the field) will also be analyzed for 1,4-dioxane and PFAS.

Monitoring wells will be installed in each of the 6 borings to allow for the collection of groundwater samples for laboratory analysis and to assist with the determination of groundwater depth and flow direction. Since the groundwater collected during the 2019 Phase II ESA was analyzed for TCL VOCs, TCL SVOCs, and TAL metals, the groundwater samples collected as part of the RI will be analyzed for Hex Cr, TCL PCBs, TCL pesticides, and TCL herbicides. Groundwater from two wells (to be determined in the field) will also be analyzed for 1,4-dioxane and PFAS.

New Boring/Well Locations

AECC will advance two borings within the interior of the existing building. The first (SB-09) will be advanced in the northeastern basement (location of the historic laundry); while the second (SB-10) will be advanced through the existing slab-on-grade in the central portion of the building.

A soil sample will be collected at each location for analysis of TCL VOCs, TCL SVOCs (including 1,4-dioxane), TAL metals, Hex Cr, TCL PCBs, TCL pesticides, and TCL herbicides. Soils from one of the two borings (the boring with the highest yield) will also be analyzed for PFAS.

Monitoring wells will be installed both borings to allow for the collection of groundwater samples for laboratory analysis and to assist with the determination of groundwater depth and flow direction. A groundwater sample will be collected at each location for analysis of TCL VOCs, TCL SVOCs, TAL metals, Hex Cr, TCL PCBs, TCL pesticides, and TCL herbicides. Groundwater from one of the two wells (the well with the highest yield) will also be analyzed for 1,4-dioxane and PFAS.

2.2.2 Off-Site Investigation Activities

No off-site investigation activities are planned as part of the RI.

2.2.3 Soil-Vapor Intrusion Evaluation

Since a sub-slab depressurization system will be installed in the existing building as a Remedial Action, no soil vapor samples will be collected as part of the RI.

2.2.4 Supplemental Investigation Work Plan (if necessary)

If sampling and analysis of soils and/or groundwater reveals concentrations of contaminants above applicable standards (Part 375 Restricted Residential Use standards for soils and TOGS 1.1.1 standards/guidelines for groundwater) and the NYSDEC Project Coordinator deems it necessary, Smith Building, LLC and the NYSDEC will negotiate a supplemental sampling plan to include the sampling of additional boring and/or well locations. If contaminants commonly associated with dense non-aqueous phase liquid (DNAPL) plumes (ex - chlorinated solvents) are determined to be a concern that required further investigation, the supplemental sampling plan may include the installation and sampling of deep wells. Deep groundwater depths would be measured (and flow direction determined) if deep groundwater wells are installed.

2.3 QUALITATIVE HEALTH RISK ASSESSMENT

In an effort to assess potential site impacts on human health and the environment, a qualitative human health risk assessment will be completed. This risk assessment will include a contaminant exposure and toxicity assessment.

The results of this focused qualitative risk assessment will be used to develop an overall characterization of risk to humans and the environment. The focused risk assessment will assess the following aspects, based on current and historic site specific analytical data:

- Identification of potential receptors
- Contaminant identification and selection of indicator compounds and chemicals of concern
- Exposure assessment to identify actual or potential exposure pathways and the extent or amount of exposure
- Toxicity assessment and dose response information
- Risk characterization of the potential risks or adverse health or environment effects for each of the exposure scenarios

2.4 DATA USABILITY

A data usability review effort will be completed for the analytical data generated as part of the investigation, consistent with NYSDEC-DUSR Guidance for this type of project. As part of this effort, a general evaluation of field records and analytical data will be performed to assess whether the data are accurate and defensible.

2.5 REPORT PREPARATION

Upon completion of the RI activities and following receipt of laboratory analysis of the soil and groundwater samples collected from at the Site, AECC will prepare a report in accordance with DER-10 that summarizes the RI activities and the results of the laboratory analyses. The RI sections of the report will identify or otherwise address the amount, concentration, persistence, mobility, state, and other relevant characteristics of the contaminants identified at the site.

Electronic data deliverables (EDDs) for each report will also be submitted in EQuIS format.

2.6 PROJECT SCHEDULE

The following project schedule is proposed. Note that due to the required coordination between State agencies, additional time to obtain approvals and complete each task may be necessary. In such a case, the project schedule will be revised.

Submit Remedial Investigation Work Plan	**July 2020**
End 30 Day RI Comment Period	August 2020
DEC Approval of Remedial Investigation Work Plan	August 2020
Begin Investigation Field Work	July 2020*
Complete Investigation Field Work	July 2020*
Submit Draft Remedial Investigation Report	**September 2020**
Significant Threat Determination / Fact Sheet	September 2020
DEC Approval of Remedial Investigation Report	October 2020
Submit Remedial Action Work Plan with Alternatives Analysis	**September 2020**
End 45 Day Comment Period	October 2020
DEC Approval of Remedial Action Work Plan	October 2020
Submit Fact Sheet Announcing Start of Construction	October 2020
Begin Construction / Remediation	**November 2020**
Submit Environmental Easement Package	November 2020
Submit Draft Site Management Plan	**January 2021**
Submit Executed Environmental Easement Package	January 2021
DEC Approval of Site Management Plan	February 2021
Environmental Easement Recorded	February 2021
Submit Draft Final Engineering Report	**April 2021**
Complete Remediation	**April 2021**
DEC Approval of Draft Final Engineering Report	May 2021
Submit Fact Sheet Announcing Final Engineering Report	May 2021
Certificate of Completion	**June 2021**
Fact Sheet Describing Institutional/Engineering Controls	June 2021
Complete Construction	**June 2021**

*Due to schedule constraints, the RI field work is being conducted concurrently with the comment / review period of this RIWP.

3.0 SAMPLING AND ANALYSIS PLAN

This Sampling and Analysis Plan discusses the sampling procedures and methods to be used on the project for the collection of soil and groundwater samples, the procedures and methods to be followed by the laboratory, and Quality Assurance / Quality Control procedures that will assure the accuracy and precision of the data collection during the project.

3.1 FIELD SAMPLING PLAN

As described in Section 2.2, the RI activities will include the advancement of soil borings, collection of surface (or near-surface), shallow, and deep soil samples, and the installation and sampling of groundwater monitoring wells.

Soil and groundwater samples collected for laboratory analysis will be delivered to the laboratory at the completion of each sample delivery group. The soil and groundwater sampling procedures are described in more detail below.

3.1.1 Sampling Objective

Field sampling will be designed to obtain representative samples of environmental media in an effort to assess the impact that the site may have upon human health and the environment. The field sampling plan will include media sampling for groundwater, surface soils (or near-surface soils), and shallow and deep subsurface soils. The goal of this investigation is to establish the nature and extent of contamination at the site.

3.1.2 Soil Sampling Procedures

Soil sampling at the site will be conducted in accordance with various AECC SOPs as identified in the individual sections and provided in Appendix A. In general, the following steps will be followed for the collection of soil samples.

Surface and Near-Surface Soil Sampling – AECC SOP #101

Spoons, scoops, and trowels are of similarly designed construction and will therefore be used in accordance with the following procedures, unless an alternate method is described. Deviations from the standard operating procedures described herein and the rationale/justification for those deviations are to be recorded in the field logbook.

1. Don PPE as per the project HASP.
2. Select location and be sure that all surface preparation and soil sampling tools are decontaminated.
3. Prepare surface for sampling. Loosen soils by use of a long-handled shovel or pitchfork outside of the perimeter of the sample location.
4. Remove the bulk of the vegetated layer (plants and roots).
5. Use a disposable trowel to collect a representative sample of soil immediately beneath the vegetative layer.
6. The soils shall be screened with a PID to identify the presence or absence of volatile organic vapors. Soils shall be visually characterized with respect to color, grain size, consistency and moisture status. Each distinct layer shall be described using the Modified Burmister classification system.
7. If sampling for VOCs is required, collect this sample portion first.
8. If a specific depth interval has been targeted, collect soils from that depth into a collection pan.
9. If more soil is needed to meet sample volume requirements, additional soil may be collected from an immediately-adjacent location.
10. Homogenize the soil in the collection pan (excluding soil for VOC analysis) by mixing the soil in the collection pan with the sampling tool until a uniform mixture is achieved.
11. Transfer soil from the collection pan into the appropriate sample jars/containers using the sampling tool or a clean stainless steel teaspoon or spatula. Use of fingers should be avoided.
12. Once filled, the rim and threads of the sample container should be cleaned of gross soil by wiping with a paper towel, then capped and labeled. Do not submerge the sample containers in water to clean them.
13. Label the samples and place the containers into a cooler with wet ice that has been contained within sealed plastic bag(s) as soon as possible (immediately) after collection.
14. Log the samples in field notebook, chain of custody and other required documentation.

15. Handle samples for shipment to the laboratory.

16. Decontaminate sampling tools prior to reuse.

17. Investigation-derived waste (IDW) should be properly contained before leaving the area.

18. In order to eliminate surface hazard and/or the creation of a preferred path for contaminant migration, backfill the sampling location and restore the surface to as close to pre-sampling conditions as possible.

Subsurface Soils Sampling via Direct-Push / Geoprobe – AECC SOP #105

At increased depths, the effectiveness of spoons, scoops, and trowels decreases. Hand augers and similar equipment can be a suitable method for collecting soil samples at shallow depths, but have been deemed unfeasible for this project. Therefore, a mechanical method such as direct-push sampling may be warranted. Deviations from the standard operating procedures described herein and the rationale/justification for those deviations are to be recorded in the field logbook.

1. Don PPE as per the project HASP.

2. Decontaminate sampling tools and components that may come in contact with soil during sampling activities.

3. Assemble the sampling tube including the liner, discrete sample tooling (if appropriate), sand-basket (if appropriate), and cutting shoe.

4. Prepare the surface for direct-push sampling. Direct push tooling can generally penetrate several inches of asphalt and/or crushed stone surface materials.

5. The direct-push rig operator will thread on a push/drive cap on the top of the device and push the sample tube into the ground.

6. The direct-push rig operator removes the push/drive cap, replaces it with a pull-cap and pulls sampler from the ground with the machine hydraulics.

7. The sample tube is then opened, to allow the soil-filled liner to be removed so that it can be cut open by the project geologist/scientist/engineer to allow for soil classification/description, field-screening, sampling for laboratory analysis, etc.

8. The sampling tube and components that contact soil during the sampling process are decontaminated, re-assembled, with a new, disposable liner and the process is repeated. The advancement of the sampling tube to depth is achieved through the addition of drive-rods, each of which is typically the same length as the sampling tube (commonly 3, 4, or 5 feet in length).

9. Upon completion of the borehole, the hole is backfilled with soil cuttings or hydrated granular bentonite, or is completed as a piezometer or monitoring well.

Upon extraction of the liner from the direct-push sampling tube, the liner must be opened so as to expose the soils for visual classification/description, field screening and/or sampling for laboratory analysis. This is accomplished through the use of a liner cutting system, typically comprising a liner holder, and a liner cutter. The liner holder is a trough-like device that holds the liner securely in place so that it can be cut open.

The liner cutter is a tool affixed with two parallel hook-shaped blades that is drawn along the liner to cut a lengthwise opening in the liner for easy access and viewing of the sampled material. Liner cutters come in one-handle and two-handle varieties.

a) Place the soil-filled liner into the soil holder. Be sure that the liner holder is placed on a solid surface such as a sturdy work table, tailgate, etc.

b) Install the liner in the liner holder. Adjust the stop on the liner holder to secure the liner tightly in the holder.

c) Wearing leather work gloves, grasp the cutter by the handle(s) (avoid accidental contact with the blades) and place the cutter on the liner. The liner holder will usually have a bent bar that secures the liner in place, which provides resistance against the draw of the liner cutter. Begin the cut at the end of the liner opposite this bar. Be sure that blades are positioned just beyond the end of the liner to initiate the cut.

d) With slight downward pressure on the cutter, draw the cutter slowly and smoothly along the liner. If excessive force is required to open the liner, the cutter blades may be dull and should be replaced immediately.

e) When the cutter has been drawn the entire length of the liner, the cut section of the liner may be removed to access the sampled material.

f) The soils shall be screened with a PID to identify the presence or absence of volatile organic vapors. Soils shall be visually characterized with respect to color, grain size, consistency and moisture status. Each distinct layer shall be described using the Modified Burmister classification system.

g) If sampling for VOCs is required, collect this sample portion first.

h) Except for VOC sample fractions, the remainder of the soil sample from the interval of interest should be collected into the collection pan.

i) If more soil is needed to meet sample volume requirements, additional soil may be collected from an immediately-adjacent location.

j) Homogenize the soil in the collection pan (excluding soil for VOC analysis) by mixing the soil in the collection pan with the sampling tool until a uniform mixture is achieved.

k) Transfer soil from the collection pan into the appropriate sample jars/containers using the sampling tool or a clean stainless steel teaspoon or spatula. Use of fingers should be avoided.

l) Once filled, the rim and threads of the sample container should be cleaned of gross soil by wiping with a paper towel, then capped and labeled. Do not submerge the sample containers in water to clean them.

m) Label the samples and place the containers into a cooler with wet ice that has been contained within sealed plastic bag(s) as soon as possible (immediately) after collection.

n) Log the samples in field notebook, chain of custody and other required documentation.

o) Handle samples for shipment to the laboratory.

When using direct-push methods for collecting soil samples for VOC analysis, the drilling subcontractor shall not retrieve more than one subsequent sampler from the subsurface while the project geologist/scientist collects samples from a previous interval.

Subsurface Soils Sampling via Split Spoon Sampling – AECC SOP #104

Split spoon sampling is an alternative to direct push sampling. Deviations from the standard operating procedures described herein and the rationale/justification for those deviations are to be recorded in the field logbook.

1. Don PPE as per the project HASP.
2. The drilling contractor advances the hollow-stem augers to the required depth for sampling. A temporary center plug shall be used in the lead auger to prevent the auger from becoming filled with drill cutting during advancement.
3. At the top of the interval to be sampled, the driller stops the auger, disconnects the auger from the drill rig's drive head, and retrieves the temporary center plug.
4. The drilling subcontractor will lower the split-spoon attached to a length of center rods to the bottom of the borehole.
5. The top of the center rods are attached to a 140 pound slide-hammer (or similar).
6. The slide hammer is repeatedly raised via rope and cathead and dropped to drive the split-spoon sampling device into the ground.
7. The hammer is disconnected from the center rod and the center rod and split spoon is retrieved from the augers.
8. The split-spoon is then disarticulated to allow for soil classification/description, field-screening, sampling for laboratory analysis, etc.
9. The drilling contractor re-installs the temporary center plug and advances the auger to the top of the next interval to be sampled.
10. Steps 2 through 8 are repeated until the termination depth of the borehole is reached.
11. Upon completion of auguring and sampling, the borehole can be backfilled or completed as a piezometer or monitoring well.

Sampling soils from split-spoon for environmental laboratory analysis shall be conducted as described:

a) Once the split-spoon sampler has been opened, materials from the split-spoon can be removed using clean decontaminated/disposable spoons or spatulas.

b) The soils shall be screened with a PID to identify the presence or absence of volatile organic vapors. Soils shall be visually characterized with respect to color, grain size, consistency and moisture status. Each distinct layer shall be described using the Modified Burmister classification system.

c) If sampling for VOCs is required, collect this sample portion first.

d) Except for VOC sample fractions, the remainder of the soil sample from the interval of interest should be collected into the collection pan.

e) If more soil is needed to meet sample volume requirements, additional soil may be collected from an immediately-adjacent location.

f) Homogenize the soil in the collection pan (excluding soil for VOC analysis) by mixing the soil in the collection pan with the sampling tool until a uniform mixture is achieved.

g) Transfer soil from the collection pan into the appropriate sample jars/containers using the sampling tool or a clean stainless steel teaspoon or spatula. Use of fingers should be avoided.

h) Once filled, the rim and threads of the sample container should be cleaned of gross soil by wiping with a paper towel, then capped and labeled. Do not submerge the sample containers in water to clean them.

i) Label the samples and place the containers into a cooler with wet ice that has been contained within sealed plastic bag(s) as soon as possible (immediately) after collection.

j) Log the samples in field notebook, chain of custody and other required documentation.

k) Handle samples for shipment to the laboratory.

When using split-spoon methods for collecting soil samples for VOC analysis, the drilling subcontractor shall not retrieve more than one subsequent sampler from the subsurface while the project geologist/scientist collects samples from a previous interval.

3.1.3 Monitoring Well Construction, Installation, and Development Procedures

<u>Monitoring Well Construction, Installation, and Development – AECC SOP #107</u>

Monitoring wells will be installed at the site in accordance with AECC SOP #107. In general, the following steps will be followed for the installation of monitoring wells.

1. Each monitoring well shall be constructed using 2-inch Schedule 40 PVC. A 10-foot length (unless groundwater depth requires a shorter screen interval) of slotted PVC screen (10 slot) will be attached to the appropriate length of riser and placed in the well. The screen shall be placed so as to intersect the observed water table.

2. A uniformly graded washed silica sand pack shall be placed using a free drop method to establish a sand pack around the screen and extending 1-foot above the top of the screen.

3. A hydrated bentonite seal shall be placed immediately on top of the sand pack and shall extend for 2-feet.

4. A grout comprised of cement and bentonite shall be placed above the seal using tremie or gravity methods.

5. The well shall be completed with a locking surface completion (flush or stick-up) set in a concrete surface seal.

6. After 48 hours has passed to allow for hardening of the grout and full hydration of the seal, the well shall be developed using a surge and pump technique to remove sediment from the well bore and sand pack. Development shall continue until turbidity has reached 50 NTU's.

7. Sampling of the developed wells shall not occur until a minimum of 7-days has passed.

3.1.4 Groundwater Sampling Procedures

Groundwater Sampling – AECC SOP #106

Low-flow groundwater sampling at the site will be conducted in accordance with AECC SOP #106. In general, the following steps will be followed for the collection of groundwater samples.

1. The sampling technician will remove the well cap and, using a PID, test for VOC vapors immediately above well riser pipe. The PID reading will be recorded in the field logbook. This procedure will then be performed at each well to be sampled.

2. Using a peristaltic pump, each monitoring well will be purged utilizing low-flow techniques. A metering device will be used to monitor field parameters as listed below. Only after the meter readings indicate that the following acceptance criteria (USEPA EQASOP- GW 001, Rev. 3, updated January 19, 2010) have been achieved will the sample be collected:
   - *groundwater turbidity (10% for values >5 NTU)*
   - *temperature (3%)*
   - *pH (+ 0.1 unit)*
   - *specific conductance (3%)*
   - *dissolved oxygen (10% for values >5mg/L)*
   - *Oxygen/Reduction Potential (+ 10 millivolts)*

3. Purged groundwater will be placed into a 55-gallon drum which will be labeled, tightly covered, and temporarily stored on-site.

4. A sufficient volume of groundwater will be collected from each well to fill dedicated vials/jars.

5. The label on each sample jar will identify the sample location, date and time, and parameters to be analyzed.

Sampling for PFAS will be performed in accordance with the field sampling guidelines provided by Alpha Analytical (attached to the end of AECC SOP#106).

3.1.5 Sample Handling and Chain-of-Custody Procedures

Sample Handling, Packaging, & Shipping / Sample Labeling & COC – AECC SOPs #102 and #108

Upon completion of the soil and groundwater sampling for a particular day or period of time, the following procedures will be followed:

1. The sealed, labeled samples of soil and groundwater will be carefully packed into a cooler refrigerated with ice or ice packs for delivery to the laboratory for analysis.

2. Packing material may be placed around the sample jars inside the cooler to minimize the potential for sample container breakage that could occur during sample handling and delivery to the laboratory.

3. A chain-of-custody form will be properly completed, signed, and dated by all persons responsible for the collection and delivery of the soil and groundwater samples.

4. The chain-of-custody form will be placed into a sealable plastic bag, sealed, and placed inside the cooler to accompany the soil and groundwater samples from the time of collection until delivery to the laboratory within 24-hours from the time of collection.

3.1.6 Sample Identification

Samples of soil and groundwater will be identified and labeled to include the site name, the sample location, grid location (if applicable), and the sampling time and date. The following alphanumeric system will be used to identify each sample and will correspond with the sample location to be identified on a field-generated sampling diagram:

Sample Type	+	Location No.	+	Depth	=	Example Sample I.D
Soil – Test Pit		TP-01, 02…		(# - #”, # - #’)		TP-02 (48-60”)
Soil – Boring		SB-01, 02…		(# - #”, # - #’)		SB-02 (2-6”)
Groundwater		MW-01		N/A		MW-01
Blind Duplicate		SB, MW,		N/A		SB-D2, MW-D1

3.2 QUALITY ASSURANCE / QUALITY CONTROL PROCEDURES

A Quality Assurance Project Plan (QAPP) describes the manner in which quality assurance / quality control (QA/QC) procedures will be implemented during the RI activities to assure the accuracy and precision of the data collection. Guidance for the selection of QAPP objectives was obtained from NYSDEC’s *DER-10 Technical Guidance for Site Investigation and Remediation* (May 2010).

Quality Assurance (QA) refers to the conduct of all planned and systematic actions necessary to perform satisfactorily all task-specific activities and to provide information and data confidence as a result of such activities. The QA for task-specific activities includes the development of procedures, auditing, monitoring, and surveillance of the performance.

Quality Control (QC) refers to the activity performed to determine if the work activities conform to the requirements. This includes activities such as inspections of the work activities in the field. QA is an overview monitoring of the performance of QC activities through audits rather than first time inspections.

The project-specific QAPP is presented as Appendix B.

4.0 DECONTAMINATION PROCEDURES

The following procedures will be performed to decontaminate exploration equipment, sampling equipment, and personnel after each drilling/sampling event and equipment demobilization. See AECC Standard Operating Procedure #103 for additional details.

4.1 PERSONNEL DECONTAMINATION

Personnel will be required to follow procedures outlined in the Health and Safety Plan (see Appendix C).

4.2 EQUIPMENT DECONTAMINATION

Equipment will be decontaminated between uses, and at the end of each project phase (contractor demobilization).

4.2.1 Prior to Use On-Site

The drill rig, backhoe, and/or excavator will be steam-cleaned prior to their entrance to the site. Greases and oils will not be used on any down-hole equipment during drilling or exploration activities.

Hand-operated equipment, direct-push sampling tubes, split-spoons, etc. that have been used on other sites will be decontaminated according to the protocols detailed in Section 4.2.2 prior to their use on-site.

4.2.2 Reusable Equipment

The following steps will be employed to decontaminate reusable equipment:

1. Don PPE items appropriate to the characteristics of the contaminated material that was encountered (safety glasses, latex or nitrile gloves, and disposable Tyvek garment for example).
2. Remove gross contamination, dirt, etc from the equipment by brushing and rinsing with tap water. This step should be completed in a 5-gallon bucket or appropriately sized container.
3. Wash the equipment with a phosphate-free detergent and tap water solution. This step should be completed in a separate wash bucket using brush, or pressure sprayer.
4. Rinse the equipment with potable water until all detergent has been removed. This step can be performed over an empty bucket using a squeeze bottle or pressure sprayer.
5. Triple-rinse the equipment with distilled or de-ionized water. Rinsate should be collected in the bucket used in step 3.
6. Allow the equipment to air dry on clean plastic sheeting. If faster drying is required, use paper towels to blot the equipment dry before reuse.
7. Wrap the dried decontaminated equipment with aluminum foil, shiny side out, for storage until the equipment is to be used again. Alternately, small equipment can be placed into clean plastic bags and sealed for longer term storage.
8. Properly containerize and/or manage wash water and decontamination rinsate.

<u>Submersible Pumps</u>

When decontaminating submersible pumps used for groundwater sampling (or monitoring well development), the above-listed steps 2 and 3 may be conducted in a tube or cylinder that is sealed at the bottom end (commonly a 3-foot length of PVC pipe affixed with a water-tight end cap). The pump is inserted into the cylinder which is filled with the wash water, detergent solution, or rinse water and is turned on at a low setting for approximately five (5) minutes, so as to cycle the wash solutions through the pump’s impellers and internal components. After the pump is removed from the potable water rinse cycle, the triple-rinse is performed with copious amounts of distilled/deionized water, being sure to flush through the impellers.

Large Equipment Decontamination

On some projects, large equipment (excavators, backhoes, truck-mounted drilling equipment, etc.) is used for sampling or site characterization activities, and may become contaminated during site activities (or may require decontamination prior to use on site). Due to the asphalt/concrete cover at the Site, large equipment is not anticipated to become contaminated. However, if such a condition arises, the contractor will construct a temporary decontamination pad (typically consisting of a bermed, plastic-sheet lined area) where equipment and tooling can be brought for decontamination with a high-temperature high-pressure washer and/or manual scrubbing.

4.2.3 Disposable Equipment

In lieu of decontamination, disposable equipment will be placed in a dedicated 55-gallon drum or equivalent container for subsequent disposal.

4.2.4 Sample Containers

Upon filing and capping sample bottles, the outside of the bottle will be wiped off with a clean paper towel. These towels will be handled / managed as disposable equipment.

5.0 GENERAL SITE-SPECIFIC HEALTH AND SAFETY PLAN

A Health and Safety Plan (HASP) sets forth requirements for maintaining the health and safety of persons at the Site. The HASP addresses general health and safety issues related to the presence of specific chemical and physical hazards that may be encountered during performance of the work activities at the Site. The HASP includes an Emergency Response Plan, which presents the procedures to be followed in the event of an emergency situation.

The site-specific Health and Safety Plan is presented as Appendix C.

6.0 COMMUNITY AIR MONITORING PLAN

The intent of the CAMP 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 investigative and remedial work activities. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air. The action levels specified within the Plan require increased monitoring, corrective actions to abate emissions, and / or work shutdown.

Continuous monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) will be required for all ground intrusive activities, including but not limited to, soil excavation and handling, trenching, and the installation of monitoring wells. CAMP monitoring is not required for this project when using hand tools for shallow soil sampling, provided that sampling does not occur during extremely dry or windy conditions to minimize any off-site migration of contaminated soil particles.

The site-specific CAMP, prepared in accordance with Appendix 1A of DER-10, is presented as Appendix D.

7.0 CITIZEN PARTICIPATION PLAN

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well-being. NYSDEC provides opportunities for citizen involvement and encourages early two-way communication with citizens before decision makers form or adopt final positions.

A Citizen Participation Plan (CPP) provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the site identified above. The public information and involvement program will be carried out with assistance, as appropriate, from the Applicant.

A site-specific CPP has been approved by the NYSDEC and is available for review at the document repository. The CPP activities that will be conducted during the RI include:

- Maintaining and updating the Site Contact List
- Distributing a fact sheet to the individuals / entities listed on the Site Contact List regarding the proposed RI activities and announcing a 30-day public comment period for the RIWP
- Conducting the 30-day public comment period
- Delivering the RI report to the document repository upon completion.
- Distributing a fact sheet to the Site Contact List that describes the results of the RI

Tables

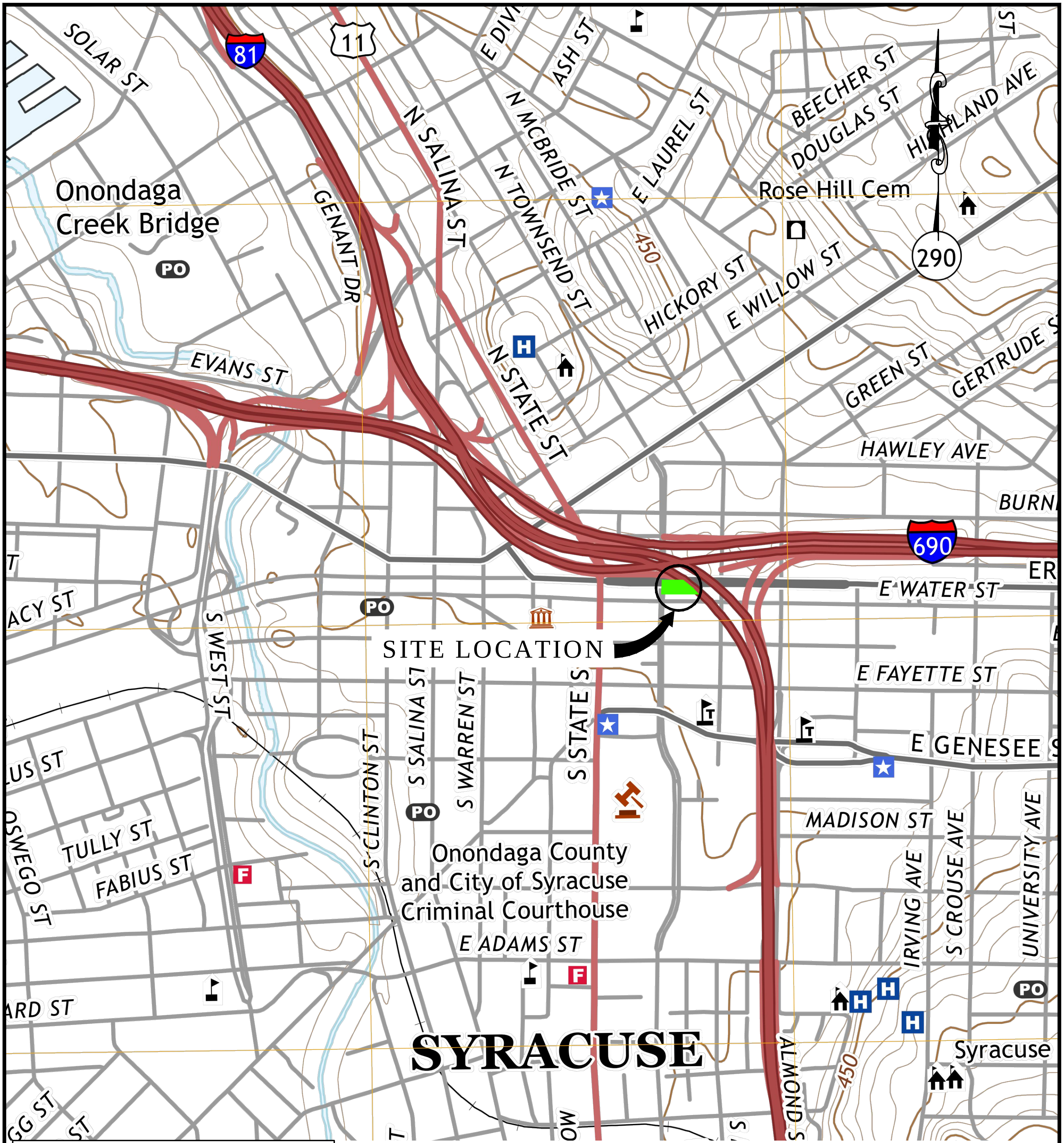
Summary of Past and Proposed Sample Locations

Table 1: Sample and Analysis Summary

Boring/Well Location	Type of Sample	Analysis								
		TCL VOCs	TCL SVOCs	TAL Metals	Hex Cr	TCL PCBs	TCL Pesticides	TCL Herbicides	1,4-Dioxane	PFAS
SB/MW-01	Surface Soil	X	X	X	X	X	X	X	X	
	Shallow Soil	P	P	P	X	X	X	X		X
	Deep Soil	P	P	P	X	X	X	X	X	
	Groundwater	P	P	P	X	X	X	X	X	X
SB/MW-02	Surface Soil	X	X	X	X	X	X	X	X	
	Shallow Soil	P	P	P	X	X	X	X		
	Deep Soil	P	P	P	X	X	X	X		
	Groundwater	P	P	P	X	X	X	X		
SB/MW-03	Surface Soil	X	X	X	X	X	X	X	X	
	Shallow Soil	P	P	P	X	X	X	X		
	Deep Soil	P	P	P	X	X	X	X		
	Groundwater	P	P	P	X	X	X	X		
SB/MW-06	Surface Soil	X	X	X	X	X	X	X	X	
	Shallow Soil	P	P	P	X	X	X	X		
	Deep Soil	P	P	P	X	X	X	X		
	Groundwater	P	P	P	X	X	X	X	X	X
SB/MW-07	Surface Soil	X	X	X	X	X	X	X	X	
	Shallow Soil	P	P	P	X	X	X	X		
	Deep Soil	P	P	P	X	X	X	X		
	Groundwater	P	P	P	X	X	X	X		
SB/MW-08	Surface Soil	X	X	X	X	X	X	X	X	
	Shallow Soil	P	P	P	X	X	X	X		
	Deep Soil	P	P	P	X	X	X	X	X	X
	Groundwater	P	P	P	X	X	X	X		
SB/MW-09	Sub-Slab Soil	X	X	X	X	X	X	X	X	X
	Groundwater	X	X	X	X	X	X	X	X	X
SB/MW-10	Sub-Slab Soil	X	X	X	X	X	X	X	X	
	Groundwater	X	X	X	X	X	X	X		

- P = Previously sampled and analyzed as part of 2019 Phase II ESA
- X = To be sampled and analyzed as part of RI
- Locations of 1,4-Dioxane and PFAS are subject to change based on boring / well conditions (i.e. - volume)
- A blind duplicate, matrix spike, and matrix spike duplicate will be submitted for soil samples at a rate of 1 for every 20 samples collected.
- A trip blank (VOCs), blind duplicate, matrix spike, and matrix spike duplicate will be submitted for aqueous samples at a rate of 1 for every 20 samples collected. In addition, one field duplicate and one equipment blank will be submitted for PFAS samples.

Figures



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SOURCE: USGS SYRACUSE WEST
QUADRANGLE, 7.5 SERIES.
SYRACUSE WEST, NY 2019

0 1,000' 2,000'

AECC
ENVIRONMENTAL CONSULTING

Asbestos & Environmental
Consulting Corporation

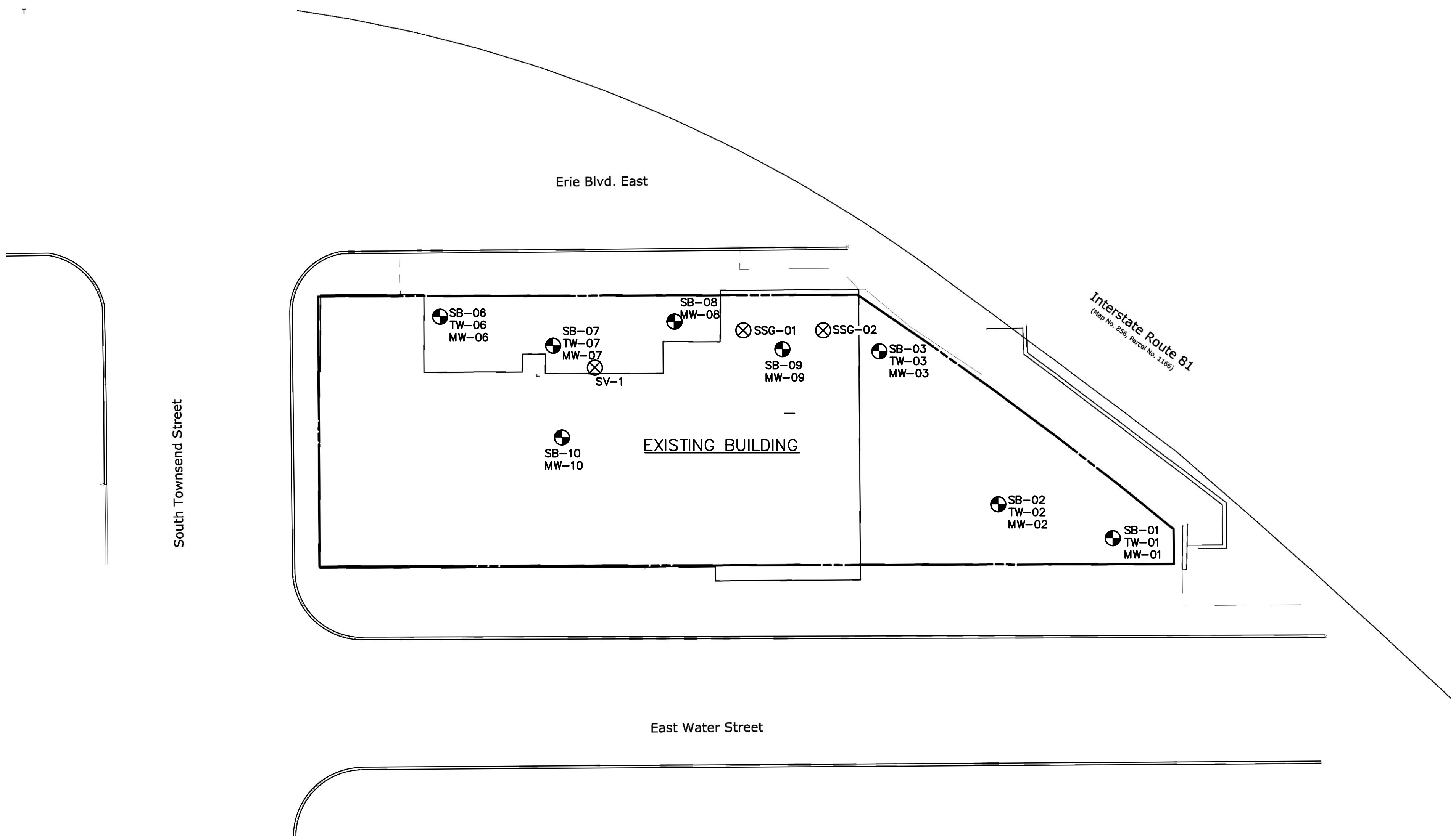
6308 Fly Road
East Syracuse, NY 13057

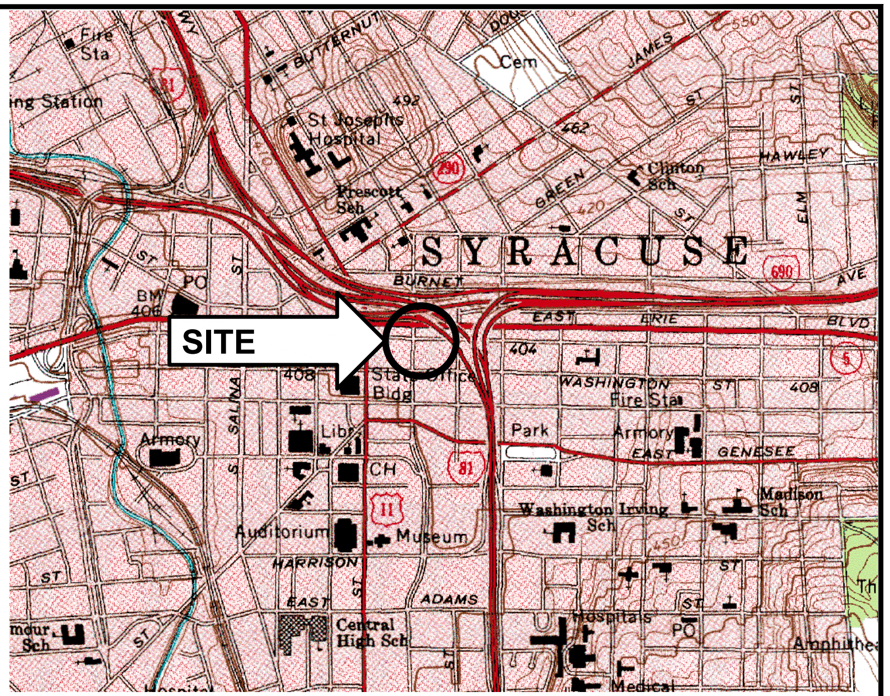
PROJECT NO. 20-032
DRAWN: FEB 2020
DRAWN BY: NP
CHECKED BY: RM

SITE LOCATION PLAN

Smith Restaurant Building
500 Erie Boulevard East
Syracuse, New York 13202

FIGURE
1





SITE LOCATION

LEGEND:

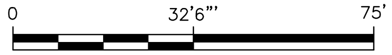
— — — APPROXIMATE PROPERTY LINE

● BORING / WELL LOCATION

⊗ SOIL VAPOR POINT LOCATION

NOTES:

1. PROPERTY LINE AND BUILDING PER ENGINEERING DOCUMENT PG 47 SITE PLAN DATED JULY 2019 .
2. ALL LOCATIONS ARE APPROXIMATE.



GRAPHIC SCALE

AECC
ENVIRONMENTAL CONSULTING
Asbestos & Environmental
Consulting Corporation

6308 Fly Road
East Syracuse, NY 13057

PROJECT NO. 20-032
DRAWN: FEB. 2020
DRAWN BY: NP
CHECKED BY: RW

Sample Location Plan

Smith Restaurant Building
500 Erie Boulevard East
Syracuse, New York 13202

FIGURE
2

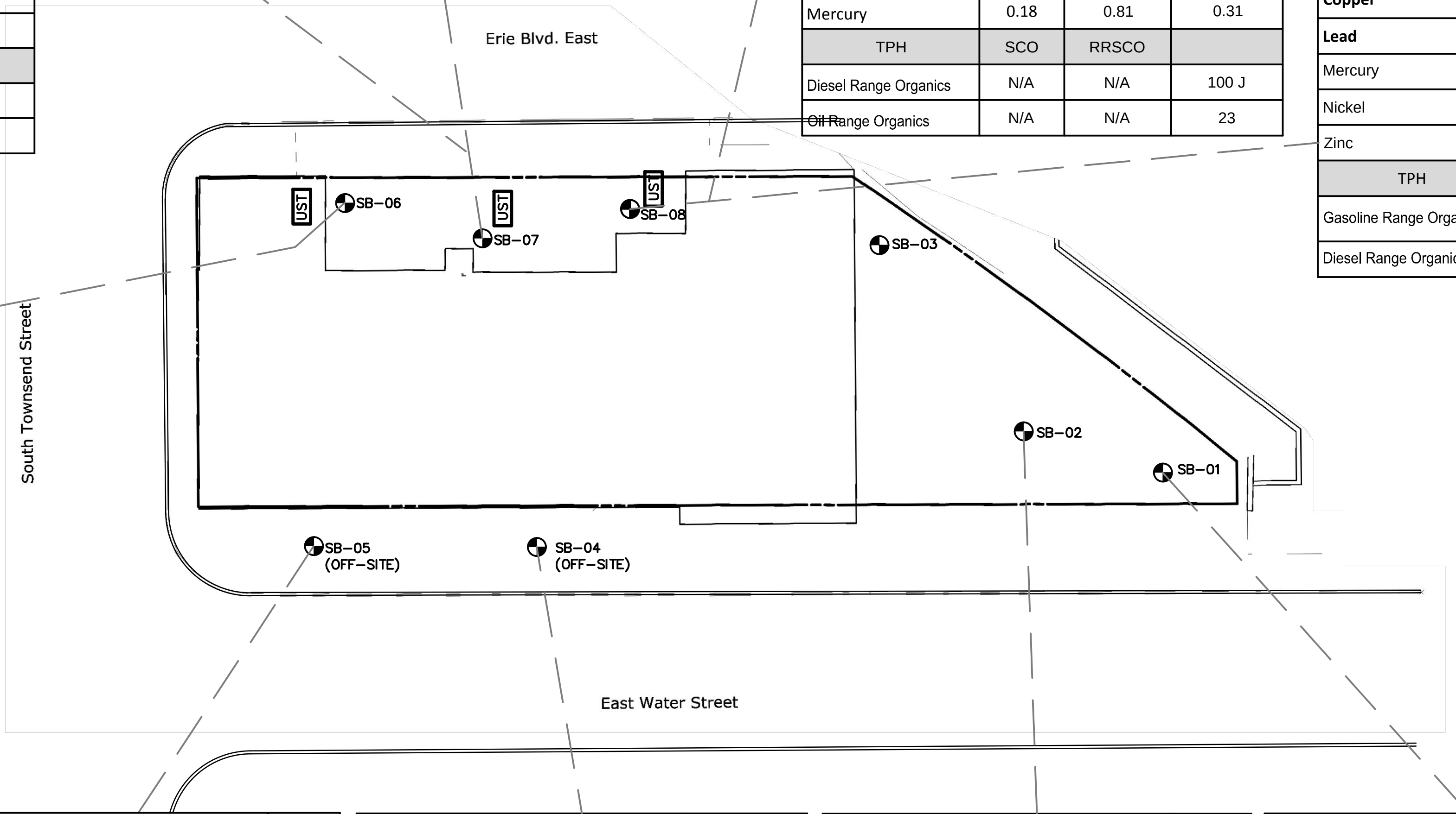
SAMPLE ID / LOCATION			SB-07
SAMPLING DATE			9/25/2019
SAMPLE DEPTH (feet bgs)			1-4
SVOC	SCO	RRSCO	CONC
Benzo(a)anthracene	**1**	**1**	**18.000**
Benzo(a)pyrene	**1**	**1**	**18.000**
Benzo(b)fluoranthene	**1**	**1**	**21.000**
Chrysene	**1**	**3.9**	**17.000**
Indeno(1,2,3-cd)pyrene	**0.5**	**0.5**	**11.000**
Benzo(k)fluoranthene	**0.8**	**3.9**	**8.900**
Metals	SCO	RRSCO	CONC
Copper	50	270	115 J
Lead	**63**	**400**	**504**
Mercury	0.18	0.81	0.72
Zinc	109	10,000	184
TPH	SCO	RRSCO	
Diesel Range Organics	N/A	N/A	91 J
Oil Range Organics	N/A	N/A	23

SAMPLE ID / LOCATION			SB-07
SAMPLING DATE			9/25/19
SAMPLE DEPTH (feet bgs)			5-8
TPH	SCO	RRSCO	CONC
Diesel Range Organics	N/A	N/A	18 J
Oil Range Organics	N/A	N/A	5.6 J

SAMPLE ID / LOCATION			SB-08
SAMPLING DATE			9/25/19
SAMPLE DEPTH (feet bgs)			1-4
SVOC	SCO	RRSCO	CONC
Benzo(a)anthracene	**1**	**1**	**3.400 J**
Benzo(a)pyrene	**1**	**1**	**3.300 J**
Benzo(b)fluoranthene	**1**	**1**	**4.200 J**
Benzo(k)fluoranthene	0.8	3.9	1.700 J
Chrysene	1	3.9	2.900 J
Indeno(1,2,3-cd)pyrene	**0.5**	**0.5**	**2.000 J**
Metals	SCO	RRSCO	CONC
Lead	63	400	362 J
Zinc	109	10,000	148
Mercury	0.18	0.81	0.31
TPH	SCO	RRSCO	
Diesel Range Organics	N/A	N/A	100 J
Oil Range Organics	N/A	N/A	23

SAMPLE ID / LOCATION			SB-08
SAMPLING DATE			9/25/19
SAMPLE DEPTH (feet bgs)			10-12
SVOC	SCO	RRSCO	CONC
Benzo(a)anthracene	**1**	**1**	**11.000**
Benzo(a)pyrene	**1**	**1**	**11.000**
Benzo(b)fluoranthene	**1**	**1**	**11.000**
Benzo(k)fluoranthene	**0.8**	**3.9**	**6.400**
Chrysene	**1**	**3.9**	**11.000**
Indeno(1,2,3-cd)pyrene	**0.5**	**0.5**	**4.700**
Metals	SCO	RRSCO	CONC
Arsenic	13	16	14.5
Copper	**50**	**270**	**531**
Lead	**63**	**400**	**490**
Mercury	0.18	0.81	0.31
Nickel	30	310	44.8
Zinc	109	10,000	344
TPH	SCO	RRSCO	CONC
Gasoline Range Organics	N/A	N/A	8.6
Diesel Range Organics	N/A	N/A	860

SAMPLE ID / LOCATION			SB-06
SAMPLING DATE			09/26/19
SAMPLE DEPTH (feet bgs)			1-4
SVOC	SCO	RRSCO	CONC
Benzo(a)anthracene	**1**	**1**	**1.600 J**
Benzo(a)pyrene	**1**	**1**	**1.600 J**
Benzo(b)fluoranthene	**1**	**1**	**2.100**
Chrysene	1	3.9	1.600 J
Indeno(1,2,3-cd)pyrene	**0.5**	**0.5**	**1.300 J**
Metals	SCO	RRSCO	CONC
Copper	**50**	**270**	**332**
Lead	**63**	**400**	**2,850**
Nickel	30	310	35.5
Zinc	109	10,000	326
TPH	SCO	RRSCO	CONC
Diesel Range Organics	N/A	N/A	63
Oil Range Organics	N/A	N/A	6.8 J



LEGEND:

— — — —	APPROXIMATE PROPERTY LINE
◐ SB-#	SOIL BORING LOCATION AND ID
UST	APPROXIMATE LOCATION OF HISTORIC UST (REMOVED)

TABLE NOTES:

ALL SOIL VALUES ARE REPORTED IN mg/kg (APPROXIMATE PARTS PER MILLION - ppm)

SCO - NYSDEC UNRESTRICTED USE SOIL CLEANUP OBJECTIVE

RRSCO - NYSDEC RESTRICTED RESIDENTIAL USE SOIL CLEANUP OBJECTIVE

J - ESTIMATED VALUE (THE CONCENTRATION IS GREATER THAN THE METHOD DETECTION LIMIT, BUT BELOW THE QUANTITATION LIMIT)

BOLD - CONCENTRATION EXCEEDS APPLICABLE RRSCO VALUE

SAMPLE ID / LOCATION			SB-05
SAMPLING DATE			9/25/19
SAMPLE DEPTH (feet bgs)			1-4
TPH	SCO	RRSCO	CONC
Diesel Range Organics	N/A	N/A	9.9 J
SAMPLE ID / LOCATION			SB-05
SAMPLING DATE			9/25/19
SAMPLE DEPTH (feet bgs)			5-8
Metal	SCO	RRSCO	CONC
Copper	50	270	127
TPH	SCO	RRSCO	CONC
Diesel Range Organics	N/A	N/A	16 J

SAMPLE ID / LOCATION			SB-04
SAMPLING DATE			09/24/19
SAMPLE DEPTH (feet bgs)			4-7
SVOC	SCO	RRSCO	CONC
Benzo(a)anthracene	**1**	**1**	**1.100**
Benzo(a)pyrene	**1**	**1**	**1.100**
Benzo(b)fluoranthene	**1**	**1**	**1.300**
Chrysene	1	3.9	1.100

SAMPLE ID / LOCATION			SB-02A
SAMPLING DATE			9/24/19
SAMPLE DEPTH (feet bgs)			1-3
TPH	SCO	RRSCO	CONC
Diesel Range Organics	N/A	N/A	6.0 J

SAMPLE ID / LOCATION			SB-01A
SAMPLING DATE			9/24/19
SAMPLE DEPTH (feet bgs)			1-4
Metal	SCO	RRSCO	
Nickel	30	310	37.1

NOTES / DISCLAIMERS:

1. APPROXIMATE PROPERTY LINE BASED ON PROVIDED PROPERTY SURVEY (C.T. MALE ASSOCIATES, JUNE 2019)
2. ALL LOCATIONS ARE APPROXIMATE.

0 37'-6" 75'

GRAPHIC SCALE

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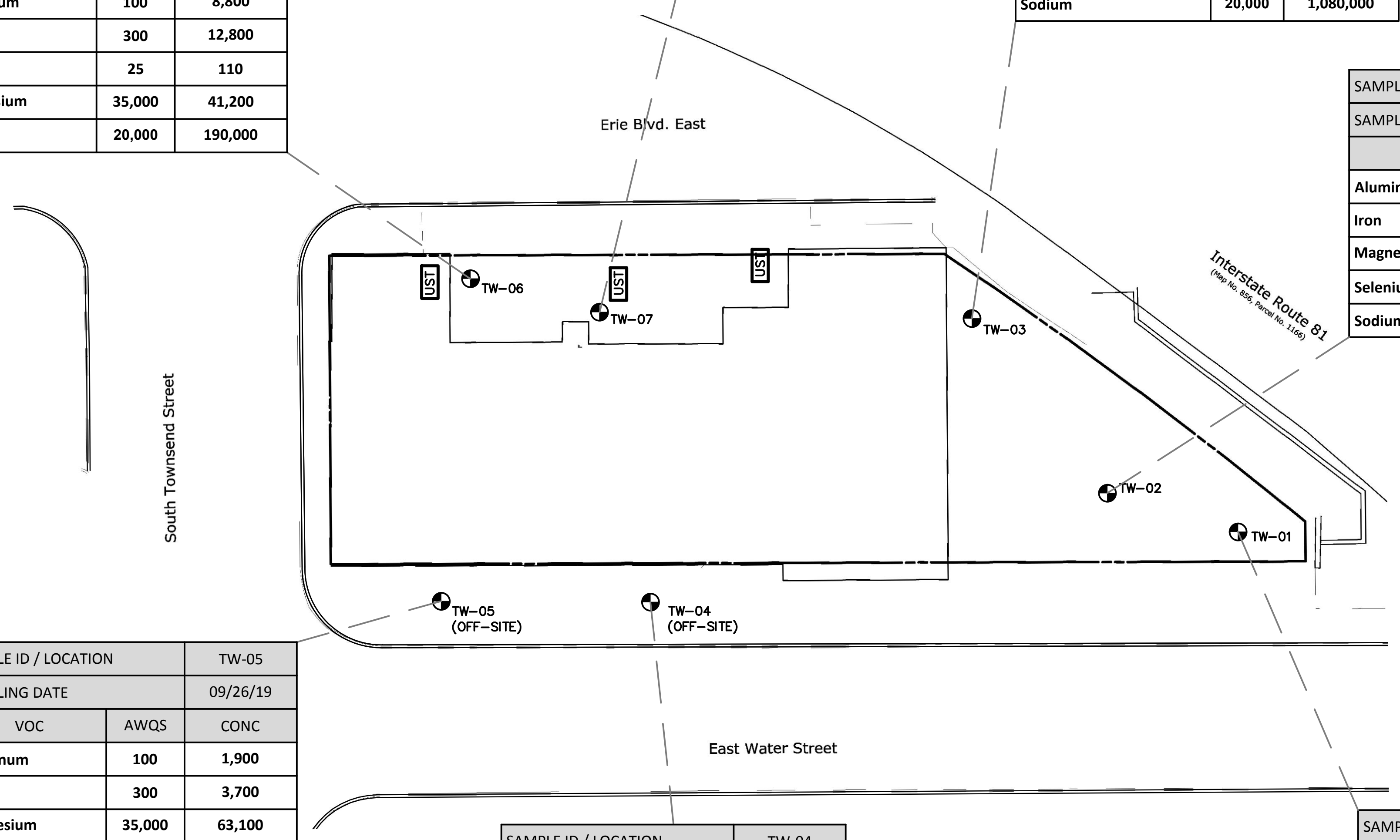
PROJECT NO. 20-032
DRAWN: FEB. 2020
DRAWN BY: NP
CHECKED BY: RM

Summary of Analytical Exceedances
In Soil

Smith Restaurant Building
500 Erie Boulevard East
Syracuse, New York 13202

FIGURE
3A



SAMPLE ID / LOCATION		TW-06
SAMPLING DATE		09/26/19
VOC	AWQS	CONC
Chloroform	7	**9.3**
Metals	AWQS	CONC
Aluminum	100	**8,800**
Iron	300	**12,800**
Lead	25	**110**
Magnesium	35,000	**41,200**
Sodium	20,000	**190,000**

SAMPLE ID / LOCATION		TW-07
SAMPLING DATE		09/26/19
VOC	AWQS	CONC
Chloroform	7	**11**
Metals	AWQS	CONC
Aluminum	100	**560**
Iron	300	**640**
Sodium	20,000	**191,000**

SAMPLE ID / LOCATION		TW-03
SAMPLING DATE		09/26/19
VOC	AWQS	CONC
Tetrachloroethene (PERC)	5	**7.6**
Metals	AWQS	CONC
Aluminum	100	**110 J**
Iron	300	**39,900**
Sodium	20,000	**1,080,000**

SAMPLE ID / LOCATION		TW-02
SAMPLING DATE		09/26/19
VOC	AWQS	CONC
Aluminum	100	**400**
Iron	300	**450**
Magnesium	35,000	**57,500**
Selenium	10	**13 J**
Sodium	20,000	**567,000**

SAMPLE ID / LOCATION		TW-05
SAMPLING DATE		09/26/19
VOC	AWQS	CONC
Aluminum	100	**1,900**
Iron	300	**3,700**
Magnesium	35,000	**63,100**
Sodium	20,000	**1,980,000**

SAMPLE ID / LOCATION		TW-04
SAMPLING DATE		09/26/19
VOC	AWQS	CONC
Chloroform	7	10
Tetrachlorethene (PERC)	5	9.6
Metals	AWQS	CONC
Aluminum	100	**2,200 J**
Magnesium	35,000	**2,600**
Sodium	20,000	**294,000**

SAMPLE ID / LOCATION		TW-01
SAMPLING DATE		09/26/19
VOC	AWQS	CONC
Aluminum	100	**6,800**
Iron	300	**8,300**
Magnesium	35,000	**71,900**
Manganese	300	**350**
Selenium	10	**39**
Sodium	20,000	**508,000**

LEGEND:

— — —	APPROXIMATE PROPERTY LINE
● TW-#	TEMPORARY GROUNDWATER MONITORING WELL LOCATION AND ID
UST	APPROXIMATE LOCATION OF HISTORIC UST (REMOVED)

TABLE NOTES:

ALL GROUNDWATER VALUES ARE REPORTED IN ug/L (APPROXIMATE PARTS PER BILLION - ppb)

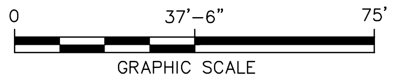
AWQS - NYSDEC AMBIENT WATER QUALITY STANDARD OR GUIDANCE VALUE

J-ESTIMATED VALUE (THE CONCENTRATION IS GREATER THAN THE METHOD DETECTION LIMIT, BUT BELOW THE QUANTITATION LIMIT)

BOLD - CONCENTRATION EXCEEDS APPLICABLE AWQS VALUE

NOTES / DISCLAIMERS:

1. APPROXIMATE PROPERTY LINE BASED ON PROVIDED PROPERTY SURVEY (C.T. MALE ASSOCIATES, JUNE 2019)
2. ALL LOCATIONS ARE APPROXIMATE.



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DRAWN: FEB. 2020
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CHECKED BY: RM

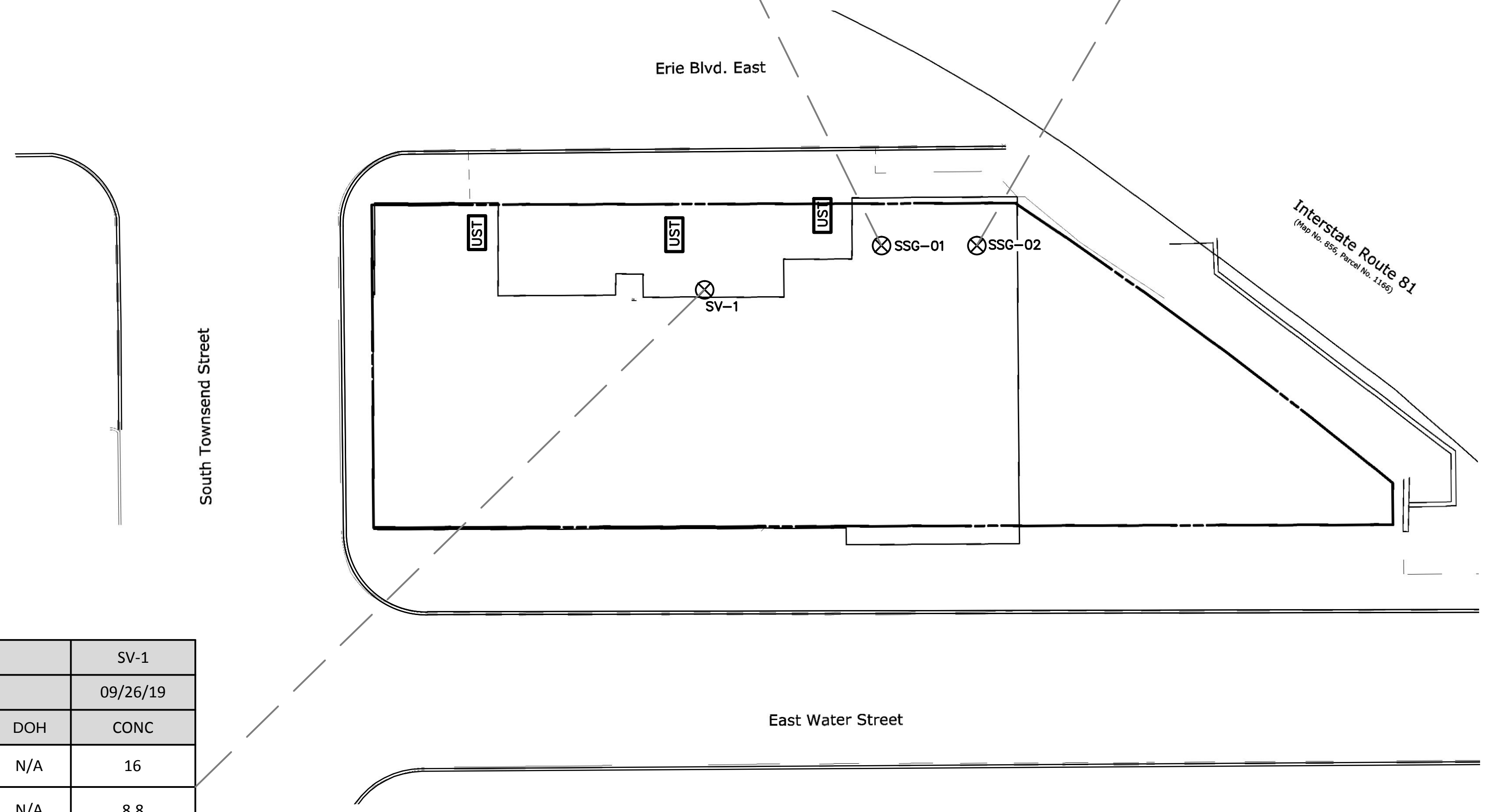
Summary of Analytical Exceedances
In Groundwater

Smith Restaurant Building
500 Erie Boulevard East
Syracuse, New York 13202

FIGURE
3B

SAMPLE ID / LOCATION		SSG-01
SAMPLING DATE		09/26/19
VOC	DOH	CONC
cis-1,2 Dichloroethene	**6**	**34**
Tetrachloroethene (PCE / PERC)	**100**	**7,400**
Trichloroethene (TCE)	**6**	**350**
Chloroform	N/A	54

SAMPLE ID / LOCATION		SSG-02
SAMPLING DATE		09/27/19
VOC	DOH	CONC
cis-1,2 Dichloroethene	**6**	**54**
Tetrachloroethene (PCE / PERC)	**100**	**520**
Trichloroethene (TCE)	**6**	**70**
Chloroform	N/A	8.3



SAMPLE ID / LOCATION		SV-1
SAMPLING DATE		09/26/19
VOC	DOH	CONC
Benzene	N/A	16
Chloroform	N/A	8.8
Ethylbenzene	N/A	54
Naphthalene	N/A	3.2
Trichloroethene (TLE)	N/A	2.4 J
1,2,4 - Trimethylbenzene	N/A	11

LEGEND:

— — — —	APPROXIMATE PROPERTY LINE
⊗ SSG-#	SUB-SLAB SOIL GAS SAMPLE LOCATION AND ID
UST	APPROXIMATE LOCATION OF HISTORIC UST (REMOVED)

TABLE NOTES:

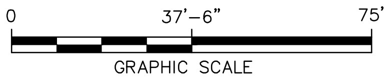
ALL SOIL GAS / VAPOR VALUES ARE REPORTED IN MICROGRAMS PER CUBIC METER (ug/m^3)

DOH - NOTE THAT SUB-SLAB SOIL GAS CONCENTRATION AT WHICH MITIGATION MAY BE DEPENDENT ON MEASURED CONCENTRATION OF INDOOR VAPORS.

BOLD - CONCENTRATION EXCEEDS APPLICABLE DOH VALUE

NOTES / DISCLAIMERS:

1. APPROXIMATE PROPERTY LINE BASED ON PROVIDED PROPERTY SURVEY (C.T. MALE ASSOCIATES, JUNE 2019)
2. ALL LOCATIONS ARE APPROXIMATE.
3. THE NYSDOH ONLY MAINTAINS STANDARDS FOR A LIMITED NUMBER OF COMPOUNDS



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East Syracuse, NY 13057

PROJECT NO.	20-032
DRAWN:	FEB. 2020
DRAWN BY:	NP
CHECKED BY:	RM

Summary of Analytical Exceedances
In Soil Vapor

Smith Restaurant Building
500 Erie Boulevard East
Syracuse, New York 13202

FIGURE
3C

APPENDIX A

Standard Operating Procedures

Asbestos & Environmental Consulting Corporation Standard Operating Procedures			Doc No:	SOP No. 101
			Initial Issue Date	November 2011
			Revision Date:	Initial Version
SOP#101 – SURFACE AND SHALLOW SOIL SAMPLING USING HAND-OPERATED SAMPLING EQUIPMENT			Revision No.	0
			Next Revision Date:	November 2012
Preparation:	Authority:	Issuing Dept: Environmental Group	Page:	1 of 8

Scope and Application

The purpose of this SOP is to establish uniform procedures for the collection of surface and shallow soil samples using hand-operated sampling tools/equipment. Adherence to this SOP will promote consistency in sampling methods and if followed properly will provide a basis for sample representativeness.

It is noted that other state or federal agency standard operating procedures may exist that require deviation from this SOP. These required deviations must be identified before the sampling program begins (ideally during the work plan/sampling plan development), and must be explained in the project-specific work plan/sampling plan.

Equipment/Apparatus/Supplies

Materials needed for this SOP may include:

Spoons/Scoops/Trowels – Sampling spoon/scoops/trowels may be reusable or disposable. Reusable spoons/scoops shall be constructed of stainless steel to facilitate easy decontamination. Disposable scoops may be constructed of other materials (example: high density polypropylene (HDPE), which are preferable to stainless steel when acquiring samples for trace element analysis.) however the use of softer and more brittle materials may be less effective in higher density soils.

Shovel – Shovels may be used for the preparation of the sample collection area (i.e., to remove surface materials to allow sampling with a spoon or scoop) or for samples requiring large sample volume (i.e, bench-scale treatability samples).

Soil Auger/Bucket (Hand) Auger - A soil auger/bucket (hand) auger usually comprises a T-handle attached to a spiral-bladed metal auger (soil auger) or a hollow tube with cutting teeth at the bottom (bucket or hand auger). Turning the handle in a clockwise direction, either brings soil toward the surface (hand auger) or into the hollow tube (bucket). Only moderate down-pressure should be used as forcing the auger through hard zones or in cobble-rich soils can damage equipment and injure the individual using the equipment.

Soil Augers are typically good for sampling depths up to 3 feet. Representative samples can be collected directly from the auger flight as it is withdrawn from the ground, or from the tube-sampler attachment which can be advanced into the soil after augering to the top of the desired depth interval. It should be noted that soil augers cause considerable disturbance of the soil that can cause the loss of volatile organic compounds (VOCs) from the soil, therefore, some consideration should be given to using a tube-sampler attachment, or another less invasive method for sampling soils for (VOCs).

Bucket/hand augers are generally used to collect soil samples from depths ranging from the ground surface to approximately five (5) feet below the ground surface. In some instances, soil samples may be collected from greater depths, but often with considerable more difficulty. Bucket/hand augers allow for discrete depth interval sampling as the soil is retained within the hollow tube of the auger when it is extracted from the ground. It should be noted that if depth-discrete sampling is the objective, more than one auger may be necessary, with one larger bucket auger used to provide access to the required sampling depth and another (clean) smaller auger used for sample collection.

Upon retrieval from the ground, the soil on the flights of the auger or within the bucket can be poured directly into collection pan or sample container (if loosely consolidated) or be removed with a clean decontaminated spoon or scoop and transferred into the appropriate container.

Collection Pan – A soil collection pan is often used as an intermediate between removal of soil from the ground and filling the sample containers/soil jars. Stainless steel is required material of construction..

Other commonly used materials –

- Stainless steel teaspoon or spatula
- Ziploc-type bags
- Aluminum Foil
- Sampling kit (i.e., bottles, labels, custody records, cooler, etc.)
- Six foot folding tape for depth measurement
- Personal protective equipment (as required in HASP)
- Field project notebook/pen

Procedures

General

Site-specific soil characteristics and project-specific requirements such as sampling depth will dictate the preferred type of sampling equipment to be used. In addition, the analytical program requirements will define the volume of sample needed, which will also influence the selection of the appropriate sampling equipment (i.e., sampling for semi-volatile organic compounds requires a larger soil volume and thus a larger sized bucket auger, than that necessary for total lead sampling). The project work plan/sampling plan should define specific requirements and equipment required for the given site. Sampling personnel should be equipped with a variety of sampling equipment to address deviations from anticipated sampling situations.

Equipment Decontamination

Sampling equipment must be decontaminated prior to its initial use and following the collection of each soil sample. Site specific decontamination should be outlined in the sampling plan/work plan. If site-specific decontamination procedures are not stipulated in the work/sampling plan, the procedures described in AECC SOP # 103 – Equipment Decontamination, shall be used.

Samples for Volatile Organic Compound Analysis

Because volatile organic compounds (VOCs) can volatilize and be lost during the sampling process, precautions are necessary to minimize this effect during soil sampling. A sample collected for VOC analysis should be collected first (before collecting samples to be analyzed for other parameters) and should collected as quickly and as directly as possible, from a discrete, relatively undisturbed portion of soil. In general, it is best to transfer soils directly from the sampling device into the sampling container, without the use of an intermediate collection pan.

Sampling Procedures

Preparing the Ground Surface at the Sampling Location

At most locations the surface must be prepared prior to surface soil sampling. This may include removal of surface debris or vegetation to expose the actual soil surface, or the loosening of dense compacted soils such as those in heavy traffic areas or frozen soils.

Shovel Sampling

Detailed operating procedures for shovels, trowels, spoons and scoops is unnecessary, other than to state that this equipment shall be decontaminated before use.

Upon completion of sampling activities, backfill the sampling location and restore the surface to as close to pre-sampling conditions as possible to eliminate surface hazard or preferred path for contaminant migration. The sampling plan/work plan may specify the requirements for backfilling and surface restoration.

Trowel, Spoon and Scoop Sampling

Spoons, scoops, and trowels are of similarly designed construction and will therefore be operated in accordance with the following procedure, unless an alternate method is described in the site-specific work plan or sampling plan. Deviations from the standard operating procedures described herein and the rationale/justification for those deviations are to be recorded in the field logbook.

1. Select location and be sure that all surface preparation and soil sampling tools are decontaminated.
2. Prepare surface for sampling – Remove surficial material with shovel if necessary to achieve the required depth.
3. Turn the sampling tool into the ground and rotate so that a representative column of soil is removed.

4. If sampling for VOCs is required, collect this sample portion first.
5. If a specific depth interval has been targeted, collect soils from that depth into a collection pan.
6. If more soil is needed to meet sample volume requirements, additional soil cores may be collected from an immediately adjacent location.
7. Homogenize the soil in the collection pan (excluding soil for VOC analysis) by mixing the soil in the collection pan with the sampling tool until a uniform mixture is achieved.
8. Transfer soil from the collection pan into the appropriate sample jars/containers using the sampling tool or a clean stainless steel teaspoon or spatula. Use of fingers should be avoided.
9. Once filled, the rim and threads of the sample container should be cleaned of gross soil by wiping with a paper towel, then capped and labeled. Do not submerge the sample containers in water to clean them.
10. Label the samples and place the containers into a cooler with wet ice that has been contained within sealed plastic bag(s) as soon as possible (immediately) after collection.
11. Log the samples in field notebook, chain of custody and other required documentation.

12. Handle samples for shipment to the laboratory in accordance with AECC SOP # 102 – Environmental Sample Handling, Packaging, and Shipping.
13. Decontaminate sampling tools prior to reuse.
14. Investigation-derived waste (IDW) should be properly contained before leaving the area.
15. Backfill the sampling location and restore the surface to as close to pre-sampling conditions as possible, to eliminate surface hazard and/or the creation of a preferred path for contaminant migration. The sampling plan/work plan may specify the requirements for backfilling and surface restoration.

Soil Auger Sampling

When using a soil auger for the collection of surface or shallow soil samples, the following procedure will be employed unless an alternate method is described in the site-specific work plan or sampling plan. Deviations from the standard operating procedures described herein and the rationale/justification for those deviations are to be recorded in the field logbook.

1. Select Location and be sure that all surface preparation and soil sampling tools are decontaminated.
2. Prepare surface for sampling – remove vegetation or surface debris as necessary.
3. Turn the soil auger gently in a clockwise direction until the top of the desired depth is achieved.
4. Remove the auger, thus clearing the disturbed soil from the augered hole.
5. If using the auger flights to collect the sample, return the auger to the hole and continue turning the auger so that it penetrates the interval of interest. Retrieve the auger and transfer soil into a collection pan.

6. If using a tube–sampler attachment, insert the tube sampler into the augered hole to the top of the desired interval and push/turn the tube sampler through the interval of interest.
7. Multiple trips and/or multiple adjacent auger holes may be necessary to sample the interval of interest at a given location.
8. Samples to be analyzed for VOCs should be collected first, directly from the auger flights or tube-sampler attachment.
9. With the exception of the VOC fraction (if required), the remaining soils should be placed into the soil collection pan.
10. Homogenize the soil in the collection pan (excluding soil for VOC analysis) by mixing the soil in the collection pan with the sampling tool until a uniform mixture is achieved.
11. Transfer soil from the collection pan into the appropriate sample jars/containers using the sampling tool or a clean stainless steel teaspoon or spatula. Use of fingers should be avoided.
12. Once filled, the rim and threads of the sample container should be cleaned of gross soil by wiping with a paper towel, then capped and labeled.
13. Label the samples and place the containers into a cooler with wet ice that has been contained within sealed plastic bag(s) as soon as possible (immediately) after collection.
14. Log the samples in field notebook, chain of custody and other required documentation.
15. Handle samples for shipment to the laboratory in accordance with AECC SOP # 102 – Environmental Sample Handling, Packaging, and Shipping.
16. Decontaminate sampling tools prior to reuse.
17. Investigation-derived waste (IDW) should be contained before leaving the area.
18. Backfill the sampling location and restore the surface to as close to pre-sampling conditions as possible, to eliminate surface hazard and/or the creation of a preferred path for contaminant migration. The sampling plan/work plan may specify the requirements for backfilling and surface restoration.

Bucket/Hand Auger Sampling

When using a bucket/hand auger for the collection of surface or shallow soil samples, the following procedure will be employed unless an alternate method is described in the site-specific work plan or sampling plan. Deviations from the standard operating procedures described herein and the rationale/justification for those deviations are to be recorded in the field logbook.

1. Select location and be sure that all surface preparation and soil sampling tools are decontaminated.
2. Prepare surface for sampling – remove vegetation or surface debris as necessary.
3. Push downward and turn the bucket/hand auger in a clockwise direction until bucket becomes filled with soil. Usually a 6 to 12-inch core of soil is obtained each time the auger is inserted.
4. Empty and repeat until the top of the interval of interest is encountered. Soil from above the interval that requires sampling and analysis can be emptied onto plastic sheeting for description/classification.

5. Using a clean/decontaminated bucket auger, insert the auger into the bottom of the hole so that it is positioned above the interval of interest. A smaller diameter bucket may be necessary to prevent the auger from being contaminated by passing through the overburden soils.
6. Turn the bucket/hand auger so that bucket fills with soil from the interval of interest.
7. Once filled, the auger should be removed from the ground and emptied into the soil collection pan. If a VOC sample is required, the sample should be taken directly from the auger bucket using a clean/decontaminated teaspoon or spatula and/or directly filling the sample container from the auger.
8. Repeat the process until the desired sample interval has been thoroughly penetrated with extracted soils placed into the collection pan.
9. Except for VOC sample fractions, the remainder of the soil sample should be collected into the collection pan.
10. Homogenize the soil in the collection pan by mixing the soil in the collection pan with the sampling tool until a uniform mixture is achieved.
11. Transfer soil from the collection pan into the appropriate sample jars/containers using the sampling tool or a clean stainless steel teaspoon or spatula. Use of fingers should be avoided.
12. Once filled, the rim and threads of the sample container should be cleaned of gross soil by wiping with a paper towel, then capped and labeled.
13. Label the samples and place the containers into a cooler with wet ice that has been contained within sealed plastic bag(s) as soon as possible (immediately) after collection.
14. Log the samples in field notebook, chain of custody and other required documentation
15. Handle samples for shipment to the laboratory in accordance with AECC SOP # 102 – Environmental Sample Handling, Packaging, and Shipping.
16. Decontaminate sampling tools prior to reuse.
17. Investigation-derived waste (IDW) should be contained before leaving the area.
18. Backfill the sampling location and restore the surface to as close to pre-sampling conditions as possible to eliminate surface hazard and/or the creation of a preferred path for contaminant migration. The sampling plan/work plan may specify the requirements for backfilling and surface restoration.

Quality Assurance/Quality Control

Quality control requirements for sample collection are dependent on project-specific sampling objectives which may be outlined in the site-specific Quality Assurance Project Plan (QAPP) if applicable, or may be included in the site-specific work plan/sampling plan. This information will include requirements for sample preservation and holding times, container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, matrix spike/matrix spike duplicates, field blanks/equipment blanks, and field duplicates. The Project Manager is responsible for assuring that the Quality Assurance/Quality Control objectives are specified and communicated to individuals responsible for collecting the samples.

Documentation

Documentation of sample collection, handling and shipping is required, and takes a variety of forms including:

- Field log book
- Sample collection records
- Chain-of-Custody forms
- Shipping Labels

The field book will be maintained as an overall log of all samples collected during a project. Sample collection records are generated for each sample collected during a project and must include:

- Project Number and Location
- Sampling point location location/ID
- Date and time that sample was collected
- Description/designation of the sample location
- Name of collector
- Equipment used to collect the sample
- Number of sample containers, sizes, preservatives
- Specific Sample ID
- Depth
- Soil type
- Analysis Requested
- Laboratory Designation
- Shipping ID Number/Tracking ID Number

Depending on project-specific requirements, this information may be required to be collected on a separate sample collection record form. If such a form is not required, the information will be collected in the project field log book.

Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes. These may be AECC-specific or be provided by the laboratory providing analytical services for the project. Shipping labels are required if sample coolers are to be transported to the laboratory by a third-party (courier service). Original and/or copies of these documents will be retained in the appropriate project files.

Training & Qualifications

Surface soil sampling is a relatively simple procedure requiring minimal training and generally a small amount of equipment. Individuals conducting surface soil sampling for the first time will be supervised/trained by experienced personnel. Sampling personnel collecting samples that might contain petroleum compounds, heavy metals, or other potentially hazardous materials will be trained and certified in accordance with the requirements of 29 CFR 191O.120(e)(3}(i), OSHA's HAZWOPER standard.

AECC ENVIRONMENTAL CONSULTING	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP #102
			Initial Issue Date	September 2012
			Revision Date:	Initial Version
SOP#102 – ENVIRONMENTAL SAMPLE HANDLING, PACKAGING, AND SHIPPING			Revision No.	0
			Next Revision Date:	As Needed
Preparation:	Authority:	Issuing Dept: Environmental Group	Page:	1 of 3

Scope and Application

The purpose of this procedure is to establish a uniform set of procedures for handling, packaging and shipping environmental samples. Adherence to this SOP will ensure that samples are received by the laboratory in good condition. This procedure will also prevent cross-contamination of samples during shipment and minimize sample container breakage.

This SOP is to be used **ONLY** for environmental samples. Hazardous material shipments shall adhere to USDOT requirements which are not presented in this document.

Equipment/Apparatus/Supplies

Required materials include the following:

Duct tape
Strapping tape (1-inch minimum width)
Clear packing tape
Re-sealable plastic bags (Ziploc® or equivalent) sized for the sample containers used
Bubble wrap
“Fragile” labels
“This Side Up” labels
Adhesive address labels

Procedures

Sample bottle shipping preparation

Each bottle shall be properly labeled using the provided labels as detailed in SOP # 108. Once the label is affixed to the bottle the label shall be covered with clear packing tape which is wrapped completely around the bottle.

Each bottle shall be sealed by placing clear packing tape completely around the neck of the bottle and the bottle cap. If a QAPP for a particular project states that a custody seal on the bottle cap is required it shall be placed across the bottle cap prior to placing the clear packing tape on the bottle.

Sample bottle packaging

Each bottle or VOA vial pair (aqueous samples) shall be placed in an appropriately sized sealable plastic bag. Care shall be taken to ensure that air is removed from each bag. The purpose of bagging the samples is to protect against sample material release and cross-contamination should the sample container leak or break during shipment.

Bubble wrap shall then be used to completely wrap the bagged sample bottle or VOA vial pair. The bubble wrap shall be secured in place using packing tape.

Cooler Inspection, Preparation and Packing

Each cooler to be used for shipment of samples shall be inspected for integrity. The hinges shall be inspected and the walls, bottom and top of the cooler shall be inspected for cracks. Coolers with broken hinges and/or cracks shall not be used for sample shipment.

Each cooler shall be clean and free of any solid or liquid residue. If the cooler is equipped with a drain then duct tape shall be placed on the inside and outside portions of the drain to ensure that liquids or solids cannot pass through it.

Prior to placement of ice and or samples in the cooler, the cooler shall be lined with bubble wrap. A layer of bagged ice (see below) shall then be placed on the bottom of the cooler.

Prepared sample containers shall then be placed upright in the cooler such that they are tightly arranged. If there are insufficient sample bottles to achieve a tight packing arrangement then the samples shall be equally spaced throughout the cooler and the interstices shall be filled with additional bubble wrap.

A second layer of bagged ice shall then be placed on top of the samples and bubble wrap shall be laid over the top of them.

If the cooler is to be shipped via an overnight carrier (i.e.FedEx®, UPS or similar) the signed chain of custody shall be placed in a sealable plastic bag and taped to the underside of the cooler lid.

Ice Bagging

Ice, consisting of commercially available cubed ice, shall be placed in sealable plastic bags sized for the cooler to be used. A second bag shall be place over the first to provide a secondary containment layer. Care shall be taken not to overfill the bags such that the bag is difficult to seal. A typical cooler will require four 1 or 2-gallon bags with two bags beneath the samples and two on top of the samples.

Cooler Sealing and Labeling

The cooler shall be closed and the lid shall be securely sealed using duct tape. Duct tape shall be placed along the entire perimeter of the lid where it meets the cooler body including hinges. Care shall be taken to ensure a tight seal by the tape on the cooler surface.

“Fragile” and “This Side Up” labels shall be placed on each side of the cooler. A “Fragile” label shall be placed on the top of the cooler. “This Side Up” labels shall have an arrow pointing upward. Clear packing tape shall be placed over labels. Examples of the labels are shown below:

An adhesive label shall be attached to the top of the cooler which has the destination information clearly shown on it. Clear packing tape shall be placed over the entire surface of the label.

Clear packing tape shall be wrapped completely around the cooler at a minimum of two points. Strapping tape (1-inch width minimum) shall then be placed on top of the packing tape and shall completely encircle the cooler.

If shipping will be by FedEx® or similar, the airbill shall be affixed to the top of the cooler.

Quality Assurance/Quality Control

Prior to shipment, the cooler shall be inspected to ensure that it is properly sealed and labeled.

Documentation

If samples are being shipped via courier or via direct delivery then a copy of the signed chain of custody shall be retained. If shipping via other carrier, the copy of the airbill shall be retained for the project records.

AECC ENVIRONMENTAL CONSULTING	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP No. 103
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SOP#103 – EQUIPMENT DECONTAMINATION			Revision No.	0
			Next Revision Date:	As Needed
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Scope and Application

The purpose of this procedure is to establish a uniform set of procedures for conducting decontamination of field sampling equipment. Decontamination is performed as a quality assurance measure and a safety precaution. The use of equipment that has not been properly decontaminated for collecting samples for chemical analysis can lead to erroneous data due to cross contamination. In addition, decontamination protects field personnel and others from potential exposure to hazardous materials and prevents contamination from being transported away from a site.

This SOP focuses on decontamination of non-disposable equipment used for sampling environmental media for chemical analysis. Decontamination of other materials (well-construction materials and drill stem for example)are sometimes required and are discussed in other SOPs or dealt with in project-specific work plans.

It is noted that other state or federal agency standard operating procedures may exist that require deviation from this SOP. These required deviations must be identified before the sampling program begins (ideally during the work plan/sampling plan development), and must be explained in the project-specific work plan/sampling plan.

Equipment/Apparatus/Supplies

Required materials may include:

- Tap/potable water
- Phosphate-free detergent (Liqui-nox, Alconox, or similar)
- Distilled and/or deionized water
- Solvents as defined by the Work Plan, QAPP, etc. (may include nitric acid, dilute hydrochloric acid, methanol, hexane, isopropanol, etc.)
- PPE
- Paper towels
- Wash buckets/basins/containers
- Waste containers pails/buckets with lids, drums or plastic bags.
- Cleaning brushes
- Pressure sprayers and/or squeeze bottles
- Plastic sheeting
- Aluminum foil/plastic bags
- Project notebook/pen

Procedures

AECC's standard decontamination procedure is presented in the steps listed below. The standard may be modified on a project-specific basis, as described in project specific QAPP, sampling programs or other documents, and may include additional steps, solvents, materials, etc., depending on the quality assurance objectives for the project.

1. Don PPE items appropriate to the characteristics of the contaminated material that was encountered (safety glasses, latex or nitrile gloves, and disposable Tyvek garment for example).
2. Remove gross contamination, dirt, etc from the equipment by brushing and rinsing with tap water. This step should be completed in a 5-gallon bucket or appropriately sized container.
3. Wash the equipment with a phosphate-free detergent and tap water solution. This step should be completed in a separate wash bucket using brush, or pressure sprayer.
4. Rinse the equipment with potable water until all detergent has been removed. This step can be performed over an empty bucket using a squeeze bottle or pressure sprayer.
5. Triple-rinse the equipment with distilled or de-ionized water. Rinseate should be collected in the bucket used in step 3.
6. Allow the equipment to air dry on clean plastic sheeting. If faster drying is required, use paper towels to blot the equipment dry before reuse.
7. Wrap the dried decontaminated equipment with aluminum foil, shiny side out, for storage until the equipment is to be used again. Alternately, small equipment can be placed into clean plastic bags and sealed for longer term storage.
8. Containerize and/or manage wash water and decontamination rinseate in accordance with project-specific requirements.

When decontaminating submersible pumps used for groundwater sampling (or monitoring well development), the above-listed steps 2 and 3 may be conducted in a tube or cylinder that is sealed at the bottom end (commonly a 3-foot length of PVC pipe affixed with a water-tight end cap). The pump is inserted into the cylinder which is filled with the wash water, detergent solution, or rinse water and is turned on at a low setting for approximately five (5) minutes, so as to cycle the wash solutions through the pump's impellers and internal components. After the pump is removed from the potable water rinse cycle, the triple-rinse is performed with copious amounts of distilled/deionized water, being sure to flush through the impellers.

As stated previously, project-specific decontamination procedures may be required and will be specified in the project's QAPP, sampling plan or project-specific work plan. Some project-specific modifications may include the following:

- For glass and plastic sampling equipment used for sampling environmental media for metals analyses, decontamination may include a rinse with a 10% solution of nitric acid.
- For metallic sampling equipment used for sampling environmental media for metals analyses, decontamination may include a rinse with a 10% hydrochloric acid solution.

- For sampling equipment used for sampling environmental media for organic parameters (volatile organic compounds, semivolatile organic compounds, pesticides, polychlorinated biphenyls, etc.), decontamination may include an intermediate rinse with methanol, hexane, or isopropanol.

The above-listed solvents are hazardous materials due to their toxicity and/or corrosivity, and are specifically excluded from AECC's standard decontamination procedure because of these properties. When the use of these (or other similar) solvents is required by a project-specific QAPP or Sampling Plan, the plans must also describe additional protocols and procedures regarding their safe use and handling and to assure that associated investigation-derived waste (wash water and spent rinseate) is handled, characterized, and disposed of in accordance with federal, state and local requirements.

Large Equipment Decontamination

On some projects, large equipment (excavators, backhoes, truck-mounted drilling equipment, etc) is used for sampling or site characterization activities, and may become contaminated during site activities (or may require decontamination prior to use on site). For these situations, the drilling subcontractor will construct a temporary decontamination pad that typically consists of a bermed, plastic-sheet lined area where equipment and tooling can be brought for decontamination with a high-temperature high pressure washer (steam jenny) and/or manual scrubbing. If heavy equipment decontamination is required for a specific project, the specifications for the decontamination pad, and procedures for decontamination will be stipulated in the project QAPP and/or Sampling Plan.

Quality Assurance/Quality Control

General guidelines for quality control check of field equipment decontamination usually require the collection of one equipment blank from the decontaminated equipment per day, however the collection of equipment blanks and similar QA/QC samples is to be based on specific project requirements. For projects with a QAPP, the document will specify the type and frequency of collection of each type of quality assurance sample. For projects without a QAPP, the need for and/or frequency of equipment blanks and other QA/QC samples will be specified in the scope of work, or the project work plan.

Equipment blanks are generally collected by pouring laboratory-supplied deionized water into, over, or through the freshly decontaminated sampling equipment and then transferring this water into a sample container. Field blanks should then be labeled as a sample and submitted to the laboratory to be analyzed for the same parameters as the associated sample. Field blank sample numbers, as well as collection method, time and location should be recorded in the field notebook.

Documentation

Specific information regarding decontamination procedures should be documented in the project-specific field notebook. Documentation in the notebook should thoroughly describe the construction of each decontamination facility and the decontamination steps implemented in order to show compliance with the project work plan. Decontamination events should be logged when they occur with the following information documented:

- Date, time and location of each decontamination event
- What equipment was decontaminated
- Method used for decontamination
- Solvents used
- Notable circumstances
- Date, time and location of equipment blanks collected and the methods/procedures used for collection.
- Storage of decontamination wastes (spent wash and rinse water).

Repetitive decontamination of small items of equipment does not need to be logged each time the item is cleaned, however a note should be made that such equipment was decontaminated as required and in accordance with this SOP, or project specific QAPP, Work Plan, etc.

Scope and Application

The purpose of this SOP is to lay out the specific standardized procedure to be used for collecting soil samples using split-spoon sampling methods. Subsurface soil sampling, conducted in accordance with this SOP will promote consistency in sampling and provide a basis for sample representativeness.

This SOP covers split-spoon sampling methods only, and does not cover other types of subsurface soil sampling equipment.

Split-spoon sampling generally requires use of a drilling rig, typically a hollow-stem auger rig, to drill a borehole in which the sampling equipment is used. The split-spoon sampler is inserted through the augers and driven into the subsurface soil with a weighted hammer. The sampler is then retrieved and opened to reveal the recovered soil sample.

Split spoon sampling methods are generally applicable to unconsolidated subsurface soil/fill materials. Soils may be obtained using this method for visual classification, field screening for contamination, as well as physical and/or chemical analysis.

Split-spoon sampling (and the associated drilling process) is an intrusive subsurface exploration method. By law, the clearance of underground utilities must be performed prior to the initiation of any intrusive activities. The drilling subcontractor performing drilling activities is responsible for notifying the Underground Facilities Protective Organization (UFPO) with jurisdiction over the project site.

Responsibilities

Project Geologist/Scientist

The project geologist/scientist is responsible for conducting subsurface soil sampling in a manner consistent with this SOP. The project geologist/scientist will observe all sampling activities to ensure that the SOP is followed, and will record all pertinent data and information on appropriate forms, logs and/or in the project field notebook.

It is also the project geologist/scientist's responsibility to indicate the specific targeted sampling depth or sampling interval to the drilling subcontractor. Sample depth intervals are usually defined on a project-specific basis with these requirements specified in the project sampling plan. Sampling intervals typically range from one (1) sample per five (5) feet of drilling to continuous sampling where the entire drilled interval is sampled.

The project geologist/sampling engineer is also responsible for the collection of representative environmental characterization samples once the sampling device has been retrieved from the subsurface, disarticulated and liner removed.

Additional sample collection responsibilities include labeling, handling, and storage of samples while in their custody.

Drilling Subcontractor

The drilling subcontractor is responsible for providing the necessary equipment for obtaining subsurface soil samples. This generally includes the truck-mounted drilling rig, and one or more split-spoon samplers (multiple diameters) in good operating condition, and other necessary equipment for borehole preparation and sampling. It is the drilling subcontractor's responsibility to provide and maintain their own boring logs if desired and to provide sample containers for geotechnical/stratigraphic characterization samples. Additionally, the drilling contractor is responsible for providing for decontamination of the drilling and sampling equipment, consistent with the project specifications.

Equipment/Apparatus/Supplies

In addition to the equipment and materials provided by the drilling subcontractor, required materials may include the following:

- Project-specific documents (Scope of work, HASP, QAPP, Sampling Plan)
- Boring Logs
- Stainless steel spoons, spatulas, soil mixing pans etc.
- Sampling supplies (bottles, labels, custody records and tape, cooler, ice)
- Folding rule or tape measure
- Photoionization detector (PID) meter, (if volatile organic compounds (VOCs) are expected)
- Decontamination supplies (per the QAPP)
- Health and safety equipment/PPE (per the HASP)
- Portable chair & folding table
- Field project notebook/pen
- Plastic sheeting

Procedures

Split-spoon samplers are generally constructed of steel and a variety of sizes. 2-inch diameter, two-foot long samplers are most common, however 3-inch diameter samplers are often used when the use of a 2-inch sampler produces poor soil recovery. The split-spoon consists of a tubular body with two halves that split apart lengthwise, a drive head on the upper end with a ball-check valve for venting, and a steel cutting shoe at the bottom. As the sampler is driven into the ground, soil enters the split-spoon through the cutting shoe. A replaceable plastic basket is often inserted into the shoe to assist with retaining soil within the device. Upon retrieval of the sampler from the subsurface, the drive head and cutting shoe are removed and the split-spoon halves are separated and the soil is exposed.

Split-spoons used collecting samples for chemical analysis must be decontaminated prior to their initial use and after each time they are used. Decontamination shall be completed in accordance with AECC SOP 103 – Equipment Decontamination or, if applicable, project specific specifications.

Subsurface soil sampling is typically performed as part of a drilling program where a soil boring is advanced to a designated depth prior to collection of a representative sample. The following briefly outlines the procedures for conducting split-spoon sampling in conjunction with hollow-stem auguring.

1. The drilling contractor advances the hollow-stem augers to the required depth for sampling. A temporary center plug shall be used in the lead auger to prevent the auger from becoming filled with drill cutting during advancement.
2. At the top of the interval to be sampled, the driller stops the auger, disconnects the auger from the drill rig’s drive head, and retrieves the temporary center plug.
3. The drilling subcontractor will lower the split-spoon attached to a length of center rods to the bottom of the borehole.
4. The top of the center rods are attached to a 140 pound slide-hammer (or similar).
5. The slide hammer is repeatedly raised via rope and cathead and dropped to drive the split-spoon sampling device into the ground.
6. The hammer is disconnected from the center rod and the center rod and split spoon is retrieved from the augers.
7. The split-spoon is then disarticulated to allow for soil classification/description, field-screening, sampling for laboratory analysis, etc.
8. The drilling contractor re-installs the temporary center plug and advances the auger to the top of the next interval to be sampled.
9. Steps 2 through 8 are repeated until the termination depth of the borehole is reached.
10. Upon completion of auguring and sampling, the borehole can be backfilled or completed as a piezometer of monitoring well.

<u>Standard Penetration Test</u>

Split-spoon samplers are typically hammered into the ground (see steps 4 and 5 above) using a method referred to as the Standard Penetration Test (SPT) in accordance with ASTM standard D 1586-11 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel

Sampling of Soils. The STP method involves driving a 2-inch diameter split spoon by dropping the 140-pound hammer through a vertical free fall of 30 inches (hydraulic hammers that simulate these conditions are common). The number of hammer blows required for each 6 inches of penetration is recorded on the boring log. Blow count information can be used as an indicator of soil density for geotechnical and stratigraphic logging purposes. If STP in accordance with the ASTM standard is required for a project, it should be communicated to the drilling subcontractor before the sampling program begins. During the program, the project geologist/scientist should verify that the equipment being during sampling meets the required specifications.

Adding Water During Drilling

Drilling in some geologic conditions may require the use of added water. The use of added water is permitted, however the volume of water used should be minimized as it may affect sample quality. The volume and source of added water should be documented in the field notebook. Sampling the added water may be necessary for QA/QC purposes (refer to the project specific QAPP).

Sampling Soils for Environmental Laboratory Analysis

Sampling soils for environmental laboratory analysis shall be conducted as described in AECC SOP-101 - Surface and Shallow Soil Sampling. If the sampling program includes laboratory analysis for volatile organic compounds (VOCs), the VOC sampling shall be performed before any other activity.

Once the split-spoon sampler has been opened, the soils contained within can be sampled for laboratory analysis and classified. Materials from the split-spoon can be removed using clean decontaminated/disposable spoons or spatulas. Except for soils to be sampled for volatile organic compound analysis, the soils should be placed into a sample collection pan and homogenized, or placed directly into the appropriate sample container(s).

Once filled, the sample container should be properly capped, cleaned and labeled, and placed into a cooler with ice in preparation for shipping to the laboratory, in accordance with AECC SOP # 102 – Environmental Sample Handling, Packaging and Shipping.

Volatile Organic Samples

In order to minimize the loss of volatiles during the sampling process, samples should be collected into lab-supplied glassware as soon as possible after retrieving the sampler from the subsurface. Other tasks (classification, sampling for other parameters, field-screening with a PID meter, equipment decontamination, etc.) should either be performed by others, or be completed after collecting samples for VOC analysis.

Upon filling the sample container, clean and label the container and place it into a cooler immediately. Residual sample may then be used to fill other sample or logging requirements

When using split-spoon methods for collecting soil samples for VOC analysis, the drilling subcontractor shall not retrieve more than one subsequent sampler from the subsurface while the project geologist/scientist collects samples from a previous interval.

Soil Classification

Soils will be visually classified in using the Modified Burmeister Soil Classification System or alternate methods required by project specifications.

Equipment Decontamination

Sampling equipment must be decontaminated prior to its initial use and following the collection of each soil sample. Site specific decontamination should be outlined in the sampling plan/work plan. If site-specific decontamination procedures are not stipulated in the work/sampling plan, the procedures described in AECC SOP # 103 – Equipment Decontamination, will be used.

Quality Assurance/Quality Control

Quality control requirements are dependent on project-specific sampling objectives. The QAPP will provide requirements for equipment decontamination (frequency and materials), sample preservation and holding times, sample container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, field blanks, equipment blanks, and field duplicate samples.

In the absence of a QAPP, QA/QC will be attained through adherence to SOPs and requirements stipulated in project-specific specifications.

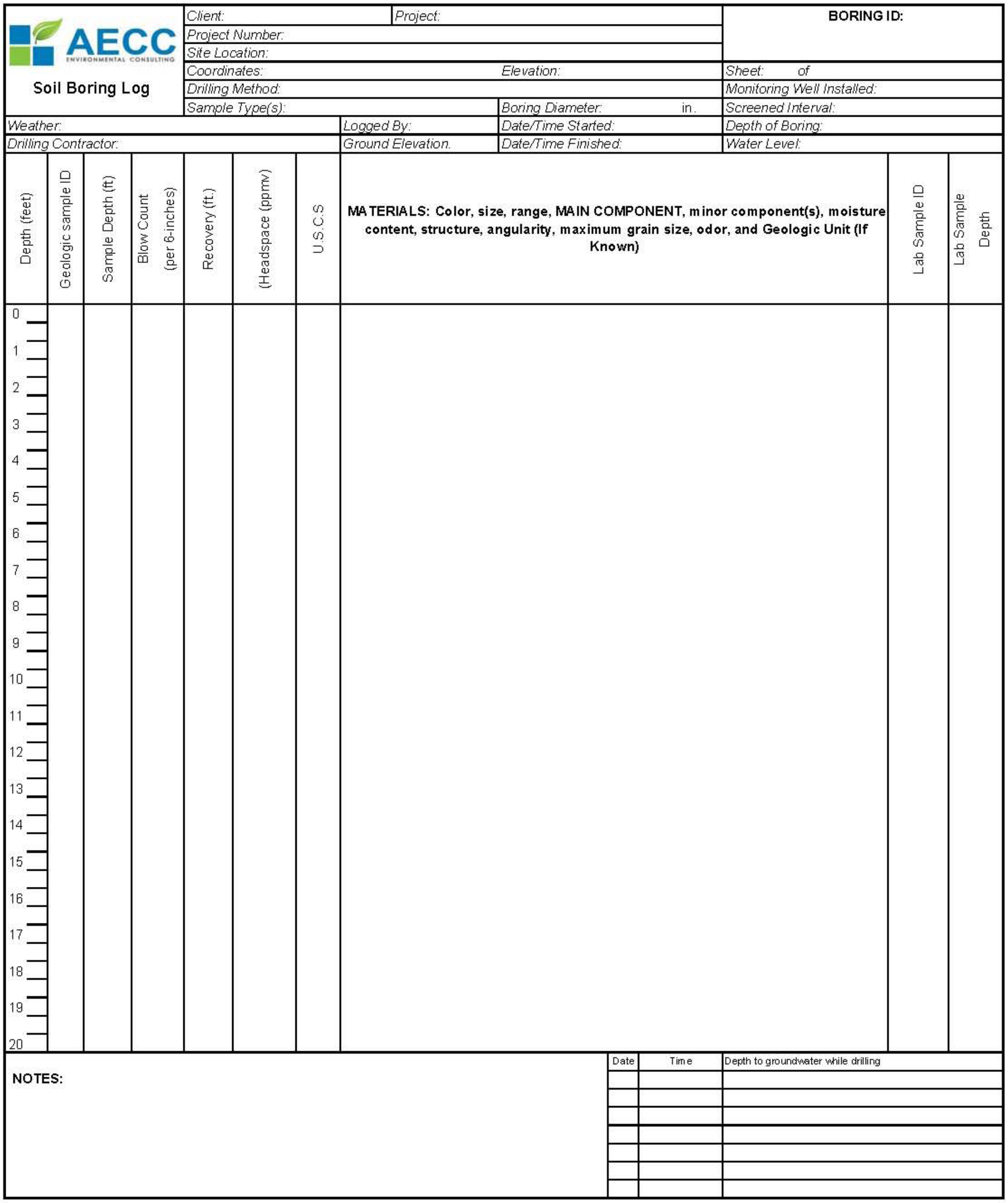
Documentation

Various forms are required to ensure that adequate documentation is made of sample collection activities. These forms will vary from project to project and may include:

- Field Log Books
- Soil Boring Logs
- Sample Collection Records
- Chain of Custody Forms
- Shipping Labels

Boring logs (Figure 1) will provide visual and descriptive information for each sample collected and are often the most critical form of documentation generated during a soil sampling program. The field log book is kept as a general log of activities. Occasionally, sample collection records are used to supplement boring logs, especially for environmental samples which have been collected for laboratory analysis. Chain-of-custody forms are transmitted with the samples to the laboratory for sample custody tracking purposes. Shipping labels are required if sample coolers are to be transported to the laboratory by a third party (courier service). Original copies of these records should be maintained in the appropriate project files.

Figure 1 – Soil Boring Log



AECC ENVIRONMENTAL CONSULTING

Soil Boring Log

Client:

Project:

BORING ID:

Project Number:

Site Location:

Coordinates:

Elevation:

Sheet: *of*

Drilling Method:

Monitoring Well Installed:

Sample Type(s):

Boring Diameter: in.

Screened Interval:

Weather:

Logged By:

Date/Time Started:

Depth of Boring:

Drilling Contractor:

Ground Elevation:

Date/Time Finished:

Water Level:

Depth (feet)	Geologic sample ID	Sample Depth (ft)	Blow Count (per 6-inches)	Recovery (ft.)	(Headspace (ppmv)	U.S.C.S	**MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known)**	Lab Sample ID	Lab Sample Depth
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

NOTES:

Date	Time	Depth to groundwater while drilling

AECC ENVIRONMENTAL CONSULTING	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP # 105
			Initial Issue Date	September 2012
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SOP# 105 – DIRECT-PUSH SOIL SAMPLING			Revision No.	0
			Next Revision Date:	As Needed
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Scope and Application

The purpose of this SOP is to lay out the specific standardized procedure to be used for collecting soil samples using direct-push methods. Subsurface soil sampling, conducted in accordance with this SOP will promote consistency in sampling and provide a basis for sample representativeness.

Direct push sampling involves the hydraulic pushing and/or percussive hammering of a sampling tube into the subsurface. The inside of the sampling tube is generally lined with a sleeve or liner made of acetate or (it may also be made of stainless steel, brass, plastic, Teflon, etc.), that catches the soil during the samplers advancement. The sampler includes a cutting shoe, and may also include an internal locking piston (or similar device) that seals the sampling tube until it is unlocked at the top of a specific depth to facilitate the collection of soils from a discrete interval. The sampling tube is threaded onto direct-push rods. The rods and tooling are driven into, and subsequently pulled from the subsurface with the hydraulic/percussive direct-push equipment. The direct-push “rig” may be mounted on wheels so that it can be manually moved about. More typically, however, the direct-push rig is mounted in the back of a pick up truck, on a skid-steer or the unit is track mounted so that it can be driven from location to location in areas of a site that are not accessible to truck-mounted units.

Direct-push sampling methods are generally applicable to unconsolidated soil/fill materials to a maximum recommended depth of approximately 30 feet below ground surface (bgs). Soils may be obtained using this method for visual classification, field screening for contamination, as well as for physical and/or chemical analysis. Sampling shall be continuous throughout the length of the boring.

Direct-push sampling is an intrusive subsurface exploration method. By law, the clearance of underground utilities must be performed prior to the initiation of any intrusive activities. The drilling subcontractor performing the direct-push activities is responsible for notifying Dig Safely New York or another Underground Facilities Protective Organization (UFPO).

The ability to drive the sample tooling to a desired depth (as well as the ability to retrieve the sampling device from the subsurface) depends on the density and composition of the soil and the power of the hydraulic equipment. Additionally, sample recovery is somewhat dependent on grain size. Coarse gravel, cobbles, and boulders may plug a small diameter sample tube, preventing material from entering, or may cause refusal of the tooling altogether.

Likely soil types that might be encountered and preliminary site information (accessibility, surface conditions, etc) should be used to determine whether direct-push methods are appropriate for a site, and to determine the specific tooling best suited for subsurface characterization. Subcontractors/direct-push service providers should then be selected on the basis of whether or not they have equipment and tooling necessary for those specific site/soil conditions.

Responsibilities

Project Geologist/Scientist

The project geologist/scientist is responsible for conducting subsurface soil sampling in a manner consistent with this SOP. The project geologist/scientist will observe all sampling activities to ensure that the SOP is followed, and will record all pertinent data and information on appropriate forms, logs and/or in the project field notebook.

It is also the project geologist/sampling engineer's responsibility to indicate the specific targeted sampling depth or sampling interval to the drilling subcontractor.

The project geologist/sampling engineer is also responsible for the collection of representative environmental characterization samples once the sampling device has been retrieved from the subsurface, disarticulated and liner removed.

Additional sample collection responsibilities include labeling, handling, and storage of samples until further chain-of-custody procedures are implemented.

Drilling Subcontractor

The drilling subcontractor is responsible for providing the necessary equipment for obtaining subsurface soil samples. This generally includes the truck or ATV-mounted percussion/probing machine and one or more sampling tubes (multiple diameters) in good operating condition, appropriate liners, and other necessary equipment for borehole preparation and sampling. It is the drilling subcontractor's responsibility to provide and maintain their own boring logs if desired. Equipment decontamination materials should also be provided by the subcontractor and should meet project specifications.

Equipment/Apparatus/Supplies

In addition to the equipment and materials provided by the drilling subcontractor, required materials may include the following:

- Project-specific documents (Scope of work, HASP, QAPP, Sampling Plan)
- Boring Logs
- Stainless steel spoons, spatulas, soil mixing pans etc.
- Sampling supplies (bottles, labels, custody records and tape, cooler)
- Folding rule or tape measure

- Portable chair and/or folding table
- Decontamination supplies (per the QAPP)
- Health and safety equipment/PPE (per the HASP)
- Field project notebook/pen
- Steel tape measure
- Stainless steel spoons, spatulas
- Plastic sheeting

Procedures

Typical Direct-Push Sampling Procedure

1. Don PPE as per the project HASP.
2. Decontaminate sample tooling and components that may come in contact with soil during sampling activities. Note: the level of decontamination will depend on whether soils are being sampled for laboratory analysis, field screening, or simply for visual classification.
3. Assemble the sampling tube including the liner, discrete sample tooling (if appropriate), sand-basket (if appropriate), and cutting shoe.
4. Prepare the surface for direct-push sampling. Direct push tooling can generally penetrate several inches of asphalt and/or crushed stone surface materials. If several inches of concrete are present at the location, coring or another method will be necessary to penetrate the surface pavement.
5. The direct-push rig operator will thread on a push/drive cap on the top of the device and push the sample tube into the ground.
6. The direct-push rig operator removes the push/drive cap, replaces it with a pull-cap and pulls sampler from the ground with the machine hydraulics.
7. The sample tube is then opened, to allow the soil-filled liner to be removed so that it can be cut open by the project geologist/scientist/ engineer to allow for soil classification/description, field-screening, sampling for laboratory analysis, etc.
8. The sampling tube and components that contact soil during the sampling process are decontaminated, re-assembled, with a new, disposable liner and the process is repeated. The advancement of the sampling tube to depth is achieved through the addition of drive-rods, each of which is typically the same length as the sampling tube (commonly 3, 4, or 5 feet in length).
9. Upon completion of the corehole, the hole is backfilled with soil cuttings or hydrated granular bentonite, or is completed as a piezometer or monitoring well.

Exposing Soils for Classification/Characterization and/or Sampling for Laboratory Analysis

Upon extraction of the liner from the direct-push sampling tube, the liner must be opened so as to expose the soils for visual classification/description, field screening and/or sampling for laboratory analysis. This is accomplished through the use of a liner cutting system, typically comprising a liner holder, and a liner cutter. The liner holder is a trough-like device that holds the liner securely in place so that it can be cut open.

The liner cutter is a tool affixed with two parallel hook-shaped blades that is drawn along the liner to cut a lengthwise opening in the liner for easy access and viewing of the sampled material. Liner cutters come in one-handle and two-handle varieties.

1. Place the soil-filled liner into the soil holder. Be sure that the liner holder is placed on a solid surface such as a sturdy work table, tailgate, etc.
2. Install the liner in the liner holder. Adjust the stop on the liner holder to secure the liner tightly in the holder.
3. Wearing leather work gloves, grasp the cutter by the handle(s) (avoid accidental contact with the blades) and place the cutter on the liner. The liner holder will usually have a bent bar that secures the liner in place, which provides resistance against the draw of the liner cutter. Begin the cut at the end of the liner opposite this bar. Be sure that blades are positioned just beyond the end of the liner to initiate the cut.
4. With slight downward pressure on the cutter, draw the cutter slowly and smoothly along the liner. If excessive force is required to open the liner, the cutter blades may be dull and should be replaced immediately.
5. When the cutter has been drawn the entire length of the liner, the cut section of the liner may be removed to access the sampled material.

The equipment described above is standard practice for most drilling subcontractors and is required by this SOP. This requirement should be communicated and confirmed with the drilling subcontractor before going into the field. Alternate methods of cutting sample liners open (i.e., holding a liner with one hand and using a hook-blade utility knife with the other to open the liner) can result in severe cuts and nasty infections, and **are not to be used**.

Sampling Soils for Environmental Laboratory Analysis

Sampling of soils for environmental laboratory analysis shall be conducted as described in AECC SOP # 101 - Surface and Shallow Soil Sampling. The intervals to be sampled shall be specified in the Project Work Plan. If the sampling program includes laboratory analysis for volatile organic compounds (VOCs), the VOC sampling shall be performed before any other activity.

Once the liner has been opened, the soils contained within can be sampled for laboratory analysis and classified. Materials from the liner can be removed using clean decontaminated/disposable spoons or spatulas. Except for soils to be sampled for volatile organic compound analysis, the soils should be placed into a sample collection pan and homogenized, or placed directly into the appropriate sample container(s).

Once filled, the sample container should be properly capped, cleaned and labeled, and placed into a cooler with ice in preparation for shipping to the laboratory, in accordance with standard operating procedures pertaining to sample handling, packaging and shipping.

Volatile Organic Samples

In order to minimize the loss of volatiles during the sampling process, samples should be collected into lab-supplied glassware as soon as possible after retrieving the sampler from the subsurface. Other tasks (classification, sampling for other parameters, field-screening, equipment decontamination, etc.) should either be performed by others, or be completed after collecting samples for VOC analysis.

Upon filling the sample container, clean and label the container and place it into a cooler immediately. Residual sample may then be used to fill other sample or logging requirements

When using direct-push methods for collecting soil samples for VOC analysis, the drilling subcontractor shall not retrieve more than one subsequent sampler from the subsurface while the project geologist/scientist collects samples from a previous interval.

Soil Classification

Soils will be visually classified in using the Modified Burmeister Soil Classification System or alternate methods required by project specifications.

Equipment Decontamination

Sampling equipment must be decontaminated prior to its initial use and following the collection of each soil sample. Site specific decontamination should be outlined in the sampling plan/work plan. If site-specific decontamination procedures are not stipulated in the work/sampling plan, the procedures described in AECC SOP # 103 – Equipment Decontamination, will be used.

Quality Assurance/Quality Control

Quality control requirements are dependent on project-specific sampling objectives. The QAPP will provide requirements for equipment decontamination (frequency and materials), sample preservation and holding times, sample container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, field blanks, equipment blanks, and field duplicate samples.

In the absence of a QAPP, QA/QC will be attained through adherence to SOPs and requirements stipulated in project-specific specifications.

Documentation

Various forms are required to ensure that adequate documentation is made of sample collection activities. These forms will vary from project to project and may include:

- Field Log Books
- Soil Boring Logs
- Sample Collection Records
- Sample Container Labels
- Chain of Custody Forms
- Shipping Labels

Boring logs (see Example in AECC SOP # 104 – Split Spoon Soil Sampling) will provide visual and descriptive information for each sample collected and are often the most critical form of documentation generated during a soil sampling program. The field log book is kept as a general log of activities and should not be used in place of the boring log. Occasionally, sample collection records are used to supplement boring logs, especially for environmental samples which have been collected for laboratory analysis. Sample container labels are affixed to individual sample containers and then completed. Chain-of-custody forms are transmitted with the samples to the laboratory for sample custody tracking purposes. Shipping labels are required if sample coolers are to be transported to the laboratory by a third party (courier service). Original copies of these records should be maintained in the appropriate project files.

AECC ENVIRONMENTAL CONSULTING	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP No. 106
			Initial Issue Date	September 2012
			Revision Date:	Initial Version
SOP#106 – GROUNDWATER SAMPLING			Revision No.	0
			Next Revision Date:	As Needed
Preparation:	Authority:	Issuing Dept: Environmental Group	Page:	1 of 12

Scope and Application

The purpose of this SOP is to establish uniform procedures for the collection of groundwater samples. Adherence to this SOP will promote consistency in sampling methods and if followed properly will provide a basis for sample representativeness.

This SOP focuses on the collection of groundwater samples from properly developed monitoring wells, and may be applicable from other wells, springs etc that can be accessed for sampling. Groundwater samples might also need to be collected from residential potable water wells, industrial supply wells, open soil borings/core holes, and other sources which are not readily accessible, or that might require additional instruction and protocols for sampling. The collection of groundwater samples from these sources will vary according to the project and protocols, and procedures for collecting groundwater samples from these features will be discussed in the project-specific QAPP, or sampling plan.

State or federal agency mandated operating procedures may exist that require deviation from this SOP. These required deviations must be identified before the sampling program begins (ideally during the work plan/sampling plan development), and must be explained in the project-specific work plan/sampling plan.

Responsibilities

Project Manager

The project manager is responsible for assuring that project specific requirements are communicated to the project team and for providing the materials, resources, and guidance necessary to perform the work in accordance with this SOP and associated project-specific work plan.

Sampling Technician

The sampling technician is responsible for conducting groundwater sampling in a manner consistent with this SOP and/or in accordance with the QAPP, sampling plan or other project documents. The sampling technician will observe all sampling activities to ensure that the SOP is followed, and will record all pertinent data and information on appropriate forms, logs and/or in the project field notebook.

The sampling technician is responsible for ensuring that he/she has the appropriate laboratory supplied sampling supplies, the sampling equipment and supplies, and the supplies and materials for equipment decontamination.

Generally, the sampling technician is also responsible for handling the collected samples, maintaining custody documentation and preparing the samples for shipping/delivery to the analytical laboratory. On larger projects, a separate team may be assigned this task.

Equipment/Apparatus/Supplies

Required materials will vary depending on the method of groundwater sampling being conducted. In general, the equipment necessary may include:

- Project-specific plans (QAPP, sampling plan, scope of work, HASP).
- Appropriate PPE and safety equipment.
- Plastic sheeting
- Bailers (disposable or re-usable) and bailer-line/string.
- Development pumps (submersible, peristaltic, bladder, Waterra, centrifugal, air-lift, etc.)
- Sampling pumps (typically submersible, peristaltic or bladder)
- Monitors/meters (water quality meter) with calibration standards.
- Water Level Indicator (WLI) or Oil/Water Interface Probe
- Decontamination equipment and supplies (see AECC SOP-103)
- Sample bottles, labels, preservatives, chains of custody, coolers, etc. (sampling kits)
- Sample handling and shipping supplies (see AECC SOP–102),
- Field notebook, and records/forms for documentation/pen(s).
- Buckets and/or drums for carrying/containing purge water.
- Sampling cup/clear container for checking field parameters during purging
- Cooler and ice for samples
- Filters if required for metals analysis.
- Paper Towels

It is important that the sampling technician understand how to use all equipment and supplies that are provided for, and expected to be used, for collection of groundwater samples. If you have never used a particular piece of equipment, be sure to talk to the project manager for direction/instructions prior to deploying to the jobsite.

All equipment/supplies/apparatus that will be inserted into a well to facilitate well purging or groundwater sample collection, or that will come into contact with potentially contaminated groundwater during the sampling process must be decontaminated before and after each use.

Field monitoring equipment/meters should be calibrated and operated in accordance with manufacturer's instructions.

Procedures

General

During a groundwater sampling event, the first activity upon arrival at the site is typically the measurement/collection of depth-to-water data at each well location. Each of the wells to be gauged should be opened so that they are each able to equilibrate with the atmosphere, and should be gauged with a water level indicator, for depth to water and total well depth. If free phase product is anticipated at a given location, this should be field verified with a clean new disposable bailer and/or an oil/water interface probe.

Data on depth to water, depth to the base of the welland the diameter of each well should be recorded on the groundwater sample collection record and/or in the field notebook, as should any other pertinent information such as length and vertical position of well screen (if present), depth and thicknesses of immiscible layers, odors, lack of water, etc. The water level indicator/oil water separator must be decontaminated between use at each well. Flushing the probe and tape of the WLI with distilled water is generally sufficient for wells with no free product, however decontamination with detergents or solvents may be necessary if wells contain non-aqueous phase liquids (NAPLs).

NOTE: Historical water-level and groundwater quality data if available, should be used be used by the sampling technician. These data will aid in identifying changes in water levels over time, changes in well conditions (e.g., gradual silting up of a well screen), and which wells may be the most contaminated.

The length of the water column and the well diameter are used to calculate the volume of water in the well (calculated well volume) and is recorded on the groundwater sample collection record and/or the field notebook. Well volume is calculated as presented below.

$V = 0.041D^2(d2-d1)$, where
V = Calculated well volume in gallons
D = inside diameter of well casing in inches
d2 = total well depth in feet
d1 = depth to water surface in feet

Groundwater Sampling

Groundwater sampling is conducted in two general stages, well purging and sample collection. During purging, groundwater is removed from the well so as to remove the water that might have been affected by exposure to the atmosphere. This is commonly done by pumping or bailing a minimum of three (3) calculated well volumes from a well, prior sample collection. Field parameters such as temperature, specific conductivity, turbidity, and pH may be collected during the purging process. When such field parameters are collected, purging continues until the parameters have stabilized to within 10-percent of their preceding measurement, or until a maximum of five (5) calculated well volumes have been removed from the well.

Sample collection involves the filling of sample containers and the measurement of field-measured parameters. A summary of the most common groundwater sampling methods, and procedures to be followed for each method, are presented below.

Sampling with a Bailer

Bailing is a common and convenient method for purging and sampling groundwater, especially for situations where the depth of groundwater and the total depth of groundwater and well depth are both relatively shallow.

A bailer is a tube shaped device with a check valve at its lower end. Bailers come in a variety of sizes and volumes and are commonly disposable, although reusable bailers are available. Clean braided nylon or cotton cord is tied to the top of the bailer and the bailer is lowered into groundwater. When filled, the bailer is lifted from the well and the check-valve prevents water from draining out.

Procedures

Purging

1. Don PPE as per the project HASP section regarding groundwater sampling.
2. Obtain a clean bailer and a spool of clean polypropylene or nylon bailer cord.
3. Uncover the top end of the bailer and tie the cord to the bailer loop. Test the knot to ensure that it is secure, and remove the wrapping from the bailer.
4. Gently lower the bailer to bottom of the well.
5. Cut the cord at a proper length and tie a hand loop at the end of the cord, and attach it to your arm, or other fixed feature to prevent losing it down the well.
6. Gently raise the bailer, using the cord. The bailer cord should never touch the ground surface during purging or sampling.
7. Grab the bailer with one hand as it emerges from the well. Pour the bailed groundwater from the bailer into a graduated purge container.
8. Repeat this procedure until one calculated well volume of water is removed from the well.
9. After purging one calculated well volume, place a small volume of purged water into a sample cup and measure any required field parameters and record results on the Groundwater Sample Collection Record or in the field logbook or groundwater sampling form. If using a flow through apparatus for monitoring field parameters, record the readings from the display at this time and record in the filed logbook or groundwater sampling form.
10. Continue purging, by repeated bailing until the required purge volume has been removed from the well or until field parameters have stabilized.

Sample Collection

1. After completing purging, allow the well to recover to 90% of its static level before collecting the sample.
2. Insert the bailer into the well and gently lower the bailer to the bottom of the well.
3. Gently raise and retrieve the filled bailer from the well.
4. Grab the bailer with one hand as it emerges from the well. Insert a sample discharge tube into the bottom of the bailer to open the check valve and collect the discharging water into sample containers. In general, samples to be analyzed for VOCs are to be collected first, followed by samples to be analyzed for other organic compounds and inorganic constituents.
5. The samples to be analyzed for volatile organic compounds (VOCs) should be collected as gently as possible; so as to minimize the disturbance and aeration of the water as it enters the sample vials. Care should be taken to fill the vials such that no air bubbles are visible within the vial.
6. Repeat the sampling process until all sample containers are filled, adding required preservatives as necessary before capping.
7. After all sample containers are filled, fill the sampling cup with water and collect any required field-measured data (may include: temperature, pH, specific conductance, dissolved oxygen, total dissolved solids, oxidation-reduction potential, turbidity, salinity, etc) on the Groundwater Sample Collection Record, or in the field notebook.
8. Label and log the samples and place the containers into a cooler with ice as soon as possible (immediately) after collection.
9. Handle samples for shipment to the laboratory in accordance with AECC SOP # 102 – Environmental Sample Handling, Packaging, and Shipping.

Sampling with a Peristaltic Pump

Peristaltic pumps are commonly used for groundwater samples when the volume of water required to be purged is low, and when the depth to the groundwater surface is less than approximately 20 feet. Peristaltic pumps provide a low flow rate, typically in the range of 0.02-0.2 gallons/minute (75-750 ml/min), and are therefore best suited to low-flow sampling techniques, or for collecting samples from wells with low purge volumes.

A peristaltic pump is a type of positive displacement pump. During operation, a series of rollers rotate inside the pump casing, over a section of flexible silicone tubing. The silicone tubing is compressed and continued rotation forces water to be pumped through the system. A suction tube typically made of polyethylene or Teflon-lined polyethylene is attached to the intake end of the silicone tubing, and a discharge tube of similar material is attached to the outflow end of the silicone tubing. The suction tube is lowered into the water surface far enough so that it will remain submerged if drawdown occurs. Upon turning the pump on, the water is drawn up the suction tube, through the pump tube, and pushed out the discharge tube. Because each of the sections of hose comes in contact with groundwater, clean, new tubing must be used for each sampling location, and it is common practice to dedicate tubing to a specific well for use during future groundwater sampling events.

Procedure

Purging

1. Don PPE as per the project HASP section regarding groundwater sampling.
2. Attach new (or dedicated) sections of suction, silicone and discharge tubing, and install the silicone tubing into the peristaltic pump.
3. Insert the suction tubing into the well so that the open end is below the water surface (commonly set midway along the well screen, or so the intake is situated halfway between the lower screen slot and the uppermost submerged screen slot).
4. Start the pump and direct the discharging purge water into a graduated purge bucket, and adjust the pump speed to produce a smoothly flowing discharge.
5. Calculate the purge rate by recording the time required to purge a given volume and adjust to a flow rate of between 250 and 500 ml/min (if possible).
6. Measurements of temperature, pH and specific conductance (and/or other assigned parameters) should be made after each well purge volume and documented on the Groundwater Sample Collection Record or in the field logbook.
7. Samples may be collected after the required purge volume has been removed or the field-parameters have stabilized.

Sample Collection

1. After completing purging, allow the well to recover to 90% of its static level before collecting the sample.
2. During sample collection from a given well, samples to be analyzed for VOCs are collected first, and samples to be analyzed for other organic compounds and inorganic constituents are collected last.
3. When sampling for VOCs, reduce the flow rate so that the flow approximates 50 ml/min and use the discharge to fill the sample vials. This should be done as gently as possible, minimizing the disturbance and aeration of the water as it enters the vials. Care should be taken to fill the vial completely such that no air bubbles are visible in the vial.
4. For subsequent, non VOC samples, return the flow rate to approximately 250 ml/min and fill sample containers, being sure to add the required preservatives as necessary before capping.
5. After all sample containers are filled, fill the sampling cup with water and collect any required field-measured data (may include: temperature, pH, specific conductance, dissolved oxygen, total dissolved solids, oxidation-reduction potential, turbidity, salinity, etc) on the Groundwater Sample Collection Record or in the field notebook.
6. Label and log the samples and place the containers into a cooler with ice as soon as possible (immediately) after collection.
7. Handle samples for shipment to the laboratory in accordance with AECC SOP # 102 – Environmental Sample Handling, Packaging, and Shipping.

Sampling with a Submersible Pump

Submersible pumps are commonly used for groundwater sampling activities when groundwater is deep, or when a large volume of water must be purged prior to sampling. Because this type of pump is inserted into the groundwater being sampled, thorough decontamination between sampling locations is necessary to prevent cross-contamination. As an additional measure to prevent potential cross-contamination, historic groundwater quality data should be used (if available) to establish the order in which sampling occurs. Groundwater sampling with submersible pumps should proceed from the least contaminated wells to the most contaminated wells.

Discharge tubing, typically made of polyethylene or Teflon lined polyethylene is attached to the outflow of the pump. The pump, discharge tubing, and power cord/ air hose is lowered into the groundwater far enough so that the pump intake will remain submerged if drawdown occurs. A support cable/line is used to support the weight of the pump while it is suspended in the well, and the power cable/air hose is attached to a controller at the ground surface. Upon turning the pump on, the water is pushed up the discharge tube. Because the tubing comes in contact with groundwater, clean, new tubing must be used for each sampling location, and it is common practice to dedicate tubing to a specific well for use during subsequent groundwater sampling events.

Purging

1. Attach new or dedicated discharge tubing to the submersible pump.
2. Insert the pump, discharge hose, power cable/air hose, and support cable into the well so that the pump's intake is below the water surface (commonly set midway along the well screen, or so the intake is situated halfway between the lower screen slot and the uppermost submerged screen slot).
3. Start the pump and direct discharge into graduated purge bucket, and adjust the pump speed to produce a smoothly flowing discharge.
4. Calculate the purge rate by recording the time required to purge a given volume.
5. Measurements of temperature, pH and specific conductance (and/or other assigned parameters) should be made after each well purge volume and documented on the Groundwater Sample Collection Record or in the field logbook.
6. Samples may be collected after the required purge volume has been removed or until field parameters have stabilized.

Sample Collection

1. After completing purging, allow the well to recover to 90% of its static level before collecting the sample.
2. In general, samples to be analyzed for VOCs are to be collected first, followed by samples to be analyzed for other organic compounds and inorganic constituents.
3. If sampling for VOCs, reduce the flow rate so that the flow approximates 50 ml/min and use the discharge tube to fill the sample vials. This should be done as gently as possible, minimizing the disturbance and aeration of the water as it enters the vials. Care should be taken to completely fill the vial such that no air bubbles are visible in the vial.

4. For other parameters, adjust the flow rate to approximately 250 ml/min, and fill other sample containers, being sure to add the required preservatives as necessary before capping.
5. After all sample containers have been filled, fill the sampling cup with water and collect any required field-measured data (may include: temperature, pH, specific conductance, dissolved oxygen, total dissolved solids, oxidation-reduction potential, turbidity, salinity, etc) on the groundwater sample collection record or in the field notebook.
6. Label and log the samples and place the containers into a cooler with ice as soon as possible (immediately) after collection.
7. Handle samples for shipment to the laboratory in accordance with AECC SOP # 102 – Environmental Sample Handling, Packaging, and Shipping.

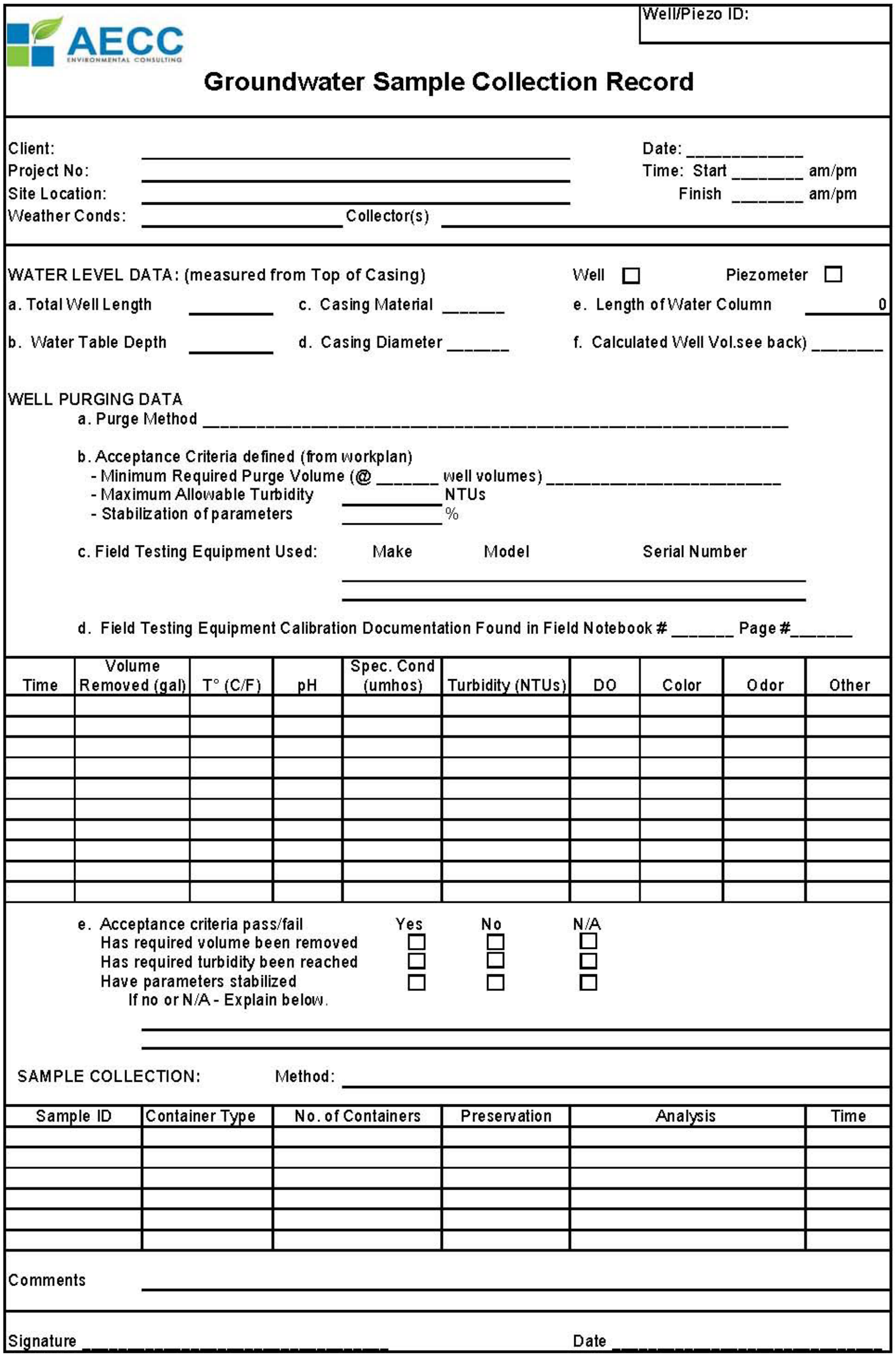
Quality Assurance/Quality Control

Quality assurance sampling is a common component of groundwater sampling programs. QA/QC sampling involves the collection and analysis of additional samples for the purposes of verifying that sampling equipment is suitably clean (equipment blanks), to check the laboratory's accuracy and/or precision (field duplicate), whether the sample matrix may be affecting the analytical results (Matrix Spike/Matrix Spike Duplicate), and whether samples might have been affected by conditions during shipment of the sample containers or samples (trip blank). The specific types of samples to be collected, the procedures to be used for collection, and the frequency QA/QC sample collection will be defined in the QAPP, work plan or project-specific work plan.

Documentation

Groundwater sampling activities should be documented in the field notebook, as well as on forms including the chain of custody record and sample collection records. Purge data collected during well purging prior to sample collection may be collected in the field notes, or on Groundwater Sample Collection Records (See Figure 1 Groundwater Sample Collection Record and Figure 2 for Low Flow Groundwater Sample Collection Record). Labels for sample jars must replicate the information provided on the chain-of-custody and at a minimum must include site ID/project number, sample ID, sampling date, sampling time, preservative, and sampler's initials. Other documentation such as meter calibration records, certifications for pre-cleaned sample containers, and shipping paperwork should be maintained as part of the project file.

FIGURE 1 Groundwater Sample Collection Record



Well/Piezo ID:

AECC ENVIRONMENTAL CONSULTING

Groundwater Sample Collection Record

Client: ______________________ Date: ____________
Project No: ______________________ Time: Start _______ am/pm
Site Location: ______________________ Finish _______ am/pm
Weather Conds: __________ Collector(s) __________

WATER LEVEL DATA: (measured from Top of Casing) Well ☐ Piezometer ☐
a. Total Well Length ________ c. Casing Material ______ e. Length of Water Column ________0
b. Water Table Depth ________ d. Casing Diameter ______ f. Calculated Well Vol.see back) _______

WELL PURGING DATA
a. Purge Method ____
b. Acceptance Criteria defined (from workplan)
- Minimum Required Purge Volume (@ ______ well volumes) ________________________
- Maximum Allowable Turbidity __________ NTUs
- Stabilization of parameters __________ %
c. Field Testing Equipment Used: Make Model Serial Number
____
____
d. Field Testing Equipment Calibration Documentation Found in Field Notebook # ______ Page #______

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other

e. Acceptance criteria pass/fail	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A - Explain below.
____
____

SAMPLE COLLECTION: Method: ________________________________

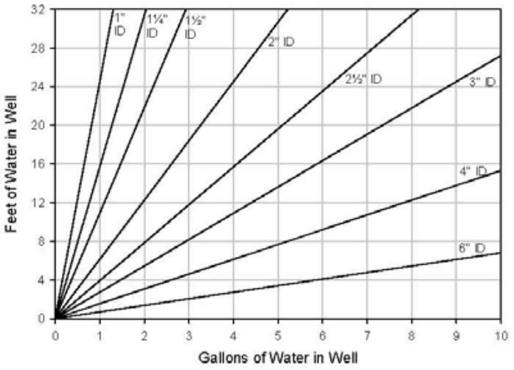
Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time

Comments ____

Signature ______________________________ Date ______________________________

FIGURE 1 (Cont'd) Groundwater Sample Collection Record

Purge Volume Calculation



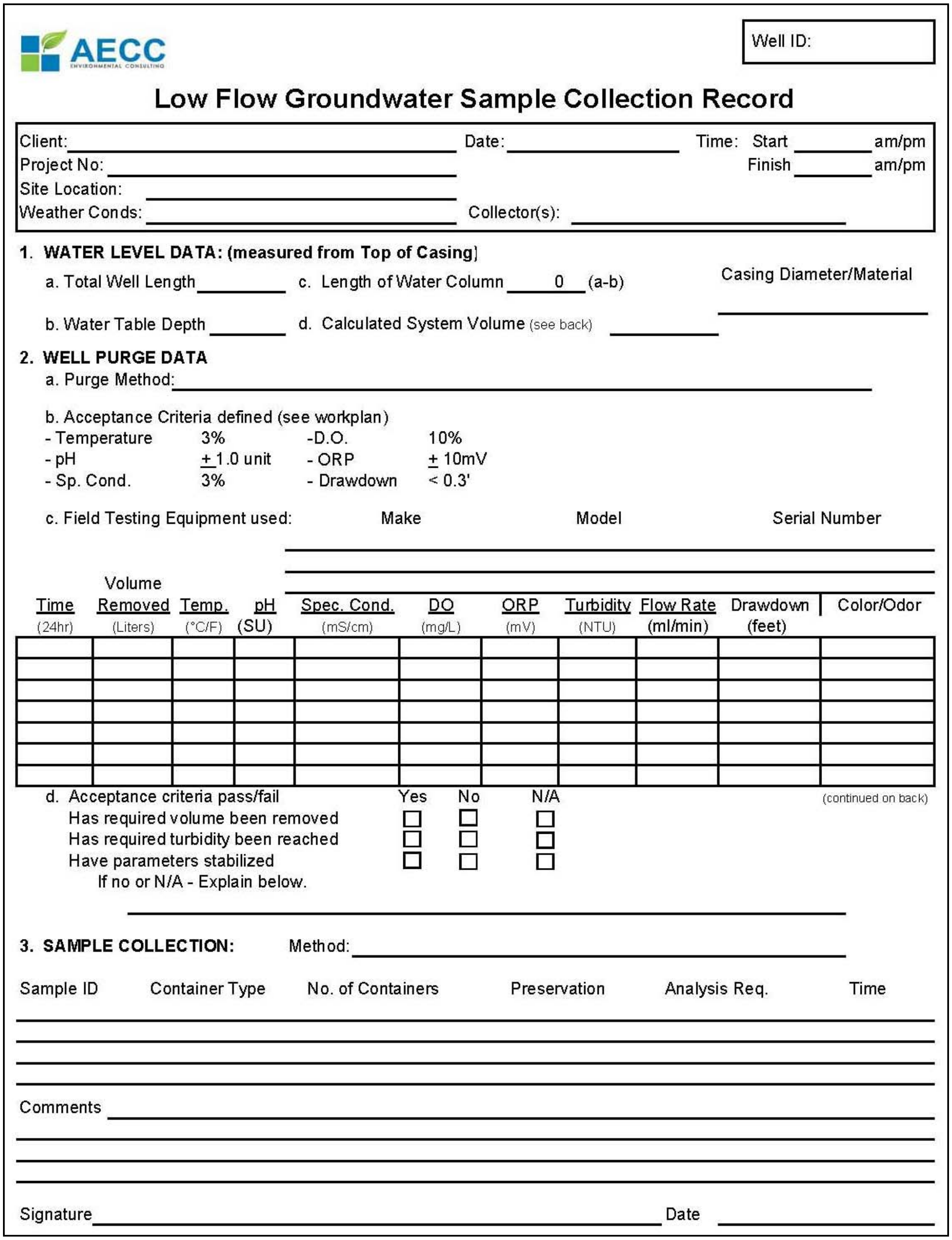
Volume / Linear Ft. of Pipe

ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600

(continued from front)

Time	Depth to GW	Temp	pH	Spec. Cond.	Turbidity	Flow Rate	Volume Removed	Draw-down	Other
(24 hr)	(feet)	(°C/F)	(SU)	(µS/cm)	(NTU)	(liters/min)	(liters)	(feet)	(Color, odor, sheen, etc.)

FIGURE 2 Low Flow Groundwater Sample Collection Record



AECC ENVIRONMENTAL CONSULTING

Well ID:

Low Flow Groundwater Sample Collection Record

Client: ____ Date: ____ Time: Start ____ am/pm
Project No: ____ Finish ____ am/pm
Site Location: ____
Weather Conds: ____ Collector(s): ____

1. WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length ____ c. Length of Water Column 0 (a-b) Casing Diameter/Material ____

b. Water Table Depth ____ d. Calculated System Volume (see back) ____

2. WELL PURGE DATA

a. Purge Method: ____

b. Acceptance Criteria defined (see workplan)

- Temperature	3%	-D.O.	10%
- pH	± 1.0 unit	- ORP	± 10mV
- Sp. Cond.	3%	- Drawdown	< 0.3'

c. Field Testing Equipment used: Make Model Serial Number

Time (24hr)	Volume Removed (Liters)	Temp. (°C/F)	pH (SU)	Spec. Cond. (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (feet)	Color/Odor

d. Acceptance criteria pass/fail	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

(continued on back)

If no or N/A - Explain below.

3. SAMPLE COLLECTION: Method: ____

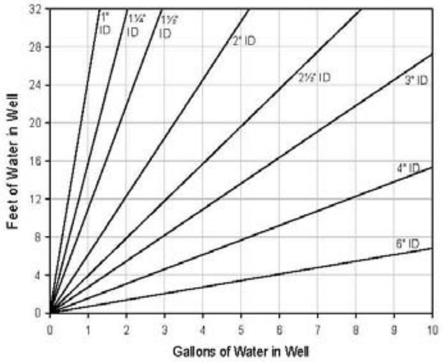
Sample ID	Container Type	No. of Containers	Preservation	Analysis Req.	Time

Comments ____

Signature ____ Date ____

FIGURE 2 (Cont'd) Low Flow Groundwater Sample Collection Record

Purge Volume Calculation



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600

(continued from front)

Time (24 hr)	Volume Removed (Liters)	Temp (°C/F)	pH	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (ft)	Color/Odor

EPA 537 (PFAS) Field Sampling Guidelines

PLEASE READ INSTRUCTIONS ENTIRELY PRIOR TO SAMPLING EVENT

Sampling for PFAS via EPA 537 can be challenging due to the prevalence of these compounds in consumer products. The following guidelines are strongly recommended when conducting sampling.

Reference-NHDES https://www.des.nh.gov/organization/divisions/waste/hwrb/documents/pfc-stakeholder-notification-20161122.pdf

FIELD CLOTHING and PPE

- No clothing or boots containing Gore-Tex®
- All safety boots made from polyurethane and PVC
- No materials containing Tyvek®
- Do not use fabric softener on clothing to be worn in field
- Do not used cosmetics, moisturizers, hand cream, or other related products the morning of sampling
- Do not use unauthorized sunscreen or insect repellant (see reference above for acceptable products)

FOOD CONSIDERATIONS

No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

OTHER RECOMMENDATIONS

Sample for PFAS first! Other containers for other methods may have PFAS present on their sampling containers

SAMPLE CONTAINERS

- All sample containers made of HDPE or polypropylene
- Caps are unlined and made of HDPE or polypropylene (no Teflon® -lined caps)

WET WEATHER (AS APPLICABLE)

Wet weather gear made of polyurethane and PVC only

EQUIPMENT DECONTAMINATION

- "PFAS-free" water on-site for decontamination of sample equipment. No other water sources to be used
- Only Alconox and Liquinox can be used as decontamination materials

FIELD EQUIPMENT

- Must not contain Teflon® (aka PTFE) or LDPE materials
- All sampling materials must be made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books can be used
- No plastic clipboards, binders, or spiral hard cover notebooks can be used
- No adhesives (i.e. Post-It® Notes) can be used
- Sharpies and permanent markers not allowed; regular ball point pens are acceptable
- Aluminum foil must not be used
- Keep PFC samples in separate cooler, away from sampling containers that may contain PFAS
- Coolers filled with regular ice only - Do not use chemical (blue) ice packs

EPA 537 (PFAS) Field Sampling Guidelines

PLEASE READ INSTRUCTIONS ENTIRELY PRIOR TO SAMPLING EVENT

Sampler must wash hands before wearing nitrile gloves in order to limit contamination during sampling. Each sample set requires a set of containers to comply with the method as indicated below. **Sample set is composed of samples collected from the same sample site and at the same time.*

Container Count	Container Type	Preservative
3 Sampling Containers - Empty	250 mL container	Pre preserved with 1.25 g Trizma
1 Reagent Water for Field Blank use	250 mL container	Pre preserved with 1.25 g Trizma
P1 Field Blank (FRB) - Empty	250 mL container	Unpreserved

Sampling container <u>must be filled to the neck.</u> For instructional purposes a black line has been drawn to illustrate the required fill level for each of the 3 Sample containers

Field blanks are recommended and the containers have been provided, please follow the instructions below.

Field Blank Instructions:

1. Locate the Reagent Water container from the bottle order. The Reagent Water container will be pre-filled with PFAS-free water and is preserved with Trizma.
2. Locate the empty container labeled "Field Blank".
3. Open both containers and proceed to transfer contents of the "Reagent Water" container into the "Field Blank" container.
4. If field blanks are to be analyzed, they need to be noted on COC, and will be billed accordingly as a sample.

Both the <u>empty</u> Reagent Water container and the <u>filled</u> Field Blank container must be returned to the lab along with the samples taken.

Sampling Instructions:

1. Each sampling event requires 3 containers to be filled to the neck of the provided containers for each sampling location.
2. Before sampling, remove faucet aerator, run water for 5 min, slow water to flow of pencil to avoid splashing and fill sample containers to neck of container (as previously illustrated) and invert 5 times.
3. Do not overfill or rinse the container.
4. Close containers securely. Place containers in sealed ZipLoc® bags, and in a separate cooler (no other container types).
5. Ensure Chain-of-Custody and all labels on containers contain required information. Place sample, Field Blank and empty Reagent Blank containers in ice filled cooler (do not use blue ice) and return to the laboratory. Samples should be kept at 4°C ±2. Samples must not exceed 10°C during first 48 hours after collection. Hold time is 14 days.

Please contact your Alpha Analytical project manager with additional questions or concerns.

	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP # 107
			Initial Issue Date	August 2012
			Revision Date:	Initial Version
SOP# 107 – Monitoring Well Construction, Installation, and Development			Revision No.	0
			Next Revision Date:	August 2013
Preparation: Environmental Group	Authority: Bryan Bowers	Issuing Dept: Environmental Group	Page:	1 of 11

Scope and Application

The purpose of this SOP is to provide guidance on the installation of overburden and bedrock monitoring wells and the subsequent development of monitoring wells after they are installed. Monitoring wells are installed to monitor the depth to groundwater, aquifer properties, and to obtain samples of groundwater for chemical analysis.

If monitoring wells are not properly installed, they may act as a route of contaminant migration between separate aquifers or may allow contamination at the ground surface to migrate to the subsurface. This condition represents a huge liability to the Company, and in many states, to the individual Professional Geologist responsible for installing the well. It is vitally important that monitoring wells be constructed and maintained so as to ensure that such migration of contamination does not occur.

Some states and EPA Regions have implemented strict requirements for monitoring well construction. These requirements must be reviewed in advance of the field program and specified in the project work plan.

Monitoring wells are generally constructed in a soil boring or core hole that has been advanced using conventional drilling equipment, using commercially-available well construction and filter/sealing materials. After installation, and prior to groundwater sample collection, the wells must be properly developed to enhance/maximize the interconnectivity between the well and the formation, and to remove fine grained material from the filterpack. Procedures for monitoring well development are outlined at the end of this SOP, and procedures for groundwater sample collection are provided in AECC SOP# 106 – Groundwater Sampling.

Responsibilities

Project Manager

The project manager is responsible to make sure that projects involving the installation of monitoring wells are properly planned and executed, and to assure that project-specific well construction specifications are effectively communicated to the Project Geologist/Scientist and to the Drilling Subcontractor that will be responsible for monitoring well construction.

Project Geologist/Scientist

The project geologist/scientist is responsible for directly overseeing the construction and installation of monitoring wells by the drilling subcontractor. He/she is also responsible for making sure that well installation procedures are consistent with this SOP and that the specifications defined in the project work plan are adhered to. The project geologist/scientist is responsible for recording all pertinent data on the appropriate forms and/or in the field notebook.

Subcontractors

The drilling subcontractor is responsible for providing the necessary equipment for well construction and installation consistent with the project requirements. In addition to the drilling equipment, this will typically include:

- Threaded flush-joint riser pipe of an approved material that typically consist of polyvinyl chloride (PVC) or stainless steel. Other specialty riser pipe materials may be required (e.g., Teflon). Note that glue or PVC cements for joining lengths of riser pipe are not permitted.
- Threaded flush-joint slotted screen of appropriate slot size and approved material (PVC, stainless steel). The use of glues or PVC cements is not permitted.
- Properly sized and washed filter pack material (quartz sand).
- Bentonite (granular, and chips or pellets)
- Steel surface casing (if required)
- Tremie pump and pipe

Commonly a surveying subcontractor is retained to survey aspects of a subsurface site characterization project. Depending on the project work plan, the surveyor may be responsible for providing a monitoring well's horizontal coordinates, ground surface elevation, gauging point (i.e., top of casing) elevation and/or the top of the protective casing elevation.

Equipment/Apparatus/Supplies

In addition to the equipment and materials provided by the drilling subcontractor, required materials may include the following:

- Project-specific documents (Scope of work, HASP, QAPP, Sampling Plan)
- Monitoring Well As-Build Diagrams (Figure 1)
- Weighted tape measure for verifying well and hole depths and well material dimensions. Stainless steel spoons, spatulas, soil mixing pans etc.
- Health and safety equipment/PPE (per the HASP)
- Field project notebook/pen

Procedures

Monitoring well installation begins with the completion of a soil boring or corehole to the required depth, and often begins while hollow-stem augers (or other temporary casing material) are still in the ground to prevent the open hole from collapsing. The soil boring/core hole should be at least 2-inches larger in diameter than the screen/riser so that filter pack, seals, and grouting materials can be installed effectively and without causing bridging. The well construction materials are carefully emplaced into the soil boring/corehole while the hollow stem augers/temporary casing is progressively withdrawn from the ground.

Before starting the well construction process, the field geologist/scientist should verify that the well construction materials are new/clean or whether decontamination of the materials is required. The geologist/scientist should also measure and record the dimensions of the various components that will collectively become the well. Upon completion, a person should be able to use these measurements to precisely locate the depth of any well feature (i.e., flush-joint, bottom of end cap, top screen slot, etc.) as measured from the top of the well casing.

Procedures

The following general procedure will be used during the installation of monitoring wells:

1. Advance the hollow stem augers/temporary casing to the required termination depth and remove center rods.
2. Check the total depth of the soil boring/corehole with a decontaminated, weighted tape.
3. Emplace lowermost portion of the filter-pack sand into the boring through the hollow-stem augers/temporary casing, withdrawing the augers/temporary casing as necessary, so that 6-inches of filter pack sand lies in the bottom of the boring.
4. Verify depth with weighted tape.
5. Thread the bottom cap onto screened section(s), and tighten so that joints are flush.
6. Insert screen into the boring, and add lengths of riser pipe, adding centralizers as necessary (especially in deeper installations), until the well string rests on the bottom of and is centered in the soil boring/corehole.
7. Cut the top riser off at the appropriate height for stick-up or flush mount type well installation and insert locking expansion plug. Be sure to measure the length of riser removed and subtract from the total riser length measured previously.
8. Continue adding filter pack sand into the annular space between the well casing and the augers/temporary casing, progressively withdrawing the augers/temporary casing as necessary, until the filter pack sand is 2 to 3 feet above the uppermost screen slot.
9. Verify depth to top of filter pack with weighted tape.
10. Tremie, or for shallow wells (<35 feet in depth) gravity feed a 2-foot thick (minimum) layer of bentonite chips, pellets or slurry above the filter pack, being sure that the bentonite does not bridge or accumulate within the hollow stem auger/temporary casing.
11. Verify depth to the top of the filter pack seal with weighted tape.
12. Prepare bentonite-cement grout approximating the ratio:

    2 # bentonite powder: 94 # Portland cement: 7 gal. potable water

13. Tremie the grout into the annulus using a tremie pipe and pump (gravity feed bentonite pellets if emplacing them at a shallow depth range). Grout the well to within 2 to 3 feet of the surface but not higher than the average frost line.

14. Install protective cover (stick-up or flush-mount) and prepare concrete pad and finish so that it slopes away from the wellhead in all directions. Pads will have a minimum thickness of 4 inches. Drill vent hole in casing or expansion plug/well cap (stick up installations only) and lock the protective cover (or the expansion plug for flush mount installations).
15. If the well design specifies guard posts/bollards, dig the holes and set the guard posts in concrete separate from the concrete well pad. Bollards must extend to a depth of 2 feet.
16. Record the appropriate construction/completion information in the field logbook and on the monitoring well as-built detail (Figure 1).
17. If a form was used for the concrete pad, return to the well site after the concrete has cured for at least 24 hours and remove the form. Backfill around the pad with native soil and restore surface as appropriate.
18. The well identification should be marked on the protective casing and PVC cap. Paint the well cover and posts, if required.

Monitoring Well Development:

Monitoring wells are developed to enhance the interconnection between the well and the aquifer. Drilling methods inherently cause disturbance of the saturated portion of a monitoring well, and if mud rotary techniques are used when drilling in bedrock, the drilling mud may cake up on and seal off, or partially obstruct the water-bearing zone in a well. Development is the process of removing the caked material from the bore/corehole wall, and/or removing fine-grained materials from the filter pack. Development using vigorous methods should occur a minimum of 48 hours after the well is completed to allow the filter pack seal grout to sufficiently cure. Development may occur before the 48 hour minimum if the development occurs before the emplacement of the filter-pack and grout, or if development is to be completed by hand bailing or other relatively low stress method that will not draw the seal/grout materials into the filter-pack or well.

Equipment needed:

- Pump, pump tubing, or bailer and bailer cord, surge block (or other method-specific equipment as appropriate)
- Water-level indicator.
- Temperature, conductivity and pH meters.
- Personnel protective equipment as specified in the site-specific HASP.
- Decontamination supplies.

- Disposal drums, if required.

The most common well development methods utilized by AECC are: surging with a surge block, over-pumping, and bailing. Surging involves raising and lowering a surge block or surge plunger inside the well. The resulting surging motion forces water into the formation and loosens sediment, pulled from the formation into the well. Occasionally, sediments must be removed from the well with a bailer or pump.

Over-pumping involves pumping at a rate high enough to draw the water level in the well down as low as possible, and then allowing the well to recharge to near the original level. This process is repeated until sediment-free water is produced.

Bailing includes the use of a simple manually operated check-valve bailer to remove water from the well. The bailing method, like other methods, should be repeated until sediment free water is produced. Bailing may be the method of choice in a shallow well or in slowly-recharging wells.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed and/or combined as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. Other less-common methods may also be applicable, depending on project/site specific situations. In all instances, the procedures employed are to be documented in the field notebook and development data log.

The following steps will be followed when developing monitoring wells:

1. Obtain information on each well to be developed and list on the Development Data Logs (i.e., drilling method, well diameter, well depth, screened interval, anticipated contaminants).
2. Obtain a water level meter, air monitoring instruments, materials for decontamination, and water quality instrumentation (if stipulated in the QAPP/Work Plan or other project specific documents).
3. Assemble drums or containers for temporary storage of water produced during well development.
4. Assemble necessary equipment on a plastic sheet surrounding the wellhead.
5. Record pertinent information in the field logbook and or development data log (personnel, time, location ID, etc.) and don appropriate PPE as specified in the site specific HASP or Job Safety Analysis (JSA).
6. Open the monitoring well, take air monitor reading with a PID at the top of casing and in the breathing zone as appropriate.
7. Measure depth to water and the total depth of the monitor well. Calculate the water column volume of the well (refer to the groundwater sampling logs in AECC SOP# 106 - Groundwater Sampling) to approximate well volume based on well diameter.

8. Begin development and measure the initial pH, temperature, turbidity, and specific conductivity of the water and record in the site logbook. Note the initial color, clarity, and any other observable conditions.
9. Continue to develop the well and periodically measure the water quality parameters indicated in step 8 (above). Depending on project objectives and available time, development should proceed until these water quality parameters stabilize, or until the water has a turbidity of less than 50 nephelometric turbidity units (NTUs).
10. Record the final water quality parameters in the field notebook and purge data sheets.
11. Remove the pump assembly or bailers from the well, decontaminate, and cleanup the site.
12. Lock the well cover before leaving. Dispose of produced water as required by the project work plan

Terms/Definitions:

Annulus: The space between the borehole wall and the outside of the well screen or riser pipe.

Bentonite Seal: A granular, chip, or pellet bentonite material that is often used to provide an annular seal above the well screen filter pack. This seal is typically installed dry followed by in-place hydration with or without the addition of water. Hydrated bentonite is sometimes used as a grout seal.

Bottom Cap/Plug: Threaded or slip-on cap placed at the bottom of the well prior to installation. Often serves as a sump for accumulation of silt which settles within the well. The measured length from the lowermost well screen slot to the bottom of the bottom cap is known as the sump or tail pipe portion of the well.

Centralizers: Stainless steel expansion clamps which, when fitted to well screens or riser pipe, expand to contact the borehole walls positioning the well centrally (and plumb) within the open borehole so as to allow for even placement and distribution of filter pack, seals and grout.

Expansion Plug/Well Cap: Cap used to cover the opening at the top of the well riser pipe. Expansion plugs are equipped with a rubber gasket and threaded wing nut which, when turned, provides a watertight seal. Expansion caps may also be locked, and generally are recommended for use with flush-constructed wells where road box protective casings are also used. Other well caps may include slip-on or threaded caps made of the same material as the well casing.

Filter Pack: A well-graded, clean sand or gravel placed around the well screen to act as a filter in preventing the entry of very fine soil particles into the well.

Grout Seal: A cement/bentonite mixture used to seal a borehole that has been drilled to a depth greater than the final well installation depth or to seal the remaining borehole annulus once the filter pack seal has been installed above the filter pack. Occasionally, pure bentonite is used as a grout seal.

Measuring Point: A selected point at the top of the well casing (riser pipe) used for obtaining periodic water-level measurements. The measuring point should consist of either a notch or indelibly marked point on the upper surface of the casing. Typically, the highest point on the casing (if not level) is used as the measuring point. The measuring point is also the point that is surveyed when well elevation data is obtained.

Protective Casing: A locking metal casing, placed around that portion of the well riser pipe that extends above the ground surface. The protective casing is generally cemented in place when the concrete pad is constructed around the well.

Riser Pipe: The non-perforated portion of well casing material used above the well screen, that extends to the ground surface. Riser pipe is typically available pre-cleaned and pre-threaded for immediate use.

Road Box/Flush Mount Protective Cover: A protective casing that is flush-mounted with the ground surface, and are used in areas where the monitoring well cannot extend above the ground surface for traffic or security reasons.

Tremie Pipe: A small diameter pipe which fits in the open borehole annulus and is used to inject filter sands or hydrated seal materials or grouts under pressure.

Well Screen: That portion of the well casing material that is perforated in some manner so as to provide a hydraulic connection to the aquifer. Typically a well screen is purchased pre-slotted, pre-cleaned, and pre-threaded for immediate use.

Vent Hole: Small diameter hole drilled in the upper portion of the well riser pipe (or in the expansion plug/well cap which provides atmospheric venting of the well. The vent holes allow for constant equilibration of the water level with changing atmospheric conditions. In flood-prone areas, or with flush-mount wells, vent holes should not be used.

Quality Assurance/Quality Control

Quality control requirements are project-specific and can vary greatly from project to project. QA/QC protocols regarding the decontamination of well construction materials or the collection and analysis of equipment blanks and/or well material blanks, if required, will be specified in the QAPP. In the absence of a QAPP, QA/QC will be attained through adherence to SOPs and requirements stipulated in other project-specific specifications (i.e., work plan, sampling plan, etc.).

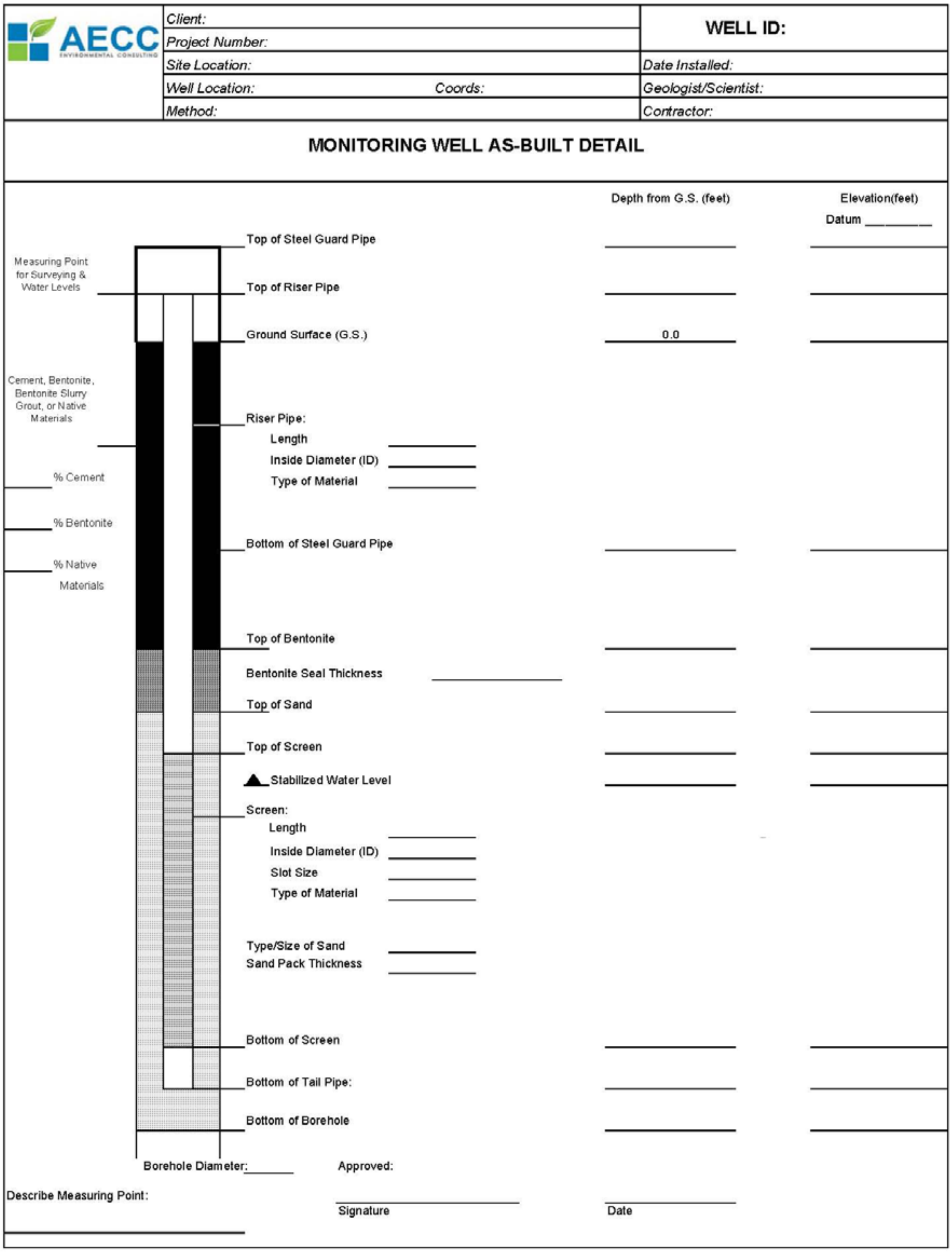
Documentation

All well construction data will be recorded on the Monitoring Well As-Built Detail form (Figure 1). Well locations are to be identified on field maps, and additional information collected during installations will be recorded in the field notebook.

Well development will be documented on the Monitoring Well Development Record (Figure 2).

Deviations from this SOP, and the rationale for those deviations should be documented in the field project notebook.

Figure 1 – Monitoring Well Construction Detail



Client:
Project Number:
Site Location:
Well Location: Coords:
Method:

WELL ID:

Date Installed:
Geologist/Scientist:
Contractor:

MONITORING WELL AS-BUILT DETAIL

	Depth from G.S. (feet)	Elevation(feet) Datum ________
Top of Steel Guard Pipe		
Top of Riser Pipe		
Ground Surface (G.S.)	0.0	
Bottom of Steel Guard Pipe		
Top of Bentonite		
Top of Sand		
Top of Screen		
Stabilized Water Level		
Bottom of Screen		
Bottom of Tail Pipe:		
Bottom of Borehole		

Measuring Point for Surveying & Water Levels

Cement, Bentonite, Bentonite Slurry Grout, or Native Materials

_____ % Cement
_____ % Bentonite
_____ % Native Materials

Riser Pipe:
Length ________
Inside Diameter (ID) ________
Type of Material ________

Bentonite Seal Thickness ________

Screen:
Length ________
Inside Diameter (ID) ________
Slot Size ________
Type of Material ________

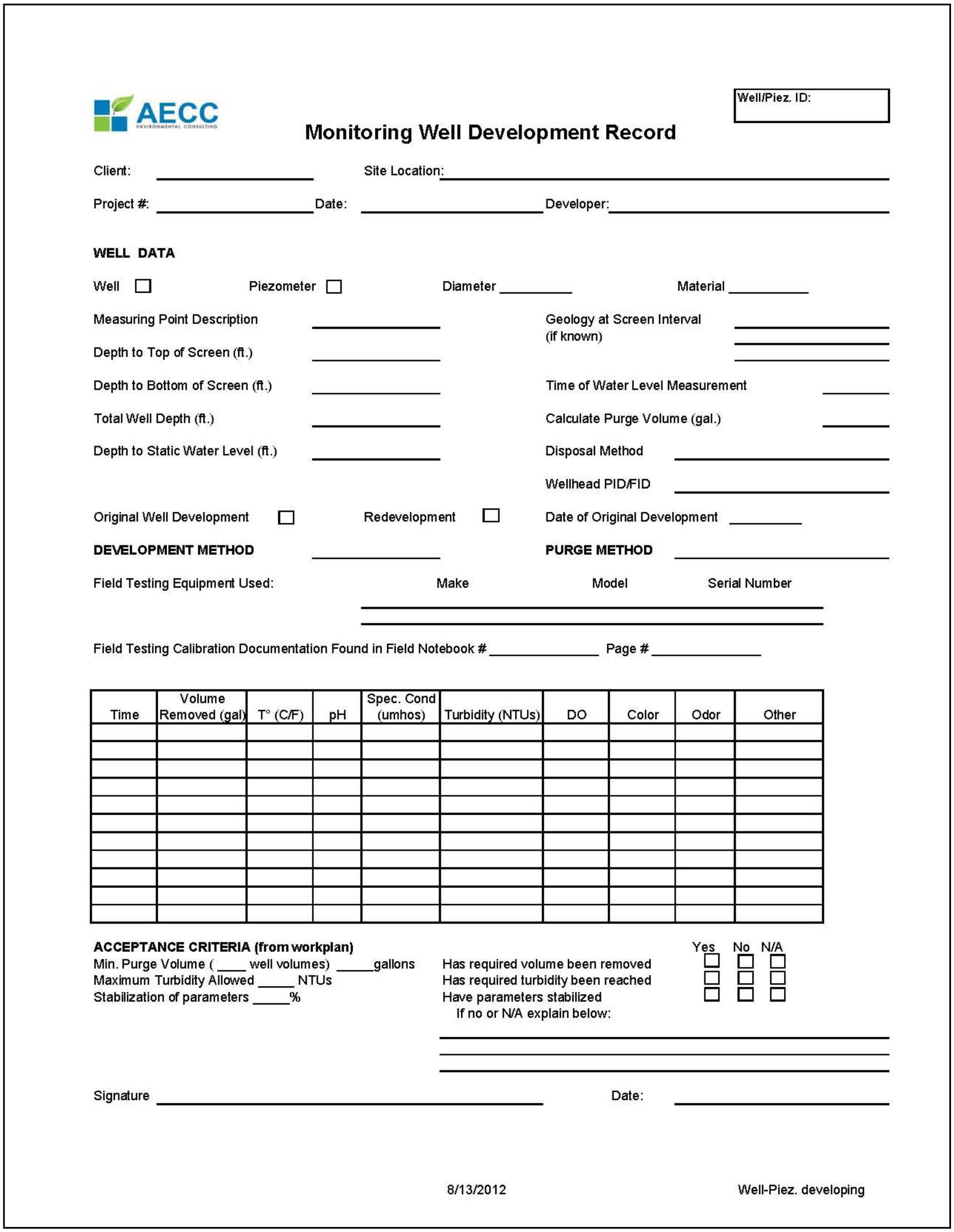
Type/Size of Sand ________
Sand Pack Thickness ________

Borehole Diameter: ______

Approved:
Signature ________
Date ________

Describe Measuring Point: ________

Figure 2
Monitoring Well Development Record



AECC ENVIRONMENTAL CONSULTING

Well/Piez. ID:

Monitoring Well Development Record

Client: ____________ Site Location: ____________

Project #: ____________ Date: ____________ Developer: ____________

WELL DATA

Well ☐ Piezometer ☐ Diameter ________ Material ________

Measuring Point Description ____________

Depth to Top of Screen (ft.) ____________

Depth to Bottom of Screen (ft.) ____________

Total Well Depth (ft.) ____________

Depth to Static Water Level (ft.) ____________

Geology at Screen Interval (if known) ____________

Time of Water Level Measurement ________

Calculate Purge Volume (gal.) ________

Disposal Method ____________

Wellhead PID/FID ____________

Original Well Development ☐ Redevelopment ☐ Date of Original Development ________

DEVELOPMENT METHOD ____________ **PURGE METHOD** ____________

Field Testing Equipment Used: Make Model Serial Number

____

____

Field Testing Calibration Documentation Found in Field Notebook # ____________ Page # ____________

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (____ well volumes) _____gallons

Maximum Turbidity Allowed _____ NTUs

Stabilization of parameters _____%

	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A explain below:

____

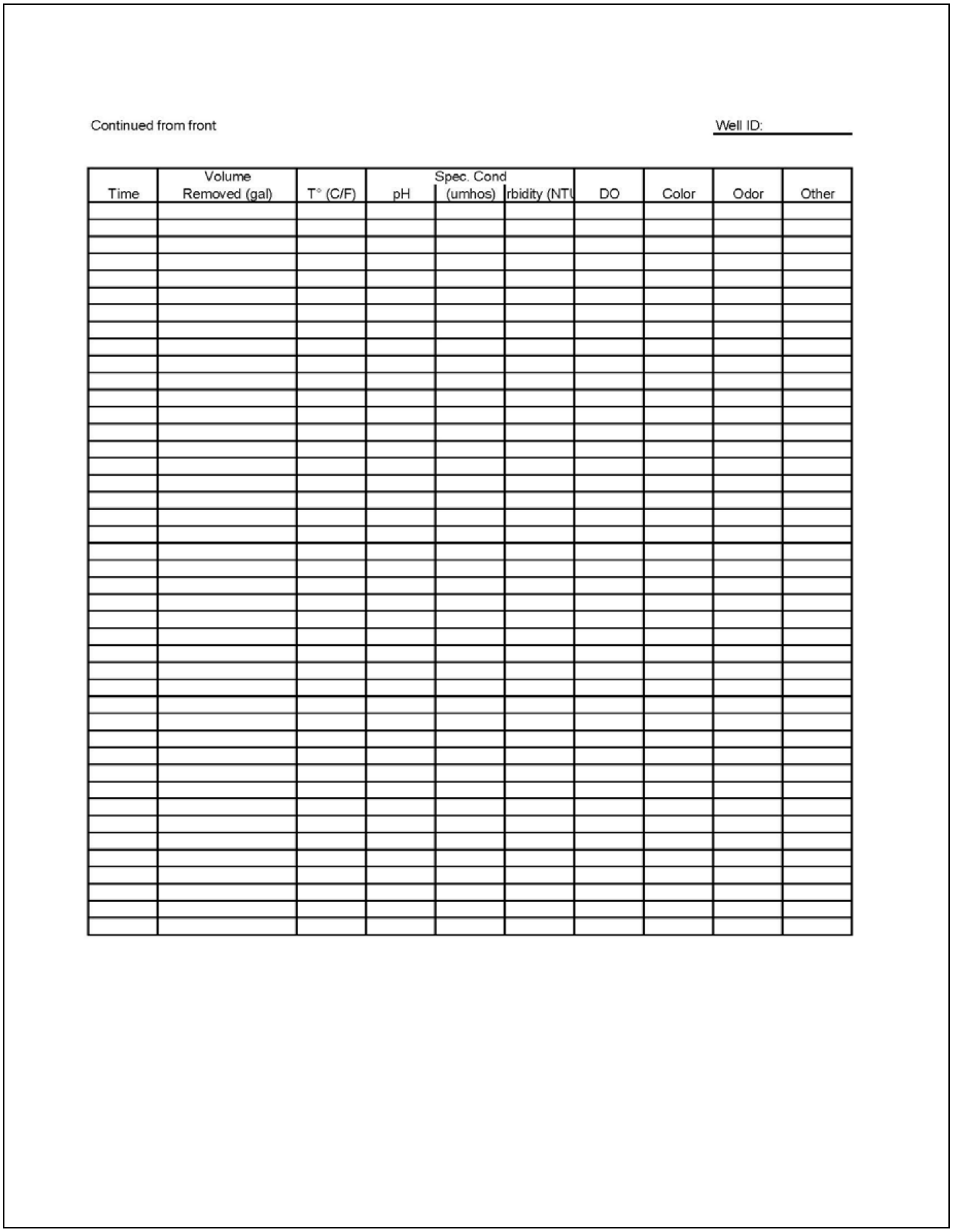
____

____

Signature ____________ Date: ____________

8/13/2012 Well-Piez. developing

Figure 2 Monitoring Well Development Record (Cont'd)



Continued from front

Well ID: __________

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	rbidity (NT	DO	Color	Odor	Other

AECC ENVIRONMENTAL CONSULTING	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP # 108
			Initial Issue Date	September 2012
			Revision Date:	Initial Version
SOP#108 – ENVIRONMENTAL SAMPLE LABELING AND CHAIN OF CUSTODY COMPLETION			Revision No.	0
			Next Revision Date:	As Needed
Preparation:	Authority: Bryan Bowers, President	Issuing Dept: Environmental Group	Page:	1 of 3

Scope and Application

The purpose of this procedure is to establish a uniform set of procedures for labeling environmental sample containers and properly completing a Chain of Custody (COC) form. Adherence to this SOP will ensure that sample containers are properly labeled, the sample collection and descriptive information is documented and that the required analytical parameters are specified on the COC form.

Sample labels provide the information necessary during handling to complete the COC forms and they reduce the possibility of confusing sample containers. The COC form is intended as a legal record of possession of a sample.

This SOP is to be used **ONLY** for the labeling and COC documentation of environmental samples. The labeling of hazardous material sample containers and the completion of COC forms shall adhere to USDOT regulations.

Equipment/Apparatus/Supplies

Required materials include the following:

Adhesive Sample Labels (laboratory-provided)
COC form(s)
Clear packing tape

Procedures

Sample bottle labeling

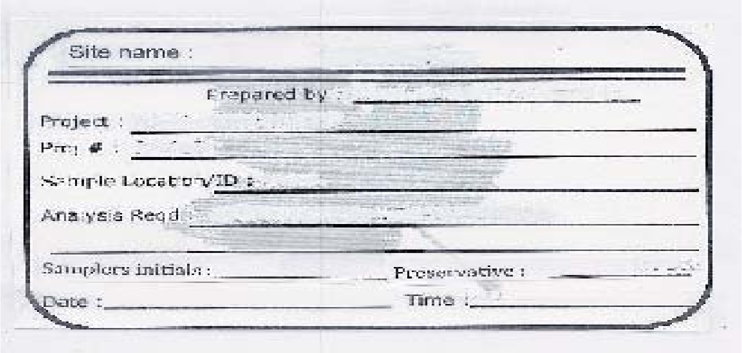
Sample containers shall be pre-labeled with blank adhesive label before samples are collected. The container shall be labeled using the adhesive labels provided by the analytical laboratory

Once a sample has been placed into a container and the container is properly sealed, the sampler shall record the following information on the label:

- Site name
- Label prepared by (lab name)
- Project name
- Project number
- Sample Location / ID
- Analysis required
- Samplers' initials
- Preservative (if present)
- Date and time that the sample was acquired

The label shall then be covered with clear packing tape which is wrapped completely around the bottle.

An example of a sample container label is shown below.



Site name :

Prepared by : [redacted]

Project :

Proj # :

Sample Location/ID :

Analysis Req'd :

Samplers initials : Preservative :

Date : Time :

Chain of Custody Completion

The COC form is typically provided by the analytical laboratory and must be partially completed by the sampler prior to releasing custody of the sample. The essential information that must be provided on the COC form by the sampler is as follows:

- Project Name/Site Name
- Details of who the lab report should be routed to
- Details of who should be invoiced for the analytical services
- Project number
- Turnaround time requested
- Date and time that each sample was collected
- Type of sample collection method (composite or grab)
- Matrix sampled (liquid, soil, sludge)
- Number of containers filled per sample number
- Requested analyses
- Remarks

Most importantly, each COC form has a section where the sampler signs, dates and records the time that he/she releases the samples to a shipping agent or the sample receiver at the laboratory. Once the samples are released a copy of the COC form shall be retained by the sampler and routed to the project file. If the cooler is to be shipped via an overnight carrier (i.e. FedEx®, UPS or similar) the signed chain of custody shall be placed in a sealable plastic bag and taped to the underside of the cooler lid. The COC form should be initiated at the lab at sample container receipt and it remains with the sample at all times.

Quality Assurance/Quality Control

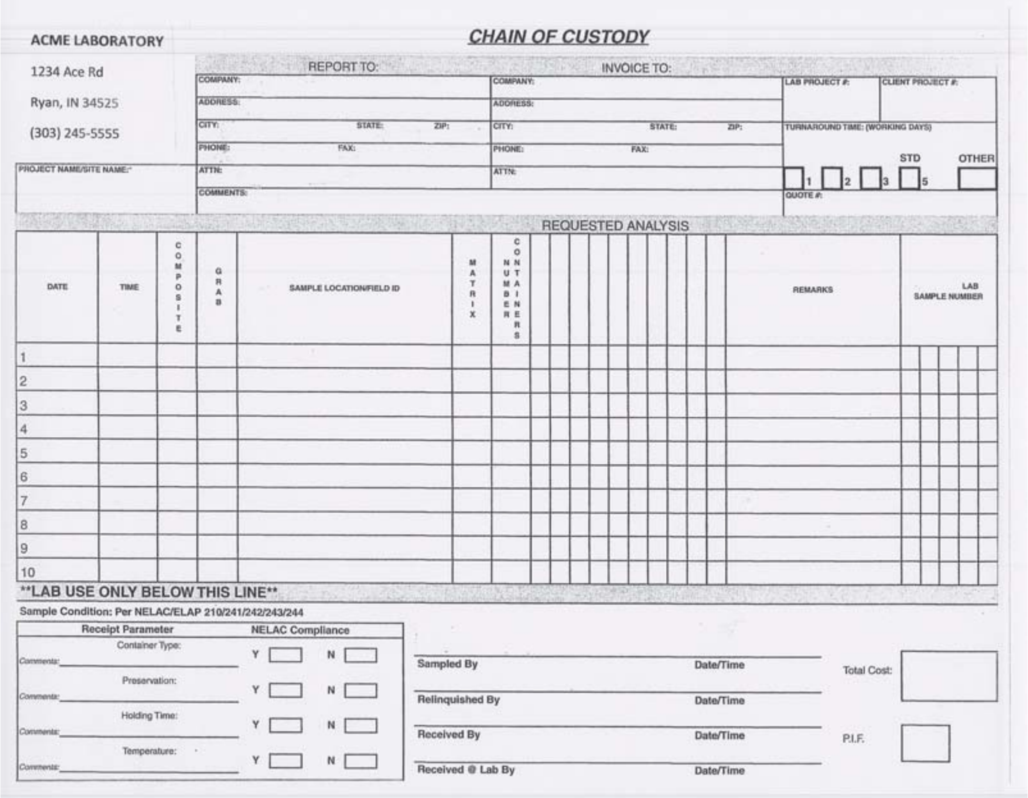
Prior to affixing a container label to a sample container, and then completing the label, the sampler shall review the project sampling plan/scope of work to ensure that the required label information has been recorded on the label.

Prior to sealing the COC for shipment the sampler shall review the project sampling plan/scope of work to ensure that the form has been fully and accurately completed (e.g., all sample Location / ID information, the appropriate laboratory analyses, and the required turn-around-time for analytical results are requested).

Documentation

If samples are being shipped via courier or via direct delivery then a copy of the signed chain of custody shall be retained. If shipping via other carrier, the copy of the airbill shall be retained for the project records.

An example of a chain of custody form is presented below.



ACME LABORATORY

1234 Ace Rd
Ryan, IN 34525
(303) 245-5555

CHAIN OF CUSTODY

REPORT TO:
COMPANY:
ADDRESS:
CITY: STATE: ZIP:
PHONE: FAX:
ATTN:
COMMENTS:

INVOICE TO:
COMPANY:
ADDRESS:
CITY: STATE: ZIP:
PHONE: FAX:
ATTN:

LAB PROJECT #:
CLIENT PROJECT #:
TURNAROUND TIME: (WORKING DAYS)
☐ 1 ☐ 2 ☐ 3 STD ☐ 5 OTHER ☐
QUOTE #:

PROJECT NAME/SITE NAME:*

REQUESTED ANALYSIS

	DATE	TIME	COMPOSITE	GRAB	SAMPLE LOCATION/FIELD ID	MATRIX	NUMBER CONTAINERS											REMARKS	LAB SAMPLE NUMBER
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

****LAB USE ONLY BELOW THIS LINE****

Sample Condition: Per NELAC/ELAP 210/241/242/243/244

Receipt Parameter	NELAC Compliance
Container Type: Comments:________	Y ☐ N ☐
Preservation: Comments:________	Y ☐ N ☐
Holding Time: Comments:________	Y ☐ N ☐
Temperature: Comments:________	Y ☐ N ☐

Sampled By Date/Time
Relinquished By Date/Time
Received By Date/Time
Received @ Lab By Date/Time

Total Cost: ☐
P.I.F. ☐

AECC ENVIRONMENTAL CONSULTING	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP # 110
			Initial Issue Date	July 2012
			Revision Date:	Initial Version
SOP#110 – FIELD MONITORING EQUIPMENT CALIBRATION			Revision No.	0
			Next Revision Date:	July 2013
Preparation: P. Micciche	Authority: Bryan Bowers, President	Issuing Dept: Environmental Group	Page:	1 of 2

Scope and Application

The purpose of this procedure is to establish a uniform general set of procedures for the calibration of field monitoring equipment. Calibration is performed as a quality assurance measure and a safety precaution. The use of equipment that has not been properly calibrated can lead to erroneous data. In addition, proper calibration of monitoring equipment helps to protect field personnel and others from potential exposure to hazardous materials.

This SOP focuses on calibration of equipment used for monitoring field activities and sampling environmental parameters.

It is noted that other state or federal agency standard operating procedures may exist that require deviation from this SOP. These required deviations must be identified before the sampling program begins (ideally during the work plan/sampling plan development), and must be explained in the project-specific work plan/sampling plan.

Equipment/Apparatus/Supplies

Examples of commonly used equipment items that require calibration include:

- Organic vapor monitors – a Photoionization detector (PID) for sampling volatile organic compounds (VOCs) in air for example.
- Combustible gas monitors – an explosimeter for detecting concentrations of explosive gases in air for example.
- Water quality meters for measuring parameters such as temperature, pH, and turbidity

Required materials may include:

- Distilled and/or deionized water
- Paper towels
- Cylinder containing standard reference gas (span gas)
- Cylinder containing clean dry air
- Calibration standards/reagents
- Tedlar® bags
- Project notebook/pen

Procedures

Given that there exist a wide variety of monitoring equipment items, and that such items are supplied by many different manufacturers, AECC does not have a standard equipment calibration procedure. However, at a minimum, each item of field monitoring equipment shall be calibrated on a daily basis. Note that specific calibration instructions are not addressed in this SOP, and personnel shall consult the equipment manufacturer supplied documents (e.g., User's

Guidebook) for detailed instructions. Equipment must be calibrated as per the manufacturer's requirements. In the case where equipment is procured on a rental basis the calibration records specific to each piece of equipment shall be provided by the vendor and remain with the equipment item. Manufacturer's specification for calibration frequency may be superseded if required by a project-specific QAPP, sampling program or other documents, depending on the quality assurance objectives for the project.

Chemical reagents used for calibration purposes sometimes can be hazardous. When the use of these (or other similar) reagents solvents is required by a project-specific QAPP or Sampling Plan, the plans must also describe additional protocols and procedures regarding their safe use and handling. If associated investigation-derived waste is generated through the use of chemical reagents the plans should detail how it is to be handled, characterized, and disposed of in accordance with federal, state and local requirements.

Quality Assurance/Quality Control

General guidelines for quality control check of field equipment calibration usually require the equipment to be calibrated on a daily basis. As stated above, AECC's procedure is that each item of field monitoring equipment shall be calibrated on a daily basis. Additional calibration shall be performed whenever an exceptionally high reading ("spike") is detected. For projects with a QAPP, the document will specify the frequency of equipment calibration. For projects without a QAPP, the need for and/or frequency of equipment calibration will be specified in the scope of work, or the project work plan.

Documentation

Specific information regarding equipment calibration procedures should be documented in the project-specific field notebook. Documentation in the notebook should thoroughly describe the calibration steps implemented in order to show compliance with the project work plan. Calibration events should be logged when they occur with the following information documented:

- Date, time and location of each calibration event
- What equipment was calibrated
- Method used for calibration
- Notable circumstances.

AECC ENVIRONMENTAL CONSULTING	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP #116
			Initial Issue Date	July 2020
			Revision Date:	Initial Version
SOP#116 – CORE DRILLING			Revision No.	0
			Next Revision Date:	As Needed
Preparation: Bryan Airel/Drew Brantner	Authority:	Issuing Dept: Environmental Group	Page:	1 of 3

Scope and Application

The purpose of this document is to establish a uniform set of procedures for Core Drilling through concrete building foundation, slab, or similar materials. The SOP is designed to be a step by step procedure for performing the task described, and is to be used in conjunction with the manufacturer's operator's manual.

Core Drilling is an effective method for retrieving substrate building material samples, and for allowing access to soil and groundwater beneath a building foundation or concrete slab.

Equipment/Apparatus/Supplies

Required materials include the following:

- Core Drill
- Drill Bits (appropriate for the material being drilled)
- Appropriate / Safe Power Supply and Equipment (GFCIs, Extensions Cords, etc.)
- Potable/Amended Water, as appropriate for the investigation being performed
- Personal protective equipment (as required in HASP), including but not limited to:
    - Hard Hat
    - Safety Glasses
    - Steel toe boots with slip-resistant soles
    - Hearing protection
    - Gloves
    - High-Visibility Safety Vest

It is critical that the operator understand how to use all equipment and supplies that are provided and expected to be used.

All equipment/supplies/apparatus that will be utilized that will come into contact with media that may be contaminated, or is to be sampled to identify potential contamination, must be decontaminated before and after each use.

Procedures

This procedure describes the general step-by-step process for performing core drilling activities. There are various models / types of core drills available. It is important the operator refer to the manufacturer's instructions to ensure that all appropriate safety measures are taken when using a specific piece of equipment. The procedure presented below is generalized and is provided for guidance purposes only.

1. Ensure the area to be sampled has no obstructions or utilities (review blueprints, provided plans, perform direct field observation, and perform other suitable means).
2. Obtain and only use the appropriate core drill and drill bits required for the substrate that is to be drilled (concrete, brick, etc.).
3. Identify safe and appropriate electrical power and potable/amended water supply (as appropriate for the type of investigation being performed).
4. Cordon off work area, at least 6' on all sides surrounding the core drilling equipment.
5. Don appropriate PPE (as defined in the HASP), including anti-vibration or shock dampening gloves and safety glasses.
6. Ensure familiarity with manufacturer's instructions and the HASP to minimize exposure to crystalline silica dust (use manufacturer supplied shroud, HEPA filtration, etc.).
7. Have spotter positioned for safe work observation.
8. Setup Core Drill in area of work. Confirm anchors are securely fastened.
9. Keep work area clear of excess water. Do not stand in water while drilling, and make sure electrical cords do not come in contact with water while drilling. Have wet-vac and absorbent pads nearby, and wear footwear with slip-resistant soles.
10. Securely anchor the drill according to manufacturer's specifications. Never operate drill without secure anchorage.
11. Once all appropriate safety measures are in place and the operator and spotter are prepared, core drilling can begin.
12. Start the motor.
13. Begin coring at a slow pace. DO NOT rush or force through a concrete surface.
14. Pay attention to the amount of water being used and the speed of the drill. Maintain a steady and safe pace.
15. Check anchors periodically to verify that the drill remains adequately secured. Always pay attention to the coring conditions.
16. When coring through rebar, slow down and reduce the force of the drill.
17. Use extra caution when the drill is nearly through the surface/material being drilled.
18. Once through, turn off the motor.
19. Release the base and carefully remove the cored material.
20. Decontaminate drill bit and other equipment that comes into contact with contaminated media or potentially contaminated media.

Quality Assurance/Quality Control

All equipment must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan.

Quality assurance sampling is a common component of investigation and sampling programs / plans. QA/QC sampling may include the collection and analysis of additional samples for the purposes of verifying that sampling equipment is suitably clean (equipment blanks). The specific types of samples to be collected, the procedures to be used for collection, and the frequency of QA/QC sample collection will be defined in the QAPP or project-specific work plan.

Documentation

Core drilling activities should be documented in a field notebook. Where sampling is to be performed, all appropriate forms (including the chain of custody record and sample collection records) must be completed.

APPENDIX B

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

Remedial Investigation Work Plan
The Smith Restaurant Building
City of Syracuse, New York

TABLE OF CONTENTS

TABLE OF CONTENTS

ATTACHMENTS

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is an appendix to the Remedial Investigation Work Plan (RIWP), which is required as an element of the remedial program at the Smith Restaurant Building site (hereinafter referred to as the “Site”) under the New York State (NYS) Brownfield Cleanup Program (BCP), administered by New York State Department of Environmental Conservation (NYSDEC). The Site is being remediated in accordance with Brownfield Cleanup Agreement (BCA) Index # C734148-06-20, which was executed on June 9, 2020.

1.1 Scope of the QAPP

This QAPP was prepared to provide quality assurance (QA) guidelines to be implemented during the Remedial Investigation (RI). The QAPP will assure the accuracy and precision of data collection during the RI. The QAPP identifies procedures for sample collection to mitigate the potential for cross-contamination, as well as analytical requirements necessary to allow for independent data validation. The QAPP has been prepared in accordance with USEPA’s Requirements for Quality Assurance Project Plans for Environmental Data Operations; the EPA Region II CERCLA Quality Assurance Manual, and NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (May 2010). This document may be modified for subsequent phases of investigative and remedial work, as necessary. The QAPP provides:

- A means to communicate to the persons executing the various activities exactly what is to be done, by whom, and when
- A culmination to the planning process that ensures that the program includes provisions for obtaining quality data (e.g., suitable methods of field operations)
- A document that can be used by the Project Managers and QA Officer to assess if the activities planned are being implemented and their importance for accomplishing the goal of quality data
- A plan to document and track project data and results
- Detailed descriptions of the data documentation materials and procedures, project files, and tabular and graphical reports

The QAPP is primarily concerned with the quality assurance and quality control aspects of the procedures involved in the collection, preservation, packaging, and transportation of samples; field testing; record keeping; data management; chain-of-custody procedures; laboratory analyses; and other necessary matters to assure that the investigation activities, once completed, will yield data whose integrity can be defended.

QA refers to the conduct of all planned and systematic actions necessary to perform satisfactorily all task-specific activities and to provide information and data confidence as a result of such activities. The QA for task-specific activities includes the development of procedures, auditing, monitoring and surveillance of the performance.

QC refers to the activity performed to determine if the work activities conform to the requirements. This includes activities such as inspections of the work activities in the field (verification that the items and materials installed conform to applicable codes and design specifications). QA is an overview monitoring of the performance of QC activities through audits rather than first time inspections.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The following section provides a generic organization for sampling activities, including roles, responsibilities, and required qualifications of these organizations.

2.1 Project Team

2.1.1 NYSDEC and NYSDOH

It is the responsibility of the NYSDEC, in conjunction with the New York State Department of Health (NYSDOH), to review the project documents for completeness and conformance with the site-specific cleanup objectives and to make a decision to accept or reject these documents based on this review. The NYSDEC also has the responsibility and authority to review and approve QA documentation collected during investigative and remedial activities and to confirm that the QA Plan was followed.

2.1.2 Property Owner

For this BCP project, the property owner (Owner) is also the BCP Volunteer. The Owner will be responsible for complying with the QA requirements as specified herein and for monitoring and controlling the quality of the Brownfield cleanup activities either directly or through their designated environmental consultant and/or legal counsel. The Owner will also have the authority to select Contractor(s) to assist them in fulfilling these responsibilities. The Owner is responsible for implementing the project, and has the authority to commit the resources necessary to meet project objectives and requirements.

2.1.3 Environmental Consultant

On behalf of the Owner, AECC will be responsible for the coordination and performance of the RI activities, interpretation of the analytical data, and evaluation of the need for and performance of Interim Remedial Measures (IRMs).

<u>Project Manager</u>

The Project Manager has the responsibility for ensuring that the project meets the overall project objectives, reports directly to the Owner, coordinates with the NYSDEC/NYSDOH Project Coordinators, and is responsible for technical and project oversight. The PM will:

- Define project objectives and develop a detailed work plan schedule
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task
- Acquire and apply technical and corporate resources as needed to assure performance within budget and schedule constraints
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product
- Review the work performed on each task to assure its quality, responsiveness, and timeliness
- Review and analyze overall task performance with respect to planned requirements and authorizations
- Review and approve all deliverables before their submission to NYSDEC
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product

- Ultimately be responsible for the preparation and quality of interim and final reports
- Represent the project team at meetings

Field Team Manager / Head Field Technician

The Field Team Manager and Head Field Technician have the shared responsibility for implementation of specific project tasks identified at the Site. They are responsible for the supervision of project field personnel, subconsultants, and subcontractors. The Head Field Technician is typically responsible for on-site operations, while the Field Team Manager is responsible for general oversight and managerial aspects of the field work. Both report directly to the Project Manager. The Field Team Manager and Head Field Technical will:

- Define daily develop work activities
- Orient field staff concerning the project's special considerations
- Monitor and direct subcontractor personnel
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness
- Assure that field activities, including sample collection and handling, are carried out in accordance with this QAPP

Quality Assurance Officer

The QA Officer will have direct access to corporate executive staff as necessary, to resolve any QA dispute, and is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations and policies, and NYSDEC requirements. Specific function and duties include:

- Performing QA audits on various phases of the field operations
- Reviewing and approving QA plans and procedures
- Providing QA technical assistance to project staff
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the Project Manager for technical operations
- Responsible for assuring third party data review of all sample results from the analytical laboratory

2.1.4 Subcontractors

During the remedial investigation, subcontractors and subconsultants will be utilized to perform various project tasks, likely including:

- Environmental Drilling Contractor - to install soil borings and groundwater monitoring wells and other sampling points to monitor environmental media (as needed)
- Environmental Laboratory - to analyze soil and groundwater samples
- Data Validator - to prepare Data Usability Summary Reports
- Licensed Land Surveyor - to determine location and/or elevation data associated with excavations, monitoring wells, sample locations, etc.

2.1.5 Key Personnel

Key personnel anticipated for this project are as follows:

Team Member	Organization	Telephone	Role/Title
Matthew Paulus	Smith Building, LLC	315.481.1552	Owner Contact
Harry Warner	NYSDEC	315.426.7400	Regional HW Engineer
Gary Priscott	NYSDEC	607.775.2545	DEC Project Coordinator
Stephanie Selmer	NYSDOH	518.402.7860	DOH Project Coordinator
Richard McKenna	AECC	315.432.9400	Project Manager
H. Nevin Bradford	AECC	315.432.9400	Field Team Manager
Drew Brantner	AECC	315.432.9400	Head Field Technician
Bryan Airel	AECC	315.432.9400	Health & Safety Officer
James Saxton	AECC	315.432.9400	QAPP Officer

2.2 Laboratory Responsibilities

Environmental laboratories utilized for sample analysis for this project must be an independent, NYSDOH Environmental Laboratory Approval Program (ELAP)-certified facility approved to perform the analyses prescribed herein.

Laboratory Director

The Laboratory Director is a technical advisor and is responsible for summarizing and reporting overall unit performance. Responsibilities of the Laboratory Director include:

- Provide technical, operational, and administrative leadership
- Allocation and management of personnel and equipment resources
- Quality performance of the facility
- Certification and accreditation activities
- Blind and reference sample analysis

Quality Assurance Manager (QA Manager)

The QA Manager has the overall responsibility for data after it leaves the laboratory. The QA Manager will be independent of the laboratory but will communicate data issues through the Laboratory Director. In addition, the QA Manager will:

- Oversee laboratory QA
- Oversee QA/QC documentation
- Conduct detailed data review
- Determine whether to implement laboratory corrective actions, if required
- Define appropriate laboratory QA procedures
- Prepare laboratory SOPs

3.0 QA/QC OBJECTIVES

The overall objectives and criteria for assuring quality for this effort are discussed below. This QAPP addresses how the acquisition and handling of samples and the review and reporting of data will be documented. The objectives of this QAPP are to address the following:

- The procedures to be used to collect, preserve, package, and transport soil, groundwater and air samples
- Field data collection

- Record keeping
- Data management
- Chain-of-custody procedures
- Precision, accuracy, completeness, representativeness, for sample analysis and data management under EPA analytical methods

3.1 Data Quality Objectives

Data Quality Objectives (DQOs) are statements that describe the desired quality of data necessary to meet the objectives of the sampling program. The DQOs for the project were prepared in anticipation of the various media that would require sampling for laboratory analysis. DQO Forms have been completed for each type of sampling media and are located in Attachment A.

The DQO forms include information on the type of media sampled, the intended use of the data being collected, the type of analyses that will be requested, the level of analytical methodology and documentation required, sampling procedures, and the type of QAPP field samples that will be collected in support of the project. The sections of the DQO forms are described below.

Sampled Media: This section describes the material that is being sampled (groundwater, soil, surface water, waste material, etc.).

Data Use: This section is used to indicate the intended purpose of the sampling and analytical data. (i.e., for site characterization, evaluation or remedial alternatives, risk assessment, monitoring of existing sampling points, or waste characterization, etc.).

Data Type: This section identifies the compounds/analytes that samples collected during the program will be analyzed for. Also indicates whether field parameters such as pH, specific conductivity, temperature and turbidity will be monitored during sample collection.

Level of Analysis: This section identifies the level of analytical support required of the samples collected for a specific purpose as described below:

- Level I - Field Screening: This level is characterized by the use of portable type instruments that provide real-time data.
- Level II - Field Analysis: This level is characterized by the use of portable analytical instruments in an on-site lab or transported to the site. This section identifies the field analysis to be used.
- Level III - Standard Analytical Protocols: This level may include standard analytical protocols in accordance with NYSDOH Environmental Laboratory Approval Program (ELAP) certification requirements, without the NYSDEC Analytical Services Protocol (ASP) Category B QAPP and deliverables / reportables documentation.
- Level IV - NYSDEC ASP Reportables / Deliverables: This level is characterized by rigorous QAPP NYSDEC ASP protocols and Category B reportable / deliverable documentation that is suitable for data validation.

Sampling Procedures: This section provides information on sampling procedures to be used in sample collection, or provides directions to where to find this information in the project plans.

Data Quality Factors: This section describes factors that influence the quality or quantity of data to be collected. Primary contaminants and associated levels of concern are identified concerning ARARs or potential risks. The required detection limits are also given or referenced.

QAPP Samples: This section indicates additional samples to be collected to support QA/QC procedures. Additional samples to be collected include:

- Split Samples –Split samples (or duplicates) are two samples taken from the same source; digested, distilled or otherwise processed; and then analyzed. Duplicate sample analysis is used to determine reproducibility or consistency in the analysis. For this RI, spilt samples will noted in AECC's log book, but will not be identified on the sample label (known as a blind duplicate), preventing the laboratory from knowing which samples are duplicates. Duplicate / split samples shall be collected at a rate of 1 per 20 samples (5%).

- Matrix Spike / Matrix Spike Duplicates – Matrix spike duplicate samples are collected as a duplicate sample, to which the analytical laboratory will add known amounts of analyte. These QA/QC samples are intended to assess the extraction procedure used by the laboratory. These samples shall be collected at a rate of 1 per 20 samples (5%) or sample delivery group whichever is smaller and for each sample matrix.

- Trip Blanks – Trip blanks are samples that are prepared prior to the sampling event in the same type of sample container and are kept with the collected samples throughout the sampling event. Trip blank vials are not opened in the field and are analyzed for volatile organics only, and trip blanks are only collected when the sampling program includes samples that are being analyzed for VOCs. Trip Blanks shall accompany any shipment of aqueous samples for VOCs.

- Equipment Blanks – Equipment blanks are samples that are obtained by running analyte-free water through or over the sample collection equipment in a way that is identical to the sample collection procedures. Field blanks may be used during QA/QC procedures to evaluate if sampling equipment has contributed contaminants to the samples. These samples shall be collected daily whenever re-usable sampling equipment is used.

3.2 Sampling Procedures

Objectives and procedures for soil, groundwater, and soil vapor sampling have been designed to allow for the acquisition of accurate and precise data, and are detailed in the Field Sampling Plan and Standard Operating Procedures attached to this RIWP.

3.3 Laboratory Coordination

Laboratory coordination will be conducted under the direction of the Project Manager and QA Officer.

All chemical analyses for matrices will be completed by a laboratory capable of performing project-specific analyses as indicated in this QAPP and approved by the NYSDOH/NYSDEC as having the appropriate standard operating procedures, QA/QC programs, resumes, and organizational structure to complete analytical work as specified in this Work Plan. The laboratory will have current certification for standard methodologies and QA/QC, and will be required to remain certified as such throughout the project.

The laboratory utilized for laboratory analysis required under this project will be certified under the NYSDOH Environmental Laboratory Approval Program (ELAP) and will be required to maintain this certification for the duration of the program.

The laboratory will be capable of producing ASP Category B deliverables, as needed for subsequent data validation / data usability evaluation purposes.

3.4 Analytical Methodologies

All analyses will be performed by SW-846 methodologies with QAPP guidelines of 2005 ASP Category B. The following criteria will describe the appropriate methodologies for extraction, digestion, and analysis of the previously listed matrices. The specific analytes to be identified by each method, along with the Contract Required Quantitation Limits, are listed in Appendix C of the NYSDEC ASP (http://www.dec.ny.gov/data/der/asp2005cd/asp2005cd.zip).

Parameter Group	Analytical Method
TCL VOCs	USEPA Method 8260B + TICS
TCL SVOCs	USEPA Method 8270C +TICS
TAL Metals	USEPA Method 6010, 7470/7471 (Hg), 9014 (CN)
PCB Aroclors	USEPA Method 8082
Herbicides	USEPA Method 8151
Organochlorine Pesticides	USEPA Method 8081
1,4-Dioxane*	USEPA Methods 8270SIM (soil) and 522 (groundwater)
PFAS**	NYSDOH Method 537 (Modified) – Groundwater Only

*The detection limit for 1,4-Dioxane in aqueous samples is to be no greater than 0.35 ug/L
**Polyfluoroalkyl substances, 2ng/L reporting limit for PFOA and PFOS

Soil / Groundwater Analysis – Soil and groundwater samples will be analyzed for certain parameters listed above, based on location (see Section 3.0 - Sampling and Analysis Plan of the RIWP). In addition, groundwater samples will also be field-analyzed for a limited group of field parameter analyses to include pH, specific conductance, dissolved oxygen (DO), redox potential (ORP), temperature, and turbidity.

Soil Vapor Sampling – Soil vapor sampling will not be performed as part of the RI since Remedial Actions will include a soil vapor mitigation system for the Site building.

Waste Characterization Samples – Samples collected for waste characterization/disposal purposes will be analyzed in accordance with the appropriate SW-846 methodologies, for the parameters required by the disposal facility.

3.5 Analytical Quality Control

As stated previously, analytical quality for samples collected for site characterization or monitoring purposes will be in accordance with NYSDEC-ASP Category B. Analysis in accordance with NYSDOH-ELAP certification requirements may be used for samples collected for waste characterization or disposal purposes. The following holding times will be required from the contracted analytical laboratory, regardless of sample matrix:

Parameter	Task	Aqueous Holding Time	Solids Holding Time
VOCs	Analysis*	14 days	14 days
SVOCs	Extraction	7 days	14 days
	Analysis**	40 days	40 days
PCBs	Extraction	7 days	14 days
	Analysis**	40 days	40 days
Pesticides	Extraction	7 days	14 days
	Analysis**	40 days	40 days
Herbicides	Extraction	7 days	14 days
	Analysis**	40 days	40 days
Metals	Analysis	180 days	180 days
Mercury	Analysis	28 days	28 days
Cyanide	Analysis	14 days	14 days
1,4-Dioxane	Extraction	7 days	7 days
	Analysis**	40 days	40 days
PFAS	Analysis	14 days	Not Applicable

* The extraction time for Encore samplers is 48 hours.
** Days after extraction.

3.6 Laboratory Deliverables

The analytical data will be presented in 2005 ASP Category B reportable/deliverables format. Category B deliverables will not be requested for waste characterization samples.

4.0 SAMPLE CUSTODY PROCEDURES

Sample custody is controlled and maintained through the chain-of-custody procedures. Chain of custody is the means by which the possession and handling of samples will be tracked from the source (field) to their final disposition, the laboratory. A sample is considered to be in a person's custody if it is in the person's possession or it is in the person's view after being in his or her possession or it was in that person's possession and that person has locked it in a vehicle or room. Sample containers will be cleaned and preserved at the laboratory before shipment to the Site.

4.1 Sample Storage

Samples are stored in secure limited-access areas. Walk-in coolers or refrigerators are maintained at 4°C, ± 2°C, or as required by the applicable regulatory program. The temperatures of all refrigerated storage areas are monitored and recorded a minimum of once per day. Deviations of temperature from the applicable range require corrective action, including moving samples to another storage location if necessary.

4.2 Sample Custody

Sample custody is defined by this document as when any of the following occur:

- It is in someone's actual possession
- It is in someone's view after being in his or her physical possession
- It was in someone's possession and then locked, sealed, or secured in a manner that prevents unsuspected tampering
- It is placed in a designated and secured area

Samples are removed from storage areas by the sample custodian or analysts and transported to secure laboratory areas for analysis. Access to the laboratory and sample storage areas is restricted to laboratory personnel and escorted visitors only; all areas of the laboratory are therefore considered secure. If required by the applicable regulatory program, internal chain-of-custody is documented in a log by the person moving the samples between laboratory and storage areas.

Laboratory documentation used to establish COC and sample identification may include the following:

- Field COC forms or other paperwork that arrives with the sample
- The laboratory COC
- Sample labels or tags are attached to each sample container
- Sample custody seals
- Sample preparation logs (i.e., extraction and digestion information) recorded in hardbound laboratory books that are filled out in legible handwriting, and signed and dated by the chemist
- Sample analysis logs (e.g., metals, GC/MS, etc.) information recorded in hardbound laboratory books that are filled out in legible handwriting, and signed and dated by the chemist
- Sample storage log (same as the laboratory COC)
- Sample disposition log, which documents sample disposal by a contracted waste disposal company

4.3 Sample Tracking

All samples are maintained in the appropriate coolers prior to and after analysis. The analysts remove and return their samples as needed. Samples that require internal COC are relinquished to the analysts by the sample custodians. The analyst and sample custodian must sign the original COC relinquishing custody of the samples from the sample custodian to the analyst. When the samples are returned, the analyst will sign the original COC returning sample custody to the sample custodian. Sample extracts are relinquished to the instrumentation analysts by the preparatory analysts. Each preparation department tracks internal COC through their logbooks/spreadsheets.

Any change in the sample during the time of custody will be noted on the COC (e.g., sample breakage or depletion).

5.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

5.1 Field Instruments

Field equipment that will likely be used for the project includes:

- Photoionization detector (PID)
- Peristaltic pump
- Multi-parameter water quality meter (includes pH, turbidity, temperature, Eh, and specific conductance)
- Electric water level indicator
- Hand-held Global Positioning System (GPS) device

5.2 Preventative Maintenance

Each piece of field equipment is checked according to its routine maintenance schedule and before field activities begin. Field personnel will report all equipment maintenance and/or replacement needs to the Project QA Officer and will record the information on the daily field record.

5.3 Field Instrument Calibration

All instruments and equipment used during sampling and analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations as well as criteria set fort hin the applicable analytical methodology references. Operation, calibration, and maintenance will be performed by personnel properly-trained in these procedures. Brief descriptions of calibration procedures for field and laboratory instruments follow.

- Photoionization detector (PID) – Standard operating procedures for the PID require that routine maintenance and calibration be performed every six months. Field calibration will be performed on a daily basis. The packages used for calibration are non-toxic analyzed gas mixtures available in pressurized containers. All calibration procedures will follow the manufacturer recommendations.

- Peristaltic pump – No calibration required.

- Multi-parameter water quality meter - This instrument is factory-calibrated, and is also re-calibrated on a regular interval by the equipment rental company. The certification of calibration is provided by the equipment rental company.

- Electric water level indicator – No calibration required.

- Hand-held GPS device – This instrument is self-calibrating.

Further calibration procedures can be reviewed in AECC Standard Operating Procedure #110 – Field

Monitoring Equipment Calibration, which attached to the RIWP.

6.0 DATA VALIDATION AND REPORTING

All data generated through field activities, or by the laboratory operation shall be reduced and validated (as required in the RIWP) before reported.

6.1 Data Usability Evaluation

Data evaluation will be performed by a third-party data validator using the most current methods and quality control criteria from the USEPA's Contract Laboratory Program (CLP) *National Functional Guidelines for Organic Data Review*, and Contract Laboratory Program*, National Functional Guidelines for Inorganic Data Review*.

6.1.1 Procedures Used to Evaluate Field Data Usability

The performance of field activities, calibration checks on field instruments at the beginning of each day of use, manual checks of field calculations, checking for transcription errors and review of field log books is the shared responsibility of the Field Team Manager and Head Field Technician.

6.1.2 Procedures Used to Evaluate Laboratory Data Usability

The data review guidance will be used only to the extent that it is applicable to the SW-846 methods. SW-846 methodologies will be followed primarily and given preference over CLP when differences occur. Also, results of blanks, surrogate spikes, MS/MSDs, and laboratory control samples will be reviewed / evaluated by the data validator. Sample analytical data for each sample matrix will be evaluated. The third-party data validation expert will also evaluate the overall completeness of the data package. Completeness checks will be administered on all data to determine whether deliverables specified in this QAPP are present. The reviewer will determine whether all required items are present and request copies of missing deliverables.

6.2 Data Reporting

6.2.1 Field Data Reporting

All field documents will be accounted for when they are completed. Accountable documents include items such as field notebooks, sample logs, field data records, photographs, data packages, computer disks, and reports.

6.2.2 Laboratory Data Reporting

Analytical data will be summarized in tabular format with such information as sample identification, sample matrix description, parameters analyzed and their corresponding detected concentrations, and the detection limit. Analytical results will be incorporated into reports as data tables, maps showing sampling locations and analytical results, and supporting text.

7.0 CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out of quality control performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. Corrective actions proposed and implemented should be documented in the regular quality assurance reports to management. Corrective action should be implemented only after approval by the Project Manager, or his/her designee. If immediate corrective action is required, approvals secured by telephone from the Project Manager should be documented in an additional memorandum.

7.1 Field Corrective Action

If errors in field procedures are discovered during the observation or review of field activities by the Project QA Officer or his/her designee, corrective action will be initiated. Nonconformance to the QA/QC requirements of the field operating procedures will be identified by field audits or immediately by project staff who know or suspect that a procedure is not being performed in accordance with the requirements. The Project QA Officer or his/her designee will be informed immediately upon discovery of all deficiencies. Timely action will be taken if corrective action is necessary.

Corrective action in the field may be needed when the sample network is changed (i.e., more/less samples, sampling locations other than those specified in the Work Plan, etc.) or when sampling procedures and/or field analytical procedures require modification due to unexpected conditions. In general, the Project Manager and QA Officer may identify the need for corrective action. The Project Manager will approve the corrective measure that will be implemented by the field team. It will be the responsibility of the Project Manager to ensure that corrective action has been implemented.

If the corrective action will supplement the existing sampling using approved procedures in the QAPP, the corrective action approved by the Project Manager will be documented. If the corrective actions result in less samples (or analytical fractions), alternate locations, etc., which may result in non-achievement of project QA objectives, it will be necessary that all levels of project management, including the NYSDEC Project Coordinator, concur with the proposed action.

Corrective actions will be implemented and documented in the project field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by the NYSDEC Project Coordinator.

If at any time a corrective action issue is identified which directly impacts project data quality objectives, the NYSDEC Project Coordinator will be notified immediately.

7.2 Laboratory Corrective Action

Corrective actions may be initiated if the quality assurance goals are not achieved. The initial step in a corrective action is to instruct the analytical laboratory to examine its procedures to assess whether analytical or computational errors caused the anomalous result. If no error in laboratory procedures or sample collection and handling procedures can be identified, then the Project Manager will assess whether reanalysis or resampling is required or whether any protocol should be modified for future sampling events.

7.3 Data Validation & Assessment Corrective Action

The need for corrective action may be identified during the data validation or assessment processes. Potential types of corrective action may include resampling by the field team, or reinjection / reanalysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team, whether the data to be collected is necessary to meet the QA objectives (the holding time for samples is not exceeded, etc.). If the data validator identifies a corrective action situation, the Project Manager will be responsible for approving the corrective action implementation. All required corrective actions will be documented by the laboratory Quality Assurance Coordinator.

ATTACHMENT A

Data Quality Objectives Forms

DATA QUALITY OBJECTIVES FORM:
NEAR-SURFACE SOIL SAMPLES

Site Name/Location: The Smith Restaurant Building (BCP Site # C734148)
500 Erie Boulevard East, City of Syracuse, Onondaga County, New York

Sample Objectives: To collect data that will assist with characterization of near-surface Site soils.

Sampling Procedures: Sampling Procedures are described within the Field Sampling Plan.

Data Quality Factors: Analytical Detection Limits will be consistent with ASP-Contract Required Quantization Limits (CRQLs).

Sampled Media:

☑ Soils ☐ Sediment ☐ Groundwater ☐ Surface Water ☐ Soil Vapor

☐ Waste Material ☐ Building Materials ☐ Dust/Surfaces ☐ Air

Data Use:

☑ Site Characterization ☐ Monitoring ☐ Health & Safety ☑ Risk Assessment ☐ Disposal

☑ Remedial Design ☐ Confirmation ☑ Evaluate Remedial Alternatives

Field Parameters:

☑ VOCs (ppmv) ☐ Temperature ☐ Turbidity ☐ Dissolved Oxygen ☐ pH

☐ RedOx Potential ☐ Specific Conductivity ☐ Other:

Data Types:

☑ SW-846 ☐ TCLP ☐ SCLP ☐ Other:

Analyses:

☑ TCL VOCs ☑ TCL SVOCs ☐ STARS VOCs ☐ STARS SVOCs ☐ TICs

☐ TO-15 VOCs ☑ TAL Metals ☑ PCBs ☑ Herbicides ☑ Pesticides

☐ PFAS ☑ 1,4-Dioxane ☐ Asbestos ☐ Lead ☐ Mold

☐ Other:

QA/QC Samples:

☑ Duplicate (Split) ☑ Equipment Blank ☑ Field Blank ☐ Trip Blank (VOCs, Aqueous) ☑ MS/MSD

☐ Other:

Level of Analysis:

☑ Level I: Field Screening (portable instruments providing real-time data):

☑ Photoionization Device (PID) ☐ Groundwater Multi-Meter ☐ Dust Monitor

☐ Level II: Field Analysis (portable analytical instruments in an on-site laboratory)

☐ Level III: ASP Analytical Methods (samples to be analyzed in accordance with NYSDEC-ASP 1995)

☑ Level IV: ASP Reportables/Deliverables (NYSDEC-ASP 1995 Category B Reportables/Deliverables)

DATA QUALITY OBJECTIVES FORM:
SOIL SAMPLES (EXTERIOR TO BUILDING FOOTPRINT)

Site Name/Location: The Smith Restaurant Building (BCP Site # C734148)
500 Erie Boulevard East, City of Syracuse, Onondaga County, New York

Sample Objectives: To collect data that will supplement previous characterization of shallow and deep Site soils.

Sampling Procedures: Sampling Procedures are described within the Field Sampling Plan.

Data Quality Factors: Analytical Detection Limits will be consistent with ASP-Contract Required Quantization Limits (CRQLs).

Sampled Media:

☑ Soils ☐ Sediment ☐ Groundwater ☐ Surface Water ☐ Soil Vapor
☐ Waste Material ☐ Building Materials ☐ Dust/Surfaces ☐ Air

Data Use:

☑ Site Characterization ☐ Monitoring ☐ Health & Safety ☑ Risk Assessment ☐ Disposal
☑ Remedial Design ☐ Confirmation ☑ Evaluate Remedial Alternatives

Field Parameters:

☑ VOCs (ppmv) ☐ Temperature ☐ Turbidity ☐ Dissolved Oxygen ☐ pH
☐ RedOx Potential ☐ Specific Conductivity ☐ Other:

Data Types:

☑ SW-846 ☐ TCLP ☐ SCLP ☐ Other:

Analyses:

☐ TCL VOCs ☐ TCL SVOCs ☐ STARS VOCs ☐ STARS SVOCs ☐ TICs
☐ TO-15 VOCs ☐ TAL Metals ☑ PCBs ☑ Herbicides ☑ Pesticides
☑ PFAS ☑ 1,4-Dioxane ☐ Asbestos ☐ Lead ☐ Mold
☐ Other:

QA/QC Samples:

☑ Duplicate (Split) ☑ Equipment Blank ☑ Field Blank ☐ Trip Blank (VOCs, Aqueous) ☑ MS/MSD
☐ Other:

Level of Analysis:

☑ Level I: Field Screening (portable instruments providing real-time data):

☑ Photoionization Device (PID) ☐ Groundwater Multi-Meter ☐ Dust Monitor

☐ Level II: Field Analysis (portable analytical instruments in an on-site laboratory)

☐ Level III: ASP Analytical Methods (samples to be analyzed in accordance with NYSDEC-ASP 1995)

☑ Level IV: ASP Reportables/Deliverables (NYSDEC-ASP 1995 Category B Reportables/Deliverables)

DATA QUALITY OBJECTIVES FORM:
SOIL SAMPLES (WITHIN BUILDING FOOTPRINT)

Site Name/Location: The Smith Restaurant Building (BCP Site # C734148)
500 Erie Boulevard East, City of Syracuse, Onondaga County, New York

Sample Objectives: To collect data that will assist with characterization of Site soils.

Sampling Procedures: Sampling Procedures are described within the Field Sampling Plan.

Data Quality Factors: Analytical Detection Limits will be consistent with ASP-Contract Required Quantization Limits (CRQLs).

Sampled Media:

☑ Soils ☐ Sediment ☐ Groundwater ☐ Surface Water ☐ Soil Vapor

☐ Waste Material ☐ Building Materials ☐ Dust/Surfaces ☐ Air

Data Use:

☑ Site Characterization ☐ Monitoring ☐ Health & Safety ☑ Risk Assessment ☐ Disposal

☑ Remedial Design ☐ Confirmation ☑ Evaluate Remedial Alternatives

Field Parameters:

☑ VOCs (ppmv) ☐ Temperature ☐ Turbidity ☐ Dissolved Oxygen ☐ pH

☐ RedOx Potential ☐ Specific Conductivity ☐ Other:

Data Types:

☑ SW-846 ☐ TCLP ☐ SCLP ☐ Other:

Analyses:

☑ TCL VOCs ☑ TCL SVOCs ☐ STARS VOCs ☐ STARS SVOCs ☐ TICs

☐ TO-15 VOCs ☑ TAL Metals ☑ PCBs ☑ Herbicides ☑ Pesticides

☑ PFAS ☑ 1,4-Dioxane ☐ Asbestos ☐ Lead ☐ Mold

☐ Other:

QA/QC Samples:

☑ Duplicate (Split) ☐ Equipment Blank ☑ Field Blank ☐ Trip Blank (VOCs, Aqueous) ☑ MS/MSD

☐ Other:

Level of Analysis:

☑ Level I: Field Screening (portable instruments providing real-time data):

☑ Photoionization Device (PID) ☐ Groundwater Multi-Meter ☐ Dust Monitor

☐ Level II: Field Analysis (portable analytical instruments in an on-site laboratory)

☐ Level III: ASP Analytical Methods (samples to be analyzed in accordance with NYSDEC-ASP 1995)

☑ Level IV: ASP Reportables/Deliverables (NYSDEC-ASP 1995 Category B Reportables/Deliverables)

DATA QUALITY OBJECTIVES FORM:
GROUNDWATER SAMPLES (EXTERIOR TO BUILDING FOOTPRINT)

Site Name/Location: The Smith Restaurant Building (BCP Site # C734148)
500 Erie Boulevard East, City of Syracuse, Onondaga County, New York

Sample Objectives: To collect data that will supplement previous characterization of Site groundwater.

Sampling Procedures: Sampling Procedures are described within the Field Sampling Plan.

Data Quality Factors: Analytical Detection Limits will be consistent with ASP-Contract Required Quantization Limits (CRQLs).

Sampled Media:

☐ Soils ☐ Sediment ☑ Groundwater ☐ Surface Water ☐ Soil Vapor

☐ Waste Material ☐ Building Materials ☐ Dust/Surfaces ☐ Air

Data Use:

☑ Site Characterization ☐ Monitoring ☐ Health & Safety ☑ Risk Assessment ☐ Disposal

☑ Remedial Design ☐ Confirmation ☑ Evaluate Remedial Alternatives

Field Parameters:

☑ VOCs (ppmv) ☑ Temperature ☑ Turbidity ☑ Dissolved Oxygen ☑ pH

☑ RedOx Potential ☑ Specific Conductivity ☐ Other:

Data Types:

☑ SW-846 ☐ TCLP ☐ SCLP ☐ Other:

Analyses:

☐ TCL VOCs ☐ TCL SVOCs ☐ STARS VOCs ☐ STARS SVOCs ☐ TICs

☐ TO-15 VOCs ☐ TAL Metals ☑ PCBs ☑ Herbicides ☑ Pesticides

☑ PFAS ☑ 1,4-Dioxane ☐ Asbestos ☐ Lead ☐ Mold

☐ Other:

QA/QC Samples:

☑ Duplicate (Split) ☑ Equipment Blank ☑ Field Blank ☑ Trip Blank (VOCs, Aqueous) ☑ MS/MSD

☐ Other:

Level of Analysis:

☑ Level I: Field Screening (portable instruments providing real-time data):

☑ Photoionization Device (PID) ☐ Groundwater Multi-Meter ☐ Dust Monitor

☐ Level II: Field Analysis (portable analytical instruments in an on-site laboratory)

☐ Level III: ASP Analytical Methods (samples to be analyzed in accordance with NYSDEC-ASP 1995)

☑ Level IV: ASP Reportables/Deliverables (NYSDEC-ASP 1995 Category B Reportables/Deliverables)

DATA QUALITY OBJECTIVES FORM:
GROUNDWATER SAMPLES (WITHIN BUILDING FOOTPRINT)

Site Name/Location: The Smith Restaurant Building (BCP Site # C734148)
500 Erie Boulevard East, City of Syracuse, Onondaga County, New York

Sample Objectives: To collect data that will assist with characterization of Site groundwater.

Sampling Procedures: Sampling Procedures are described within the Field Sampling Plan.

Data Quality Factors: Analytical Detection Limits will be consistent with ASP-Contract Required Quantization Limits (CRQLs).

Sampled Media:

☐ Soils
☐ Sediment
☑ Groundwater
☐ Surface Water
☐ Soil Vapor
☐ Waste Material
☐ Building Materials
☐ Dust/Surfaces
☐ Air

Data Use:

☑ Site Characterization
☐ Monitoring
☐ Health & Safety
☑ Risk Assessment
☐ Disposal
☑ Remedial Design
☐ Confirmation
☑ Evaluate Remedial Alternatives

Field Parameters:

☑ VOCs (ppmv)
☑ Temperature
☑ Turbidity
☑ Dissolved Oxygen
☑ pH
☑ RedOx Potential
☑ Specific Conductivity
☐ Other:

Data Types:

☑ SW-846
☐ TCLP
☐ SCLP
☐ Other:

Analyses:

☑ TCL VOCs
☑ TCL SVOCs
☐ STARS VOCs
☐ STARS SVOCs
☐ TICs
☐ TO-15 VOCs
☑ TAL Metals
☑ PCBs
☑ Herbicides
☑ Pesticides
☑ PFAS
☑ 1,4-Dioxane
☐ Asbestos
☐ Lead
☐ Mold
☐ Other:

QA/QC Samples:

☑ Duplicate (Split)
☑ Equipment Blank
☑ Field Blank
☑ Trip Blank (VOCs, Aqueous)
☑ MS/MSD
☐ Other:

Level of Analysis:

☑ Level I: Field Screening (portable instruments providing real-time data):
  ☑ Photoionization Device (PID)
  ☐ Groundwater Multi-Meter
  ☐ Dust Monitor
☐ Level II: Field Analysis (portable analytical instruments in an on-site laboratory)
☐ Level III: ASP Analytical Methods (samples to be analyzed in accordance with NYSDEC-ASP 1995)
☑ Level IV: ASP Reportables/Deliverables (NYSDEC-ASP 1995 Category B Reportables/Deliverables)

APPENDIX C

Health and Safety Plan

HEALTH AND SAFETY PLAN

Remedial Investigation Work Plan
The Smith Restaurant Building
City of Syracuse, New York

EMERGENCY CONTACT NUMBERS		
Emergency Response Number	911	
Poison Control Center	(800) 222-1222	
State Police (North Syracuse)	(315) 455-2826	
NEAREST HOSPITAL		
St. Joseph's Hospital 301 Prospect Avenue Syracuse, New York 13203	(315) 448-5111	
OWNER		
Smith Building, LLC (315) 481-1552	Owner Representative	Matthew Paulus: (315) 416-9566 (cell)
ENVIRONMENTAL CONSULTANT		
Bradford Engineering, DPC (315) 529-0482	Field Team Manager	H. Nevin Bradford, P.E.
Asbestos & Environmental Consulting Corporation (AECC) (315) 432-9400	Project Manager	Richard McKenna
	Safety Coordinator	Bryan Airel: (315) 416-9290 (cell)
	Head Field Technician	Drew Brantner
DRILLING CONTRACTOR		
NYEG Drilling, LLC	HSO	TBD
	Supervisor	Chris Sanson
	Operator	Shawn Bodah

July 2020

REVISION #	DATE	SUMMARY OF REVISION

TABLE OF CONTENTS

ATTACHMENTS

1.0 INTRODUCTION

A Brownfield Cleanup Program site investigation is being performed at the Site (See Figure 1) as a result of the detection of petroleum compounds, chlorinated solvents, and metals in Site soils, groundwater, and soil vapor.

This project-specific Health and Safety Plan (HASP) sets forth requirements for maintaining the health and safety of workers at the Site. This HASP addresses general health and safety issues related to the presence of specific chemical and physical hazards that may be encountered during performance of the work activities at the Site. Contractors and Subcontractors are required to prepare and maintain their own project-specific HASP that incorporates the minimum requirements of this HASP.

An Emergency Response Plan is included at the end of this Plan, which presents the procedures to be followed in the event of an emergency situation.

2.0 GENERAL DEFINITIONS

The following definitions shall apply to and are used throughout the HASP:

Contamination Reduction Zone – Area between the Exclusion Zone and Support Zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.

Contractor – Any contractor responsible for performing work that will disturb contaminated Site soils or involve management of other contaminated waste streams such as decontamination residues.

Environmental Consultant – A consultant to the Owner that will specialize in the environmental aspects of the project, namely preparation and implementation of the Remedial Investigation Work Plan, collection of soil samples, collection of groundwater samples, oversight of contractor activities, and decontamination of equipment at the end of the project.

Exclusion Zone – Any portion of the Site where hazardous substances are present, or may reasonably be suspected to be present, in the air, water, or soil.

HSO – The Health & Safety Officer is a qualified professional designated by the Consultant who is responsible for the execution and maintenance of the HASP.

Monitoring – The use of field instrumentation to measure the levels of contaminants. Monitoring will be conducted, if deemed necessary (i.e., excessive airborne dust and particulates), to evaluate potential exposures to chemical and physical hazards.

On-site personnel – All consultant, contractor, and subcontractor personnel working at the Site.

PPE – Personal Protective Equipment; clothing / gear worn by personnel within the work area that is designed to reduce exposure to chemical and / or physical hazards.

Project – All on-site work performed at the Site involving potentially contaminated soil disturbance (i.e., investigations and potential interim remedial measures).

Site – The subject property where the disturbance of potentially contaminated soil may occur.

Subcontractor – All subcontractors to the Contractor hired to work on this project.

Support Zone – The remainder of the Site outside of the Contamination Reduction Zone and Exclusion Zone. Support equipment is located in this zone.

Visitor – All other personnel, excluding the on-site personnel.

3.0 RESPONSIBILITIES

Implementation of the HASP will be accomplished through an integrated team effort. The following key personnel will be involved with this project:

OWNER		
Smith Building, LLC (315) 481-1552	Owner Representative	Matthew Paulus: (315) 416-9566 (cell)
ENVIRONMENTAL CONSULTANTS		
Bradford Engineering, DPC (315) 529-0482	Field Team Manager	H. Nevin Bradford, P.E.
Asbestos & Environmental Consulting Corporation (AECC) (315) 432-9400	Project Manager	Richard McKenna
	Safety Coordinator	Bryan Airel: (315) 416-9290 (cell)
	Head Field Technician	Drew Brantner
DRILLING / EXCAVATION CONTRACTOR		
NYEG Drilling, LLC	HSO	TBD
	Supervisor	Chris Sanson
	Operator	Shawn Bodah
GOVERNMENTAL AGENCIES		
NYS Department of Environmental Conservation (NYSDEC) (607) 775-2545		Gary Priscott
NYS Department of Health (NYSDOH) (518) 402-7860		Stephanie Selmer
Onondaga County Health Department (315) 435-3252		TBD

This HASP will be periodically reviewed by all parties during the project to verify that it is in accordance with the operations conducted at the Site. Changes in Site conditions or changes in the work tasks at the Site will necessitate a review and modification of the HASP. The Contractor's HSO shall contact the Environmental Consultant if site conditions change that warrant modifications to the HASP, and vise versa. Changes, modifications, and amendments to the HASP will be made in the form of addenda, and will be attached to the HASP.

All parties to the project will perform their duties in a manner consistent with generally accepted practices, and will be responsible for the following (of their own employees) during the project:

- Verification that medical examinations and training requirements for all personnel are current
- Reviewing the HASP with all on-site personnel
- Implementation and maintenance of the HASP
- Providing all on-site personnel with proper PPE
- Compliance with applicable state and federal health and safety standards

The HSO for this project is designated with the following responsibilities:

- Maintain a daily log book for recording all significant health and safety activities
- Have authority to suspend work due to health or safety-related concerns
- Provide on-site technical assistance and conduct health and safety briefings at the Site
- Verify that first aid kits, eye wash kits, and fire extinguishers are at the Site
- Verify that on-site personnel have received the necessary training and physical examinations
- Verify that on-site personnel have been provided with and are using the required PPE
- Review of the adequacy of the HASP and amend the HASP as necessary during the project
- Prepare addenda to the HASP and maintain required documents for recordkeeping purposes

4.0 SITE HAZARDS EVALUATION

4.1 CHEMICAL HAZARDS

The Site soils and groundwater have been sampled and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and asbestos. In addition, soil vapor has been sampled and analyzed for VOCs; and suspect asbestos-containing building materials (ACBMs) and lead-based paints (LBPs) have been sampled and analyzed. No sampling/analysis for PCBs, pesticides, herbicides, or perfluorinated compounds (PFCs) has been conducted to date. The associated laboratory analysis and on-site observations revealed that the following chemicals / materials of concern exist at the Site:

- Petroleum compounds (VOCs and SVOCs)
- Chlorinated solvents
- Metals
- Asbestos (limited areas)
- Lead-Based Paint

Applicable fact sheets and Safety Data Sheets are presented in Appendix A.

Except for possible lead-based paints, concentrations of identified contaminants are not above the threshold for hazardous (TSCA) waste. As the investigation progresses and additional data is collected for the other classes of chemicals, this HASP will be updated to reflect this information.

The contaminants at the Site may enter the human body in a variety of ways. The chemical routes of exposure anticipated from the remedial activities at this Site include:

<u>Absorption</u> - Dermal (skin) contact with impacted soil on-site resulting in absorption of chemicals of concern through the skin and into the blood stream. Proper use of PPE as specified later in this Plan will minimize risks of exposure at the Site.

<u>Ingestion</u> - Chemicals / materials of concern can come in direct contact with the mouth from soil or other contaminated areas (PPE, skin, tools, etc.) and enter the bloodstream through the stomach lining. Proper care in handling PPE and tools, refraining from eating and drinking at the Site, and frequent hand washing with soap and water will minimize risks of exposure.

<u>Inhalation</u> – Volatile vapors and/or contaminants attached to dust and particulates can be entrained by wind and become airborne across the Site and be subsequently inhaled through the nose and / or mouth. This exposure route is the most likely way for worker exposure to occur. The Contractor shall employ methods that minimize the creation of dust and utilize dust suppression techniques to minimize dust and particulates. Respirators with appropriate organic cartridges should be available to on-site workers in case volatile compounds become a nuisance or health hazard. The Contractor is responsible for any personal air monitoring of employees, as deemed necessary.

4.2 PHYSICAL HAZARDS

Based upon the anticipated field activities, the following potential hazardous conditions may exist:

- The use of typical mechanical equipment such as drill rigs and sampling vehicles can create a potential for crushing and pinching hazards due to movement and positioning of the equipment, movement of lever arms and hydraulics, and entanglement of clothing and appendages in exposed drives and tracks. Mechanical equipment can also create a potential for impact of steel tools, masts, and cables should equipment rigging fail, or other structural failures occur during hydraulic equipment operation. Heavy equipment work must be conducted only by trained, experienced personnel. If possible, personnel must remain outside the turning radius of large, moving equipment. At a minimum, personnel must maintain visual contact with the equipment operator. When not operational, equipment must be set and locked so that it cannot be activated, released, dropped, etc. The mechanical equipment stated above represents typical equipment that is ordinarily used during this scope of work, but is not meant to be an all-inclusive list. Similar precautions should be used around other mechanical equipment deployed to the Site that is not listed above.

- The contractor is responsible for ensuring compliance with OSHA's construction standard for excavations (29 CFR 1926 Subpart P), and for designating the Competent Person responsible for selecting and implementing the appropriate protective system(s), assuring appropriate means of access and egress for excavations greater than four (4) feet in depth, and for ensuring that potential atmospheric and physical hazards associated with any excavation / trenching activities are completed in accordance with Subpart P and other applicable OSHA Standards as applicable.

- Work around large equipment often creates excessive noise. Noise can cause workers to be startled, annoyed, or distracted; cause pain, physical damage to the ear, and temporary and / or permanent hearing loss; and can interfere with communication. If workers are subjected to noise exceeding an 8-hour time-weighted average sound level of 85 dBA, hearing protection will be required with an appropriate noise reduction rating to comply with 29 CFR 1910.95 and to reduce noise levels below levels of concern.

- Personnel may be injured during physical lifting and handling of heavy equipment, construction materials, or containers.

- Personnel may encounter slip, trip, and fall hazards associated with excavations, manways, and construction debris and materials. Precautionary measures should be taken by identifying and removing slip, trip, and fall hazards prior to commencing work. In the event slip, trip, and fall hazards cannot be removed or minimized, site workers will be shown the location of the physical hazard and be asked to avoid it during work activities.

- The potential for fire and / or explosion emergencies is always present on the Site. Field vehicles will be equipped with a fire extinguisher. Employees must be trained in the proper use of fire suppression equipment. However, large fires that cannot be controlled with a fire extinguisher shall be handled by professionals. The proper authorities shall be notified in these instances.

- Persons working outdoors in temperatures at or below freezing may be subject to frostbite. Extreme cold for a short time may cause injury to exposed body surfaces or result in a profound generalized cooling which can cause death. Areas of the body such as fingers, toes, and ears, are the most susceptible to cold stress. Ambient air temperature and wind velocity are two factors which influence the development of a cold weather injury. Local injury resulting from exposure to cold temperatures is known as "frostbite." There are several degrees of damage in which frostbite of the extremities can be categorized, as follows:

- Frost nip or incipient frostbite is characterized by sudden bleaching or whitening of the skin.
- Superficial frostbite occurs when the skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- Deep frostbite is characterized by tissues that are cold, pale, and solid; this is an extremely serious injury.

- Heat stress is another potential hazard condition that may arise. Heat stress can result from a number of contributing factors, including environmental conditions, clothing, and workload as well as the physical condition of the individual. Since heat stress is one of the most common injuries / symptoms associated with 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. Signs and symptoms of heat-related illnesses which all on-site personnel should be aware, include the following:
  - Heat rash may result from continuous exposure to heat or humid air.
  - Heat cramps are caused by heavy sweating and may include muscle spasms and pain in the hands, feet, and abdomen.
  - Heat exhaustion is indicated by pale, cool, and moist skin; heavy sweating; dizziness; nausea; and fainting.
  - Heat stroke is indicated by red, hot, and unusually dry skin; lack of or reduced perspiration; nausea; dizziness and confusion; rapid pulse; and coma. Immediate action must be taken to cool the body before serious injury or death occurs.

- Overhead and underground utilities exist within the Work Area, which may expose workers to electrocution hazards, explosive hazards, and volatile vapors. A utility location report is provided in Attachment B.

5.0 PERSONAL PROTECTIVE EQUIPMENT

Personnel will be required to wear Level D and Modified Level D PPE ensembles, at a minimum. The following PPE ensembles shall be worn by on-site personnel for the following tasks:

Level D Protection, as listed below, shall be worn by on-site personnel at all times when tasks are performed which DO NOT INVOLVE dermal exposure, or contact with chemical hazards:

- Standard outer garments (i.e. long pants and long-sleeve shirt)
- Durable leather steel-toed work boots
- Rubber boots worn over work boots
- Durable leather gloves
- Eye protection
- Hard hat
- Hearing protection

Modified Level D Protection, as listed below, shall be worn by on-site personnel at all times when tasks are performed which involve dermal exposure or contact with chemical hazards and/or during excavation/handling of soils or groundwater deemed hazardous waste (not currently anticipated for this project):

- Disposable coveralls worn over standard outer garments. Personnel will frequently verify the integrity of their coveralls by checking for holes or tears.
- Durable leather steel-toed work boots
- Disposable nitrile gloves. Personnel will frequently verify the integrity of their gloves by checking for holes or tears.
- Rubber boots worn over work boots
- Eye protection
- Hard hat
- Hearing protection

Respirator use is not anticipated on this project. If respiratory protection becomes necessary, a determination shall be made regarding each person's physical ability to wear a respirator. Consequently, persons required to wear respirators must provide the Contractor's HSO with current documentation (not older than 6 months) regarding their physical condition and ability to wear a respirator, as certified by a qualified physician. Failure to provide current, complete respirator certification documentation will be sufficient grounds to preclude personnel from conducting work activities where respiratory protection is required.

6.0 PERSONNEL TRAINING

Note that this HASP does not cover training requirements for the handling of asbestos or lead-based paint, as training for these hazards are incorporated under separate programs governed by the USEPA, NYSDOH, and NYSDOL.

6.1 REQUIREMENTS AND RESPONSIBILITIES

All on-site personnel and visitors will be trained commensurate with their job responsibilities and in accordance with Occupational Safety and Health Administration (OSHA) training and medical surveillance requirements as specified in 29 CFR 1910.120. The Contractor is responsible for providing such training prior to personnel being allowed to engage in activities that could expose them to health and safety hazards. The HSO has the responsibility to assure that this training is provided for the site-conditions and such training is updated, as needed. The HSO and Contractor's on-site Supervisor will be trained in basic first aid, and at least one of these individuals will be present during each work shift while personnel are at the Site.

6.2 SITE ORIENTATION MEETING

The Contractor will be responsible for notifying all on-site personnel of required attendance at a site orientation meeting, which will be organized by the Contractor's HSO. Any subcontractor personnel will also be required to attend the site orientation meeting as well as any other periodic health and safety meeting specified by the HSO. Personnel attending the site orientation meeting are to sign a Site Orientation Meeting Attendance Acknowledgment Form. The following is a listing of general site orientation training topics:

- Names and responsibilities of key personnel
- Safe work practices
- Personal protective equipment
- Chemical and physical hazards

- Site equipment Medical surveillance
- Site hazards
- Site control measures
- Decontamination procedures
- Standard operating procedures
- Emergency response plan

6.3 DOCUMENTATION / RECORDKEEPING

OSHA regulations require medical surveillance in the form of annual medical examinations for certain types of work involving exposure to hazardous or toxic substances. All on-site personnel, visitors, and subcontractors are required to have documented proof on file of OSHA training and medical surveillance requirements as specified in 29 CFR 1910.120 to demonstrate compliance with the training requirements specified in this Section. The HSO is responsible to check all personnel to ensure training is kept current during the project.

7.0 MEDICAL CLEARANCE

Medical clearance refers to OSHA requirements for annual physical reports performed by a licensed physician, which document a worker's physical ability to perform specific job duties. Medical clearance is not required for on-site personnel or visitors at the Site, except for OSHA medical surveillance requirements for workers within the Exclusion Zone or Contamination Reduction Zone.

8.0 STANDARD OPERATING PROCEDURES

Potential chemical and physical hazards exist at the Site. This Section presents Standard Operating Procedures (SOPs) that will be followed during the project. Specific precautions to avoid the potential hazards for each task are presented herein.

8.1 GENERAL SOPS

Workers shall adhere to the established SOP for their respective specialties. Work at the Site will be conducted according to established procedures and guidelines for the safety and health of all involved. General SOPs at the Site include the following:

- All questions should be referred to the Contractor's HSO or Project Manager.
- All on-site personnel will be trained and briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications.
- Inspections of the Site will be conducted to ensure compliance with the HASP, and if any change in operation occurs, the HASP will be modified to reflect any change.
- Be observant of not only one's own immediate surrounding but also that of others.
- On-site personnel in the work zone will act as safety backup to each other, and on-site personnel outside the work zone will provide emergency assistance when necessary.
- Use extra precautions when working near heavy equipment.
- Communications using hand signals or other means will be maintained between on-site personnel, the HSO, and the Project Manager at all times.
- Breaks should be planned to prevent heat, cold, stresses, accidents, and fatigue.
- Work areas for various operational activities will be established.
- Strict pedestrian and vehicular traffic control will be maintained on-site.
- Entrance / exit locations and emergency escape routes will be designated and delineated.

- On-site personnel and equipment in each Work Area will be minimized to maintain effective Site operations.
- Required PPE ensembles must be worn by all on-site personnel entering work areas designated for wearing PPE. At minimum, hard hat, safety glasses, steel-toe boots, durable leather gloves, and hearing protection will be worn on the project Site.
- Work Areas and decontamination procedures will be established based on expected Site conditions.
- Plan work procedures and decontamination areas to minimize contamination exposure.
- Contaminated equipment shall not be placed on unprotected surfaces.
- Procedures for leaving a Work Area will be planned prior to entering the Site.
- All electrical equipment (power tools, extension cords, instruments, etc.) will conform to 29 CFR 1926.400 Subpart K.
- Fire prevention and protection (appropriate signs for flammable liquids, smoking areas, storage areas of combustible or flammable materials, etc.) will be in accordance with OSHA 29 CFR 1926.150 Subpart F.
- Workers shall not enter areas containing asbestos debris, or handle/disturb asbestos-containing materials
- Workers shall not handle/disturb known or potential lead-based paints

Violation of these SOPs may result in immediate dismissal from the Site.

8.2 SITE CONTROL MEASURES

Site control measures will minimize potential contamination of on-site personnel, protect the public from potential on-site hazards, and prevent vandalism of equipment and materials. Site control measures also enhance response in emergency situation. For this project, the primary site control measure will be a temporary fence or other barrier installed along the Site boundary for the duration of the project.

Areas where intrusive work will occur will be routinely divided into three distinct areas: an Exclusion Zone, a Contamination Reduction Zone (CRZ), and a Support Zone.

Exclusion Zone

The Exclusion Zone will be designated as the area where the highest potential for exposure by dermal or inhalation routes exists. The Exclusion Zone coincides with areas being excavated. PPE is required and a daily log will be kept of all personnel entering this zone.

The Exclusion Zone for work areas will be demarcated with barrier tape.

Approval for entry into the Exclusion Zone will require compliance with OSHA training and medical surveillance requirements (29 CFR 1910.120). Subcontractor and vendor equipment will not be permitted to enter the Exclusion Zone without prior authorization and will be subject to Site decontamination procedures. All personnel and equipment shall be decontaminated when leaving the Exclusion Zone. No eating, drinking, or smoking will be permitted in the Exclusion Zone.

Contamination Reduction Zone (CRZ)

The Contractor will establish the CRZ in an area between the Exclusion Zone and Support Zone. Approval for entry into the CRZ will require compliance with OSHA training and medical surveillance requirements (29 CFR 1910.120). Access to the Exclusion Zone will be through the CRZ. The CRZ will be designated as the area immediately adjacent to and surrounding the Exclusion Zone. The probability of dermal and inhalation exposure is lower in the CRZ than in the Exclusion Zone. The CRZ includes facilities for personnel and equipment decontamination. PPE worn in the Exclusion Zone may not be worn outside the CRZ, except during emergencies. No eating, drinking, or smoking will be permitted in the CRZ.

Support Zone

The Support Zone includes all areas outside the CRZ and Loading Zone. The exposure potential in the Support Zone is minimal. The Support Zone provides a changing area for personnel entering the CRZ and Exclusion Zone, as well as an area for the storage of clean equipment and materials. Protective clothing worn in the Exclusion Zone will not be allowed to be worn in the Support Zone, except in emergencies. It is the responsibility of the Project Manager to control access to the Site and to assure proper security. Any evidence of unauthorized entry will be noted in the daily log.

Under no circumstances will the general public be permitted to access the work area. All preapproved visitors will be briefed on the HASP, and shall sign the Daily Site Sign-In / Sign-Out Log. Pre-approved visitors will be permitted in the immediate area of active operations only with approval from the Contractor's HSO or Project Manager. All personal vehicles are restricted to the Support Zone.

8.3 COMMUNICATION PROCEDURES

Personnel in the Exclusion Zone will remain within sight of other project personnel. The commonly used international hand and arm signals are listed below, and will be used when necessary:

Signal	Meaning
Right hand thumbs up	OK, I'm All Right
Right hand thumbs down	No, Negative
Rotating both hands at sides	Situation Under Control
Rotating both hands above head	Need Assistance
Hand gripping throat	Out of Air, Cannot Breathe
Both hands placed on hips	Leave Area Immediately
Rotating both hands at knees	Situation Grave, Evacuate Immediately
Both hands placed on top of head	Returning to Support Zone

8.4 DECONTAMINATION PROCEDURES

On-site personnel performing remediation tasks under the Modified Level D PPE ensemble will perform decontamination operations in accordance with the following steps:

- Remove re-usable boot covers, or discard disposable boot covers.
- Remove coveralls first (if applicable), then remove nitrile gloves and place in the disposal container staged in the CRZ. All disposable PPE (gloves, coveralls), rags, cloths, etc. will be containerized separately from general refuse, and disposed of in accordance with the applicable regulations.

- Remove and discard inner gloves.
- Proceed to the Support Zone bringing decontaminated tools and sampling containers.
- Wash hands, face, and other exposed skin with soap and water. Shower and shampoo as soon as possible at the end of the work day, before any social activities.
- Place non-disposable coveralls in plastic bags prior to leaving the Site and prior to entering any vehicle.
- Launder non-disposable clothing worn in Exclusion Zone prior to reuse, separately from other laundry items. Impermeable items such as vinyl boots do not need to be laundered prior to reuse; however, they should either be kept in the CRZ or placed in a sealed container prior to leaving the CRZ.

8.5 PERIODIC HEALTH AND SAFETY MEETINGS

The HSO will conduct weekly health and safety meetings. These meetings will be a review of existing protocols as well as a means to update personnel on new Site conditions. The meetings will also provide an opportunity for on-site personnel to discuss health and safety concerns. Topics for discussion may include, but are not limited to, the following:

- Review of the type and frequency of environmental and personal monitoring
- Task-specific levels of protection and anticipated potential for upgrading
- Review of existing and new health and safety issues
- Review of emergency procedures

9.0 ACCIDENT AND EMERGENCY RESPONSE PLAN

This Section includes procedures and methods of evaluating and addressing medical, fire, and other emergency situations which may occur at the Site. In any unknown situation, always assume the worst conditions and plan responses accordingly. All emergency situations require concise and timely actions conducted in a manner that minimizes the health and safety risks to on-site personnel and to the public. All on-site personnel shall be familiar with the Emergency Response Plan.

9.1 RESPONSIBILITIES

The Contractor's HSO has the responsibility for directing response activities in the event of an emergency or accident, and will be responsible for the following:

- Assess the situation
- Determine required response measures
- Notify appropriate response teams
- Direct on-site personnel during the emergency

The Contractor's HSO will coordinate the response activities of on-site personnel with those of public agencies. A list of agencies to be contacted and who may, depending on the nature of the situation, assume authority for emergency response is presented in Section 9.6. This table includes names and telephone numbers of local hospitals, ambulance service, fire and police departments, and other applicable agencies. The HSO will notify emergency response agencies and establish emergency procedures prior to commencing remedial activities at the Site.

9.2 EMERGENCY PROCEDURES

Due to the nature of the tasks to be conducted at the Site, the emergency situations that may occur are most likely limited to personnel accidents (i.e., slip, trip, and fall accidents; equipment related accidents, etc.) requiring first aid. The following procedures shall be followed in the event of an emergency:

- On-site personnel shall report all accidents and unusual events to the HSO.
- The HSO will assess the situation. If off-site assistance and medical treatment is required, the HSO will designate a person to call the proper authorities.
- First-aid or other applicable treatment will be provided by properly trained individuals.

The HSO will inform the Owner of the injury/accident, and an Accident Report Form detailing the causes and consequences of the injury/accident will be submitted to the Project Manager within 48 hours of the incident. The Accident Report Form shall include:

- Names and social security numbers of accident victims and witnesses
- Date and time of accident
- Location, cause, and duration of accident
- A description of corrective actions implemented
- Off-site persons and agencies notified and time of arrival at the Site.

Personnel shall make all reasonable attempts to conduct themselves in a calm manner in the event of an accident.

9.3 ACCIDENT AND INJURIES

Every accident is a unique event that must be dealt with by trained personnel working in a calm, controlled manner. In the event of an accident, the prime consideration is to provide the appropriate initial response to assist those in jeopardy without placing additional personnel at unnecessary risk. Several types of emergencies are outlined in the following subsections. These are not intended to cover all emergency situations.

If a person working on the Site is physically injured, basic first-aid procedures will be followed. Depending on the severity of the injury, outside medical assistance may be sought. If the person can be moved, the person will be taken outside of the Work Area, PPE will be removed, and first aid administered. If necessary, transportation to a medical facility will be provided. If the person can only be moved by emergency medical personnel, the HSO will decide what type of PPE (if any) will be required to be worn by emergency personnel.

If the injury to on-site personnel involves chemical exposure, the following first aid procedures will be initiated as soon as possible:

<u>*Eye Exposure*</u> - If solid or liquid gets into the eyes, wash eyes immediately at the emergency eyewash station using water and lifting the lower and upper lids occasionally. This emergency eyewash station shall be a portable station provided by the Contractor and set up within the CRZ. If an acute exposure is identified, then obtain medical attention immediately. Otherwise, consultation with a doctor shall be discretionary based on the severity of the incident.

<u>*Skin Exposure*</u> - If solid or liquid gets on the skin causing irritation or pain, wash skin immediately at the emergency eyewash station using water. If an acute exposure is identified, then obtain medical attention immediately. Otherwise, consultation with a doctor shall be discretionary based on the severity of the incident.

Inhalation – In the rare event that a person inhales large amounts of organic vapor or dust, and is overcome, move the person to fresh air at once. Obtain medical attention immediately. If breathing has stopped, appropriately trained personnel and/or medical personnel should perform cardiopulmonary resuscitation. Keep the affected person warm and at rest.

Ingestion - If solid or liquid is swallowed, medical attention must be obtained immediately and the Poison Control Center consulted.

9.4 FIRE

On-site personnel will be knowledgeable in fire-extinguishing techniques. They will be instructed in proper use and maintenance of the fire extinguishers supplied at the work areas. Fire extinguishers should be used only for small fires which are in the early stages of development. Where the fire cannot be controlled through extinguisher use, the area should be evacuated immediately, and the local fire department should be called to extinguish the fire. Fire extinguishers shall be provided by the Contractor.

9.5 EMERGENCY EVACUATION

In extraordinary circumstances, emergency evacuation of the Site may be necessary. On-site personnel will be notified of the need to evacuate verbally or by signaling with an air horn or similar signaling device. If the situation is deemed an emergency, personnel will be instructed to leave the Site immediately, using the closest available evacuation route; otherwise, personnel will be expected to go through normal decontamination procedures before leaving the Site.

In either case, personnel will be instructed to meet at a central location to be determined by the HSO prior to the start of Work. A head count will be made to ensure that all personnel are safe and accounted for.

The HSO will contact appropriate response agencies, as warranted. Motorized equipment / machinery will be shut off before the Site is evacuated.

9.6 EMERGENCY RESPONSE AND AREA HOSPITALS

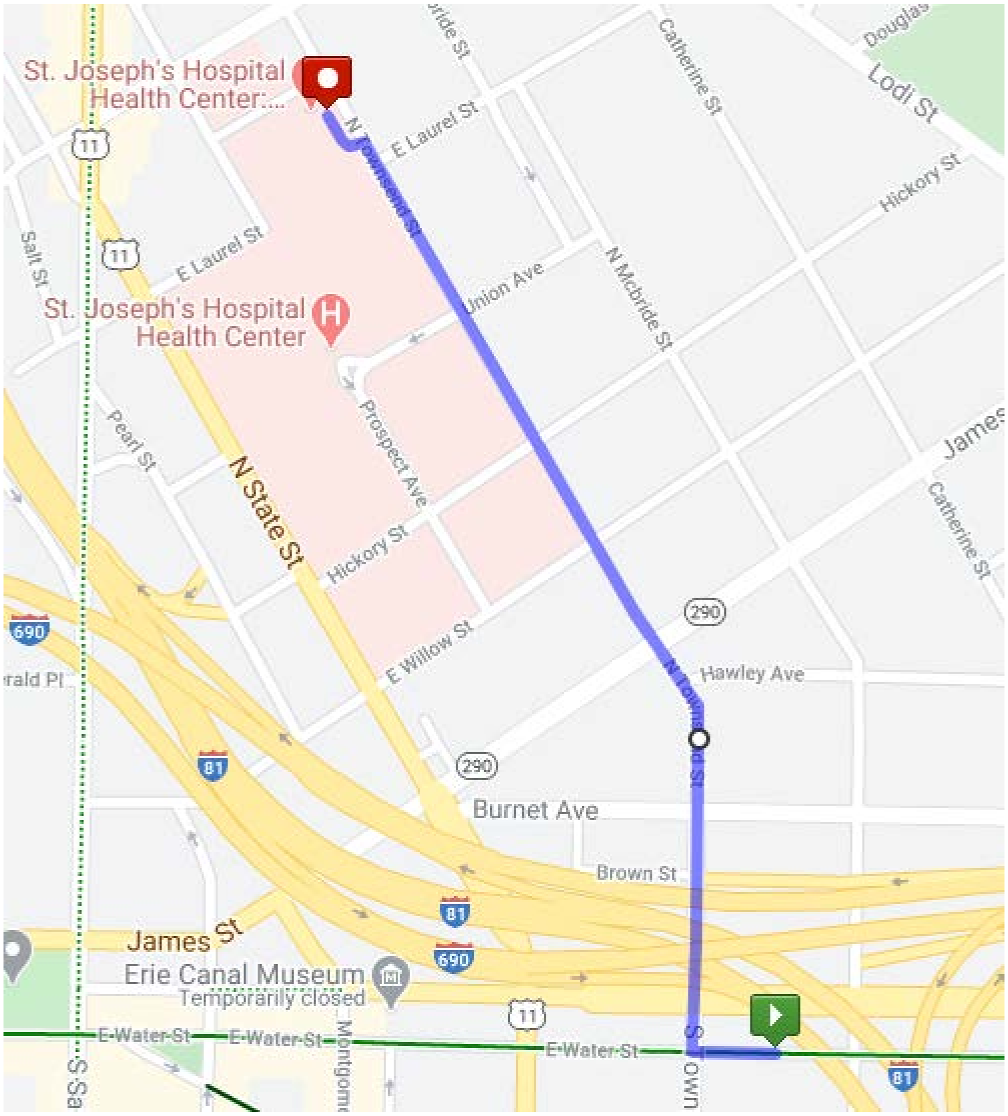
In case of emergency, call 911 or the appropriate individual authority:

EMERGENCY CONTACT NUMBERS	
Nearest Hospital	St. Joseph's Hospital 301 Prospect Avenue Syracuse, New York 13203
Emergency Response Number	911
Poison Control Center	(800) 222-1222
State Police (North Syracuse)	(315) 455 2826

Directions to Nearest Hospital (St. Joseph's Hospital; Distance ~0.6 miles; Time ~4 minutes)

1. Travel west on East Water Street
2. Right onto South Townsend Street (road becomes North Townsend Street after crossing Erie Boulevard)

3. In approximately 0.4 mile, continue straight on North Townsend Street. **DO NOT TURN LEFT ON UNION AVENUE TO MAIN HOSPITAL FACILITY**.
4. Approximately 0.1 mile after Union Avenue, St. Joseph's Hospital Emergency Room will be on left



ATTACHMENT A

Fact Sheets and Safety Data Sheets

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

TOTAL PETROLEUM HYDROCARBONS (TPH)

Agency for Toxic Substances and Disease Registry ToxFAQs **August 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about total petroleum hydrocarbons (TPH). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: TPH is a mixture of many different compounds. Everyone is exposed to TPH from many sources, including gasoline pumps, spilled oil on pavement, and chemicals used at home or work. Some TPH compounds can affect your nervous system, causing headaches and dizziness. TPH has been found in at least 23 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are total petroleum hydrocarbons?

(Pronounced tōt′l pə-trō′lē-əm hī′drə-kär′bənz)

Total petroleum hydrocarbons (TPH) is a term used to describe a large family of several hundred chemical compounds that originally come from crude oil. Crude oil is used to make petroleum products, which can contaminate the environment. Because there are so many different chemicals in crude oil and in other petroleum products, it is not practical to measure each one separately. However, it is useful to measure the total amount of TPH at a site.

TPH is a mixture of chemicals, but they are all made mainly from hydrogen and carbon, called hydrocarbons. Scientists divide TPH into groups of petroleum hydrocarbons that act alike in soil or water. These groups are called petroleum hydrocarbon fractions. Each fraction contains many individual chemicals.

Some chemicals that may be found in TPH are hexane, jet fuels, mineral oils, benzene, toluene, xylenes, naphthalene, and fluorene, as well as other petroleum products and gasoline components. However, it is likely that samples of TPH will contain only some, or a mixture, of these chemicals.

What happens to TPH when it enters the environment?

- ☐ TPH may enter the environment through accidents, from industrial releases, or as byproducts from commercial or private uses.
- ☐ TPH may be released directly into water through spills or leaks.
- ☐ Some TPH fractions will float on the water and form surface films.
- ☐ Other TPH fractions will sink to the bottom sediments.
- ☐ Bacteria and microorganisms in the water may break down some of the TPH fractions.
- ☐ Some TPH fractions will move into the soil where they may stay for a long time.

How might I be exposed to TPH?

- ☐ Everyone is exposed to TPH from many sources.
- ☐ Breathing air at gasoline stations, using chemicals at home or work, or using certain pesticides.
- ☐ Drinking water contaminated with TPH.
- ☐ Working in occupations that use petroleum products.
- ☐ Living in an area near a spill or leak of petroleum products.
- ☐ Touching soil contaminated with TPH.

How can TPH affect my health?

Some of the TPH compounds can affect your central nervous system. One compound can cause headaches and dizziness at high levels in the air. Another compound can cause a nerve disorder called "peripheral neuropathy," consisting of numbness in the feet and legs. Other TPH compounds can cause effects on the blood, immune system, lungs, skin, and eyes.

Animal studies have shown effects on the lungs, central nervous system, liver, and kidney from exposure to TPH compounds. Some TPH compounds have also been shown to affect reproduction and the developing fetus in animals.

How likely is TPH to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that one TPH compound (benzene) is carcinogenic to humans. IARC has determined that other TPH compounds (benzo[a]pyrene and gasoline) are probably and possibly carcinogenic to humans. Most of the other TPH compounds are considered not to be classifiable by IARC.

Is there a medical test to show whether I've been exposed to TPH?

There is no medical test that shows if you have been exposed to TPH. However, there are methods to determine if you have been exposed to some TPH compounds. Exposure to kerosene can be determined by its smell on the breath or clothing. Benzene can be measured in exhaled air and a breakdown product of benzene can be measured in urine. Other TPH compounds can be measured in blood, urine, breath, and some body tissues.

Has the federal government made recommendations to protect human health?

There are no regulations or advisories specific to TPH. The following are recommendations for some of the TPH fractions and compounds:

The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration has set an exposure limit of 500 parts of petroleum distillates per million parts of air (500 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Immune system: Body organs and cells that fight disease.

Pesticides: Chemicals used to kill pests.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for total petroleum hydrocarbons (TPH). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Ethylbenzene- ToxFAQs™

CAS # 100-41-4

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Breathing lower levels has resulted in hearing effects and kidney damage in animals. Ethylbenzene has been found in at least 829 of 1,699 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

Ethylbenzene is a colorless, flammable liquid that smells like gasoline.

It is naturally found in coal tar and petroleum and is also found in manufactured products such as inks, pesticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

- Ethylbenzene moves easily into the air from water and soil.
- It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.
- In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- Ethylbenzene can move through soil into groundwater.
- In soil, it is broken down by bacteria.

How might I be exposed to ethylbenzene?

- If you live in a city or near many factories or heavily traveled highways, you may be exposed to ethylbenzene in air.
- Releases of ethylbenzene into the air occur from burning oil, gas, and coal and from industries using ethylbenzene.
- Ethylbenzene is not often found in drinking water. Higher levels may be found in residential drinking water wells near landfills, waste sites, or leaking underground fuel storage tanks.
- Exposure can occur if you work in an industry where ethylbenzene is used or made.
- Exposure can occur if you use products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Exposure to high levels of ethylbenzene in air for short periods can cause eye and throat irritation. Exposure to higher levels can result in dizziness.

Irreversible damage to the inner ear and hearing has been observed in animals exposed to relatively low concentrations of ethylbenzene for several days to weeks.

Exposure to relatively low concentrations of ethylbenzene in air for several months to years causes kidney damage in animals.

How likely is ethylbenzene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that ethylbenzene is a possible human carcinogen.

Ethylbenzene

CAS # 100-41-4

How does ethylbenzene affect children?

There are no studies evaluating the effects of ethylbenzene exposure on children or immature animals. It is likely that children would have the same health effects as adults. We do not know whether children would be more sensitive than adults to the effects of ethylbenzene.

We do not know if ethylbenzene will cause birth defects in humans. Minor birth defects and low birth weight have occurred in newborn animals whose mothers were exposed to ethylbenzene in air during pregnancy.

How can families reduce the risk of exposure to ethylbenzene?

- Use adequate ventilation to reduce exposure to ethylbenzene vapors from consumer products such as gasoline, pesticides, varnishes and paints, and newly installed carpeting.
- Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.
- Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers that children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Is there a medical test to show whether I've been exposed to ethylbenzene?

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. Because these substances leave the body very quickly, this test needs to be done within a few hours after exposure occurs.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to ethylbenzene in drinking water at concentrations of 30 mg/L for 1 day or 3 mg/L for 10 days is not expected to cause any adverse effects in a child.

The EPA has determined that lifetime exposure to 0.7 mg/L ethylbenzene is not expected to cause any adverse effects.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 100 ppm for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2010. Toxicological Profile for Ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

FUEL OILS

CAS # 8008-20-6, 70892-10-3, 68476-30-2, 68476-34-6, 68476-31-3

Agency for Toxic Substances and Disease Registry ToxFAQs September 1996

This fact sheet answers the most frequently asked health questions (FAQs) about fuel oils. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Fuel oils are liquid mixtures produced from petroleum, and their use mostly involves burning them as fuels. Drinking or breathing fuel oils may cause nausea or nervous system effects. However, exposure under normal use conditions is not likely to be harmful. Fuel oils have been found in at least 26 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are fuel oils?

(Pronounced fyo͞o′əl oilz)

Fuel oils are a variety of yellowish to light brown liquid mixtures that come from crude petroleum. Some chemicals found in fuel oils may evaporate easily, while others may more easily dissolve in water.

Fuel oils are produced by different petroleum refining processes, depending on their intended uses. Fuel oils may be used as fuel for engines, lamps, heaters, furnaces, and stoves, or as solvents.

Some commonly found fuel oils include kerosene, diesel fuel, jet fuel, range oil, and home heating oil. These fuel oils differ from one another by their hydrocarbon compositions, boiling point ranges, chemical additives, and uses.

What happens to fuel oils when they enter the environment?

- ❑ Some chemicals found in fuel oils may evaporate into the air from open containers or contaminated soil or water.
- ❑ Some chemicals found in fuel oils may dissolve in water after spills to surface waters or leaks from underground storage tanks.
- ❑ Some chemicals found in fuel oils may stick to particles in water, which will eventually cause them to settle to the bottom sediment.
- ❑ Some of the chemicals found in fuel oils may be broken down slowly in air, water, and soil by sunlight or small organisms.
- ❑ Some of the chemicals found in fuel oils may build up significantly in plants and animals.

How might I be exposed to fuel oils?

- ❑ Using a home kerosene heater or stove, or using fuel oils at work.
- ❑ Breathing air in home or building basements that has been contaminated with fuel oil vapors entering from the soil.
- ❑ Drinking or swimming in water that has been contaminated with fuel oils from a spill or a leaking underground storage tank.
- ❑ Touching soil contaminated with fuel oils.
- ❑ Using fuel oils to wash paint or grease from skin or equipment.

How can fuel oils affect my health?

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene stoves for cooking do not seem to have any health problems related to their exposure.

Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, lightheadedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for long periods may cause kidney damage and lower your blood's ability to clot.

Drinking small amounts of kerosene may cause vomiting, diarrhea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.

How likely are fuel oils to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that some fuel oils (heavy) may possibly cause cancer in humans, but for other fuel oils (light) there is not enough information to make a determination. IARC has also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic in humans.

Some studies with mice have suggested that repeated contact with fuel oils may cause liver or skin cancer. However, other mouse studies have found this not to be the case. No studies are available in other animals or in people on the carcinogenic effects of fuel oils.

Is there a medical test to show whether I've been exposed to fuel oils?

There is no medical test that shows if you have been exposed to fuel oils. Tests are available to determine if some of the chemicals commonly found in fuel oils are in your blood. However, the presence of these chemicals in blood may not necessarily mean that you have been exposed to fuel oils.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) and the Air Force Office of Safety and Health (AFOSH) have set a permissible exposure level (PEL) of 400 parts of petroleum distillates per million parts of air (400 ppm) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that average workplace air levels not exceed 350 milligrams of petroleum distillates per cubic meter of air (350 mg/m^3) for a 40-hour workweek.

The Department of Transportation (DOT) lists fuel oils as hazardous materials and, therefore, regulates their transportation.

Glossary

Carcinogenic: Able to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

Hydrocarbon: Any compound made up of hydrogen and carbon.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for fuel oils. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

AUTOMOTIVE GASOLINE

CAS # 8006-61-9

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about automobile gasoline. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to automotive gasoline most likely occurs from breathing its vapor at a service station while filling a car’s fuel tank. At high levels, automotive gasoline is irritating to the lungs when breathed in and irritating to the lining of the stomach when swallowed. Exposure to high levels may also cause harmful effects to the nervous system. Automotive gasoline has been found in at least 23 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is automotive gasoline?

(Pronounced ô′tə-mō′tĭv găs′ə-lēn′)

The gasoline discussed in this fact sheet is automotive used as a fuel for engines in cars. Gasoline is a colorless, pale brown, or pink liquid, and is very flammable.

Gasoline is a manufactured mixture that does not exist naturally in the environment. Gasoline is produced from petroleum in the refining process.

Typically, gasoline contains more than 150 chemicals, including small amounts of benzene, toluene, xylene, and sometimes lead. How the gasoline is made determines which chemicals are present in the gasoline mixture and how much of each is present. The actual composition varies with the source of the crude petroleum, the manufacturer, and the time of year.

What happens to automotive gasoline when it enters the environment?

- ☐ Small amounts of the chemicals present in gasoline evaporate into the air when you fill the gas tank in your car or when gasoline is accidentally spilled onto surfaces and soils or into surface waters.
- ☐ Other chemicals in gasoline dissolve in water after spills to surface waters or underground storage tank leaks into the groundwater.
- ☐ In surface releases, most chemicals in gasoline will probably evaporate; others may dissolve and be carried away by water; a few will probably stick to soil.
- ☐ The chemicals that evaporate are broken down by sunlight and other chemicals in the air.
- ☐ The chemicals that dissolve in water also break down quickly by natural processes.

How might I be exposed to automotive gasoline?

- ☐ Breathing vapors at a service station when filling the car’s fuel tank is the most likely way to be exposed.
- ☐ Working at a service station.
- ☐ Using equipment that runs on gasoline, such as a lawn mower.
- ☐ Drinking contaminated water.
- ☐ Being close to a spot where gasoline has spilled or leaked into the soil.

How can automotive gasoline affect my health?

Many of the harmful effects seen after exposure to gasoline are due to the individual chemicals in the gasoline mixture, such as benzene and lead. Inhaling or swallowing large amounts of gasoline can cause death.

Inhaling high concentrations of gasoline is irritating to the lungs when breathed in and irritating to the lining of the stomach when swallowed. Gasoline is also a skin irritant. Breathing in high levels of gasoline for short periods or swallowing large amounts of gasoline may also cause harmful effects on the nervous system.

Serious nervous system effects include coma and the inability to breathe, while less serious effects include dizziness and headaches.

There is not enough information available to determine if gasoline causes birth defects or affects reproduction.

How likely is automotive gasoline to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified automotive gasoline for carcinogenicity. Automotive gasoline is currently undergoing review by the EPA for cancer classification.

Some laboratory animals that breathed high concentrations of unleaded gasoline vapors continuously for 2 years developed liver and kidney tumors. However, there is no evidence that exposure to gasoline causes cancer in humans.

Is there a medical test to show whether I've been exposed to automotive gasoline?

Laboratory tests are available that can measure elevated blood or urine levels of lead (as an indication of exposure to leaded gasoline only), benzene, or other substances that may result from exposure to gasoline or other sources. These methods are sensitive enough to measure background levels and levels where health effects may occur. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has established many regulations to control air pollution. These are designed to protect the public from the possible harmful health effects of gasoline.

The American Conference of Governmental Industrial Hygienists (ACGIH) set a maximum level of 890 milligrams of gasoline per cubic meter of air (890 mg/m^3) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Crude petroleum: Petroleum that has not been processed.

Dissolve: To disappear gradually.

Evaporate: To change into a vapor or a gas.

Irritant: A substance that causes an abnormal reaction.

Mixture: A combination of two or more components.

Refining process: The process by which petroleum is purified to form gasoline.

Tumor: An abnormal mass of tissue.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for automotive gasoline. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Polycyclic Aromatic Hydrocarbons (PAHs) - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.
- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences

Polycyclic Aromatic Hydrocarbons

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
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NAPHTHALENE
CAS # 91-20-3

1-METHYLNAPHTHALENE
CAS # 90-12-0

2-METHYLNAPHTHALENE
CAS # 91-57-6

Division of Toxicology ToxFAQs™ **August 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene happens mostly from breathing air contaminated from the burning of wood, tobacco, or fossil fuels, industrial discharges, or moth repellents. Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. Naphthalene has caused cancer in animals. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene have been found in at least 687, 36, and 412, respectively, of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What are naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Naphthalene is a white solid that evaporates easily. Fuels such as petroleum and coal contain naphthalene. It is also called white tar, and tar camphor, and has been used in mothballs and moth flakes. Burning tobacco or wood produces naphthalene. It has a strong, but not unpleasant smell. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride (PVC) plastics. Its major consumer use is in moth repellents and toilet deodorant blocks.

1-Methylnaphthalene and 2-methylnaphthalene are naphthalene-related compounds. 1-Methylnaphthalene is a clear liquid and 2-methylnaphthalene is a solid; both can be smelled in air and in water at very low concentrations.

1-Methylnaphthalene and 2-methylnaphthalene are used to make other chemicals such as dyes and resins. 2-Methylnaphthalene is also used to make vitamin K.

What happens to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene when they enter the environment?

- Naphthalene enters the environment from industrial and domestic sources, and from accidental spills.
- Naphthalene can dissolve in water to a limited degree and may be present in drinking water from wells close to hazardous waste sites and landfills.
- Naphthalene can become weakly attached to soil or pass through soil into underground water.
- In air, moisture and sunlight break it down within 1 day. In water, bacteria break it down or it evaporates into the air.
- Naphthalene does not accumulate in the flesh of animals or fish that you might eat.
- 1-Methylnaphthalene and 2-methylnaphthalene are expected to act like naphthalene in air, water, or soil because they have similar chemical and physical properties.

How might I be exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

- Breathing low levels in outdoor air.
- Breathing air contaminated from industrial discharges or smoke from burning wood, tobacco, or fossil fuels.
- Using or making moth repellents, coal tar products, dyes or inks could expose you to these chemicals in the air.
- Drinking water from contaminated wells.
- Touching fabrics that are treated with moth repellents containing naphthalene.
- Exposure to naphthalene, 1-methylnaphthalene and 2-methylnaphthalene from eating foods or drinking beverages is unlikely.

How can naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene affect my health?

Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. This could cause you to have too few red blood cells until your body replaces the destroyed cells. This condition is called hemolytic anemia. Some symptoms of hemolytic anemia are fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. Animals sometimes develop cloudiness in their eyes after swallowing high amounts of naphthalene. It is not clear whether this also develops in people. Rats and mice that breathed naphthalene vapors daily for a lifetime developed irritation and inflammation of their nose and lungs. It is unclear if naphthalene causes reproductive effects in animals; most evidence says it does not.

There are no studies of humans exposed to 1-methylnaphthalene or 2-methylnaphthalene.

Mice fed food containing 1-methylnaphthalene and 2-methylnaphthalene for most of their lives had part of their lungs filled with an abnormal material.

How likely are naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene to cause cancer?

There is no direct evidence in humans that naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene cause cancer. However, cancer from naphthalene exposure has been seen in animal studies. Some female mice that breathed naphthalene vapors daily for a lifetime developed lung tumors. Some male and female rats exposed to naphthalene in a similar manner also developed nose tumors.

Based on the results from animal studies, the Department of Health and Humans Services (DHHS) concluded that naphthalene is reasonably anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) concluded that naphthalene is possibly carcinogenic to humans. The EPA determined that naphthalene is a possible human carcinogen (Group C) and that the data are inadequate to assess the human carcinogenic potential of 2-methylnaphthalene.

How can naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene affect children?

Hospitals have reported many cases of hemolytic anemia in children, including newborns and infants, who either ate naphthalene mothballs or deodorants cakes or who were in close contact with clothing or blankets stored in naphthalene mothballs. Naphthalene can move from a pregnant woman's blood to the unborn baby's blood. Naphthalene has been detected in some samples of breast milk from the general U.S. population, but not at levels that are expected to be of concern.

There is no information on whether naphthalene has affected development in humans. No developmental abnormalities were observed in the offspring from rats, mice, and rabbits fed naphthalene during pregnancy.

We do not have any information on possible health effects of 1-methylnaphthalene or 2-methylnaphthalene on children.

How can families reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

❏ Families can reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene by avoiding smoking tobacco, generating smoke during cooking, or using fireplaces or heating appliances in the their homes.

❏ If families use naphthalene-containing moth repellents, the material should be enclosed in containers that prevent vapors from escaping, and kept out of the reach from children.

❏ Blankets and clothing stored with naphthalene moth repellents should be aired outdoors to remove naphthalene odors and washed before they are used.

❏ Families should inform themselves of the contents of air deodorizers that are used in their homes and refrain from using deodorizers with naphthalene.

Is there a medical test to determine whether I've been exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Tests are available that measure levels of these chemicals and their breakdown products in samples of urine, feces, blood, maternal milk, or body fat. These tests are not routinely available in a doctor's office because they require special equipment, but samples can be sent to special testing laboratories. These tests cannot determine exactly how much naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene you were exposed to or predict whether harmful effects will occur. If the samples are collected within a day or two of exposure, then the tests can show if you were exposed to a large or small amount of naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene.

Has the federal government made recommendations to protect human health?

The EPA recommends that children not drink water with over 0.5 parts per million (0.5 ppm) naphthalene for more than 10 days or over 0.4 ppm for any longer than 7 years. Adults should not drink water with more than 1 ppm for more than 7 years. For water consumed over a lifetime (70 years), the EPA suggests that it contain no more than 0.1 ppm naphthalene.

The Occupational Safety and Health Administration (OSHA) set a limit of 10 ppm for the level of naphthalene in workplace air during an 8-hour workday, 40-hour workweek. The National Institute for Occupational Safety and Health (NIOSH) considers more than 500 ppm of naphthalene in air to be immediately dangerous to life or health. This is the exposure level of a chemical that is likely to impair a worker's ability to leave a contaminate area and therefore, results in permanent health problems or death.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Trichloroethylene - ToxFAQs™

CAS # 79-01-6

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is used as a solvent for cleaning metal parts. Exposure to very high concentrations of trichloroethylene can cause dizziness headaches, sleepiness, incoordination, confusion, nausea, unconsciousness, and even death. Trichloroethylene has been found in at least 1,051 of the 1,854 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene is a colorless, volatile liquid. Liquid trichloroethylene evaporates quickly into the air. It is nonflammable and has a sweet odor.

The two major uses of trichloroethylene are as a solvent to remove grease from metal parts and as a chemical that is used to make other chemicals, especially the refrigerant, HFC-134a.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene can be released to air, water, and soil at places where it is produced or used.
- Trichloroethylene is broken down quickly in air.
- Trichloroethylene breaks down very slowly in soil and water and is removed mostly through evaporation to air.
- It is expected to remain in groundwater for long time since it is not able to evaporate.
- Trichloroethylene does not build up significantly in plants or animals.

How might I be exposed to trichloroethylene?

- Breathing trichloroethylene in contaminated air.

- Drinking contaminated water.

- Workers at facilities using this substance for metal degreasing are exposed to higher levels of trichloroethylene.

- If you live near such a facility or near a hazardous waste site containing trichloroethylene, you may also have higher exposure to this substance.

How can trichloroethylene affect my health?

Trichloroethylene was once used as an anesthetic for surgery. Exposure to moderate amounts of trichloroethylene may cause headaches, dizziness, and sleepiness; large amounts may cause coma and even death. Eating or breathing high levels of trichloroethylene may damage some of the nerves in the face. Exposure to high levels can also result in changes in the rhythm of the heartbeat, liver damage, and evidence of kidney damage. Skin contact with concentrated solutions of trichloroethylene can cause skin rashes. There is some evidence exposure to trichloroethylene in the work place may cause scleroderma (a systemic autoimmune disease) in some people. Some men occupationally-exposed to trichloroethylene and other chemicals showed decreases in sex drive, sperm quality, and reproductive hormone levels.

How likely is trichloroethylene to cause cancer?

There is strong evidence that trichloroethylene can cause kidney cancer in people and some evidence for trichloroethylene-induced liver cancer and malignant lymphoma. Lifetime exposure to trichloroethylene resulted in increased liver cancer in mice and increased kidney cancer and testicular cancer in rats.

The Department of Health and Human Services (DHHS) considers trichloroethylene to be a known human carcinogen. The International Agency for Research on Cancer (IARC) classified trichloroethylene as carcinogenic to humans. The EPA has characterized trichloroethylene as carcinogenic to humans by all routes of exposure.

Trichloroethylene

CAS # 79-01-6

How can trichloroethylene affect children?

It is not known whether children are more susceptible than adults to the effects of trichloroethylene.

Some human studies indicate that trichloroethylene may cause developmental effects such as spontaneous abortion, congenital heart defects, central nervous system defects, and small birth weight. However, these people were exposed to other chemicals as well.

In some animal studies, exposure to trichloroethylene during development caused decreases in body weight, increases in heart defects, changes to the developing nervous system, and effects on the immune system.

How can families reduce the risk of exposure to trichloroethylene?

- Avoid drinking water from sources that are known to be contaminated with trichloroethylene. Use bottled water if you have concerns about the presence of chemicals in your tap water. You may also contact local drinking water authorities and follow their advice.
- Prevent children from playing in dirt or eating dirt if you live near a waste site that has trichloroethylene.
- Trichloroethylene is used in many industrial products. Follow instructions on product labels to minimize exposure to trichloroethylene.

Is there a medical test to determine whether I've been exposed to trichloroethylene?

Trichloroethylene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of trichloroethylene or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because trichloroethylene and its metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure.

Has the federal government made recommendations to protect human health?

The EPA set a maximum contaminant goal (MCL) of 0.005 milligrams per liter (mg/L; 5 ppb) as a national primary drinking standard for trichloroethylene.

The Occupational Safety and Health Administration (OSHA) set a permissible exposure limit (PEL) of 100 ppm for trichloroethylene in air averaged over an 8-hour work day, an acceptable ceiling concentration of 200 ppm provided the 8 hour PEL is not exceeded, and an acceptable maximum peak of 300 ppm for a maximum duration of 5 minutes in any 2 hours.

The National Institute for Occupational Safety and Health (NIOSH) considers trichloroethylene to be a potential occupational carcinogen and established a recommended exposure limit (REL) of 2 ppm (as a 60-minute ceiling) during its use as an anesthetic agent and 25 ppm (as a 10-hour TWA) during all other exposures.

Reference

This ToxFAQs™ information is taken from the 2019 Toxicological Profile for Trichloroethylene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs^{TM} on the web: www.atsdr.cdc.gov/ToxFAQs

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Tetrachloroethylene - ToxFAQs™

CAS # 127-18-4

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing and in the aerospace industry. Exposure to very high concentrations of tetrachloroethylene can cause dizziness headaches, sleepiness, incoordination confusion, nausea, unconsciousness, and even death. Tetrachloroethylene has been found in at least 949 of the 1,854 National Priorities List sites identified by U.S. Environmental Protection Agency (EPA).

What is tetrachloroethylene?

Tetrachloroethylene is a nonflammable colorless liquid. Other names for tetrachloroethylene include perchloroethylene, PCE, perc, tetrachloroethene, and perchlor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part in 1 million parts of air (1 ppm) or more.

Tetrachloroethylene is used as a dry cleaning agent and metal degreasing solvent. It is also used as a starting material (building block) for making other chemicals and is used in some consumer products.

What happens to tetrachloroethylene when it enters the environment?

- Tetrachloroethylene can be released into air, water, and soil at places where it is produced or used.
- Tetrachloroethylene breaks down very slowly in the air and so it can be transported long distances in the air. Half of the amount in the air will degrade in approximately 100 days.
- Tetrachloroethylene evaporates quickly from water into air. It is generally slow to break down in water.
- Tetrachloroethylene may evaporate quickly from shallow soils or may filter through the soil and into the groundwater below. It is generally slow to break down in soil.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it. You might also be exposed to tetrachloroethylene that is released into the air during showering and bathing.
- People residing near contaminated sites or dry cleaning locations may be exposed to higher levels than the general population.
- People working in the dry cleaning industries or using metal degreasing products may be exposed to elevated levels of tetrachloroethylene.

How can tetrachloroethylene affect my health?

Breathing high levels of tetrachloroethylene for a brief period may cause dizziness or drowsiness, headache, and incoordination; higher levels may cause unconsciousness and even death.

Exposure for longer periods to low levels of tetrachloroethylene may cause changes in mood, memory, attention, reaction time, and vision.

Studies in animals exposed to tetrachloroethylene have shown liver and kidney effects, and changes in brain chemistry, but we do not know what these findings mean for humans.

Tetrachloroethylene

CAS # 127-18-4

How likely is tetrachloroethylene to cause cancer?

Studies in humans suggest that exposure to tetrachloroethylene might lead to a higher risk of getting bladder cancer, multiple myeloma, or non-Hodgkin's lymphoma.

In animals, tetrachloroethylene has been shown to cause cancers of the liver, kidney, and blood system.

The Department of Health and Human Services (DHHS) considers tetrachloroethylene to be reasonably anticipated to be a human carcinogen. EPA considers tetrachloroethylene likely to be carcinogenic to humans by all routes of exposure. The International Agency for Research on Cancer (IARC) considers tetrachloroethylene probably carcinogenic to humans.

How can tetrachloroethylene affect children?

It is not known whether children are more susceptible than adults to the effects of tetrachloroethylene.

A few studies in humans have suggested that exposure to tetrachloroethylene increased the numbers of babies with birth defects, but these studies were not large enough to clearly answer the question. Studies in animals exposed by inhalation or stomach tube have not shown clear evidence of specific birth defects.

How can families reduce the risk of exposure to tetrachloroethylene?

- Tetrachloroethylene has been found in low levels in some food. You can minimize the risk of your family's exposure by peeling and thoroughly washing fruits and vegetables before cooking.
- Use bottled water if you have concerns about the presence of tetrachloroethylene in your tap water. You may also contact local drinking water authorities and follow their advice.
- Prevent children from playing in dirt or eating dirt if you live near a waste site that has tetrachloroethylene.
- Tetrachloroethylene is widely used as a scouring solvent that removes oils from fabrics, as a carrier solvent, as a fabric finish or water repellant, and as a metal degreaser/cleaner. Follow instructions on product labels to minimize exposure to tetrachloroethylene.

Is there a medical test to determine whether I've been exposed to tetrachloroethylene?

Tetrachloroethylene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of tetrachloroethylene or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because tetrachloroethylene and its metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set an 8-hour time weighted average permissible exposure limit of 100 ppm, an acceptable ceiling exposure limit of 200 ppm, and a maximum peak of 300 ppm (not to be exceeded for more than 5 minutes of any 3-hour period).

The National Institute for Occupational Safety and Health (NIOSH) recommends that workplace exposure to tetrachloroethylene be minimized due to concerns about its carcinogenicity.

Reference

This ToxFAQs™ information is taken from the 2019 Toxicological Profile for Tetrachloroethylene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ on the web: www.atsdr.cdc.gov/ToxFAQs

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Lead - ToxFAQs™

What is lead?

Lead is a naturally occurring metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment, including air, water and soil. Lead can exist in many different chemical forms.

Lead is used in the production of batteries, ammunition, and metal products (solder and pipes). Because of health concerns, use of lead in paints, ceramic products, caulking, and pipe solder has been dramatically reduced. The use of lead as an additive to automobile gasoline was banned in 1996 in the United States.

What happens to lead in the environment?

- Lead is an element and, therefore, it does not break down.
- When lead is released to the air, it may be transported long distances before it deposits onto the ground.
- Once deposited, lead often adheres to soil particles.
- Lead in soil can be transported into groundwater, but the amount of lead that moves into groundwater will depend on the chemical form of lead and soil type.

How can I be exposed to lead?

- Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder which can leach into the water.
- Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can form lead dust which can be ingested.
- Spending time in areas where the soil is contaminated with lead.
- Working in a job where lead is used or participating in certain hobbies in which lead is used, such as making stained glass.
- Using health-care products or folk remedies that contain lead.

Lead can affect almost every organ and system in your body

How can lead affect my health?

The effects of lead are the same whether it enters the body through inhalation or ingestion. Lead can affect almost every organ and system in your body. The nervous system is the main target for lead toxicity in adults and children. Long-term exposure can result in decreased learning, memory, and attention and weakness in fingers, wrists, or ankles. Lead exposure can cause anemia and damage to kidneys. It can also cause increases in blood pressure, particularly in middle-aged and older individuals. Exposure to high lead levels can severely damage the brain and kidneys and can cause death. In pregnant women, exposure to high levels of lead may cause a miscarriage. High-level exposure in men can damage reproductive organs.

Lead

How can lead affect children?

Children are more vulnerable to lead poisoning than adults because their nervous system is still developing. Children can be exposed to lead in their environment and prior to birth from lead in their mother's body. At lower levels of exposure, lead can decrease mental development, with effects on learning, intelligence and behavior. Physical growth may also be decreased. A child who swallows large amounts of lead may develop anemia, severe stomachache, muscle weakness, and brain damage. Exposure to lead during pregnancy can result in premature births. Some effects of lead may persist into adulthood.

Can lead cause cancer?

There have been several agencies and organizations both in the United States and internationally that have reviewed studies and made an assessment about whether lead can cause cancer.

- The Department of Health and Human Services (HHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens
- The U.S. Environmental Protection Agency (EPA) has classified lead as a probable human carcinogen.
- The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans, and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

Can I get a medical test to check for lead?

A blood test is available to measure the amount of lead in your blood. Blood tests are commonly used to screen children for lead poisoning. Your doctor can draw blood samples and send them to appropriate laboratories for analysis.

How can I protect my family from lead exposure?

- Avoid exposure to sources of lead.
- Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint.
- If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Want more information?

Go to ATSDR's Toxicological Profile for Lead

CDC Lead Poisoning Prevention Program https://www.cdc.gov/nceh/lead/default.htm

Environmental Protection Agency https://www.epa.gov/lead/protect-your-family-exposures-lead

Call **CDC-INFO** at 1-800-232-4636, or submit your question online at https://wwwn.cdc.gov/dcs/ContactUs/Form

Go to ATSDR's Toxic Substances Portal: http://www.atsdr.cdc.gov/substances/index.asp

If you have any more questions or concerns, you can also find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

Chloroform - ToxFAQs™

CAS # 67-66-3

This fact sheet answers the most frequently asked health questions (FAQs) about chloroform. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to chloroform can occur when breathing contaminated air or when drinking or touching the substance or water containing it. Breathing chloroform can cause dizziness, fatigue, and headaches. Breathing chloroform or ingesting chloroform over long periods of time may damage your liver and kidneys. It can cause sores if large amounts touch your skin. This substance has been found in at least 717 of the 1,430 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is chloroform?

(Pronounced klôr′ə-fôrm′)

Chloroform is a colorless liquid with a pleasant, nonirritating odor and a slightly sweet taste. It will burn only when it reaches very high temperatures.

In the past, chloroform was used as an inhaled anesthetic during surgery, but it isn't used that way today. Today, chloroform is used to make other chemicals and can also be formed in small amounts when chlorine is added to water.

Other names for chloroform are trichloromethane and methyl trichloride.

What happens to chloroform when it enters the environment?

- Chloroform evaporates easily into the air.
- Most of the chloroform in air breaks down eventually, but it is a slow process.
- The breakdown products in air include phosgene and hydrogen chloride, which are both toxic.
- It doesn't stick to soil very well and can travel through soil to groundwater.
- Chloroform dissolves easily in water and some of it may break down to other chemicals.
- Chloroform lasts a long time in groundwater.
- Chloroform doesn't appear to build up in great amounts in plants and animals.

How might I be exposed to chloroform?

- Drinking water or beverages made using water containing chloroform.
- Breathing indoor or outdoor air containing it, especially in the workplace.
- Eating food that contains it.
- Skin contact with chloroform or water that contains it, such as in swimming pools.

How can chloroform affect my health?

Breathing about 900 parts of chloroform per million parts air (900 ppm) for a short time can cause dizziness, fatigue, and headache. Breathing air, eating food, or drinking water containing high levels of chloroform for long periods of time may damage your liver and kidneys. Large amounts of chloroform can cause sores when chloroform touches your skin.

It isn't known whether chloroform causes reproductive effects or birth defects in people.

Animal studies have shown that miscarriages occurred in rats and mice that breathed air containing 30 to 300 ppm chloroform during pregnancy and also in rats that ate chloroform during pregnancy. Offspring of rats and mice that breathed chloroform during pregnancy had birth defects. Abnormal sperm were found in mice that breathed air containing 400 ppm chloroform for a few days.

Chloroform

CAS # 67-66-3

How likely is chloroform to cause cancer?

The Department of Health and Human Services (DHHS) has determined that chloroform may reasonably be anticipated to be a carcinogen.

Rats and mice that ate food or drank water with chloroform developed cancer of the liver and kidneys.

Is there a medical test to show whether I've been exposed to chloroform?

Although the amounts of chloroform in the air that you exhale and in blood, urine, and body tissues can be measured, there is no reliable test to determine how much chloroform you have been exposed to or whether you will experience any harmful effects.

The measurement of chloroform in body fluids and tissues may help to determine if you have come into contact with large amounts of chloroform, but these tests are useful for only a short time after you are exposed. Chloroform in your body might also indicate that you have come into contact with other chemicals.

Has the federal government made recommendations to protect human health?

The current EPA drinking water limit for total trihalomethanes, a class of chemicals that includes chloroform, is 80 micrograms per liter of water (80µg/L).

The EPA requires that spills or accidental releases of 10 pounds or more of chloroform into the environment be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set the maximum allowable concentration of chloroform in workroom air during an 8-hour workday in a 40-hour workweek at 50 ppm.

Glossary

Carcinogenicity: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Ingesting: Taking food or drink into your body.

Microgram (µg): One millionth of a gram.

Miscarriage: Pregnancy loss.

ppm: Parts per million.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological Profile for Chloroform. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs^{TM} Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Benzene - ToxFAQs™

CAS # 71-43-2

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHTLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 1,000 of the 1,684 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is benzene?

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and other synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include emissions from volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

- Industrial processes are the main source of benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can attach to rain or snow and be carried back down to the ground.
- It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- Benzene does not build up in plants or animals.

How might I be exposed to benzene?

- Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Vapors (or gases) from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure.
- Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- Working in industries that make or use benzene.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

The major effect of benzene from long-term exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection. Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries, but we do not know for certain that benzene caused the effects. It is not known whether benzene will affect fertility in men.

Benzene

CAS # 71-43-2

How likely is benzene to cause cancer?

Long-term exposure to high levels of benzene in the air can cause leukemia, particularly acute myelogenous leukemia, often referred to as AML. This is a cancer of the bloodforming organs. The Department of Health and Human Services (DHHS) has determined that benzene is a known carcinogen. The International Agency for Research on Cancer (IARC) and the EPA have determined that benzene is carcinogenic to humans.

How can benzene affect children?

Children can be affected by benzene exposure in the same ways as adults. It is not known if children are more susceptible to benzene poisoning than adults.

Benzene can pass from the mother's blood to a fetus. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How can families reduce the risks of exposure to benzene?

Benzene exposure can be reduced by limiting contact with gasoline and cigarette smoke. Families are encouraged not to smoke in their house, in enclosed environments, or near their children.

Is there a medical test to determine whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is a test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood; however, since benzene disappears rapidly from the blood, this test is only useful for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. The metabolite S-phenylmercapturic acid in urine is a sensitive indicator of benzene exposure. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 5 parts benzene per billion parts of water (5 ppb).

The Occupational Safety and Health Administration (OSHA) has set limits of 1 part benzene per million parts of workplace air (1 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR) 2007. Toxicological Profile for Benzene (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs^{TM} Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATTACHMENT B

Utility Location Report

NYLD **Infrastructure**

NEW YORK LEAK DETECTION, INC.
PO Box 269, Jamesville, NY 13078
315-469-4601 info@nyld.com

Field Report – Utility Location

Date(s) on site: 10/11/19

Technician: Sonny Kentile **Other Technicians on site**:

Customer: Paulus Development

Site Address: Smith Restaurant Supply Building Site -- 500 Erie Blvd East Syracuse, NY

Contact Person: John Sheffield **Phone**: 315-559-4034

Scope of Work: Utility Location Services – locate potential utilities and UST. Less than 1 acre. Area is asphalt & concrete. Active retail site, former foundry.

Type of Service: *mark all that apply*

☐ *Leak Detection*
☐ *Infrastructure Assessment*
☐ *EM Survey*
☐ *Comprehensive Leak Survey*
☒ *Utility Location/GPR*
☐ *Video Inspection*
☐ *Pressurized Pipe Inspection*
☐ *Utility Mapping/AutoCAD*
☐ *Valve Exercising*

Type of Equipment Used: *mark all that apply*

☐ *Profiler EMP 400*
☐ *LC2500 Leak Correlator*
☐ *S-30 Surveyor*
☐ *Sonde / Locatable Rodder*
☐ *Leica Robotic Total Station*
☐ *Valve Maintenance Trailer*
☒ *RD8000 Pipe & Cable Locator*
☒ *Noggin 250 MHz*
☐ *Noggin 500 MHz*
☐ *Conquest 1000 MHz*
☐ *Leica RTK GPS*
☐ *Thermal Imaging Camera*
☐ *MetroTech vLocPro2*
☐ *PosiTector UTG G3*
☐ *Video Inspection Camera*
☐ *Helium #* *Bottles*
☐ *JD7 Investigator*
☐ *ZCorr Data Loggers*

Marking Used: *mark all that apply*

☒ *Paint*
☐ *Tape*
☒ *Flags*
☐ *Updated Onsite Mapping*
☐ *Chalk/Marker*
☐ *Other* _________

NYLD Infrastructure

NEW YORK LEAK DETECTION, INC.
PO Box 269, Jamesville, NY 13078
315-469-4601 info@nyld.com

Field Report – Utility Location

Site Access/Safety Training: N/A **Expiration Date**: N/A

Ground Cover/Weather Conditions: Asphalt & Concrete / 50's & Sunny

Instructions from Onsite Contact: We are investigating to see if there are any possible sources of contamination throughout the property. Clear all utilities and search for UST's throughout areas specified (see provided mapping and overview below).

Information Transfer:

In addition to this field report,
mark all that apply:

☒ *Information relayed on site to:*

John Sheffield

☐ *Hand drawn sketch*

☐ *Photographs*

☐ *Surveyed and AutoCAD Mapping by NYLD*

☐ *Maps updated onsite*

☐ *Surveyed by others*

Notes/Testing Results:

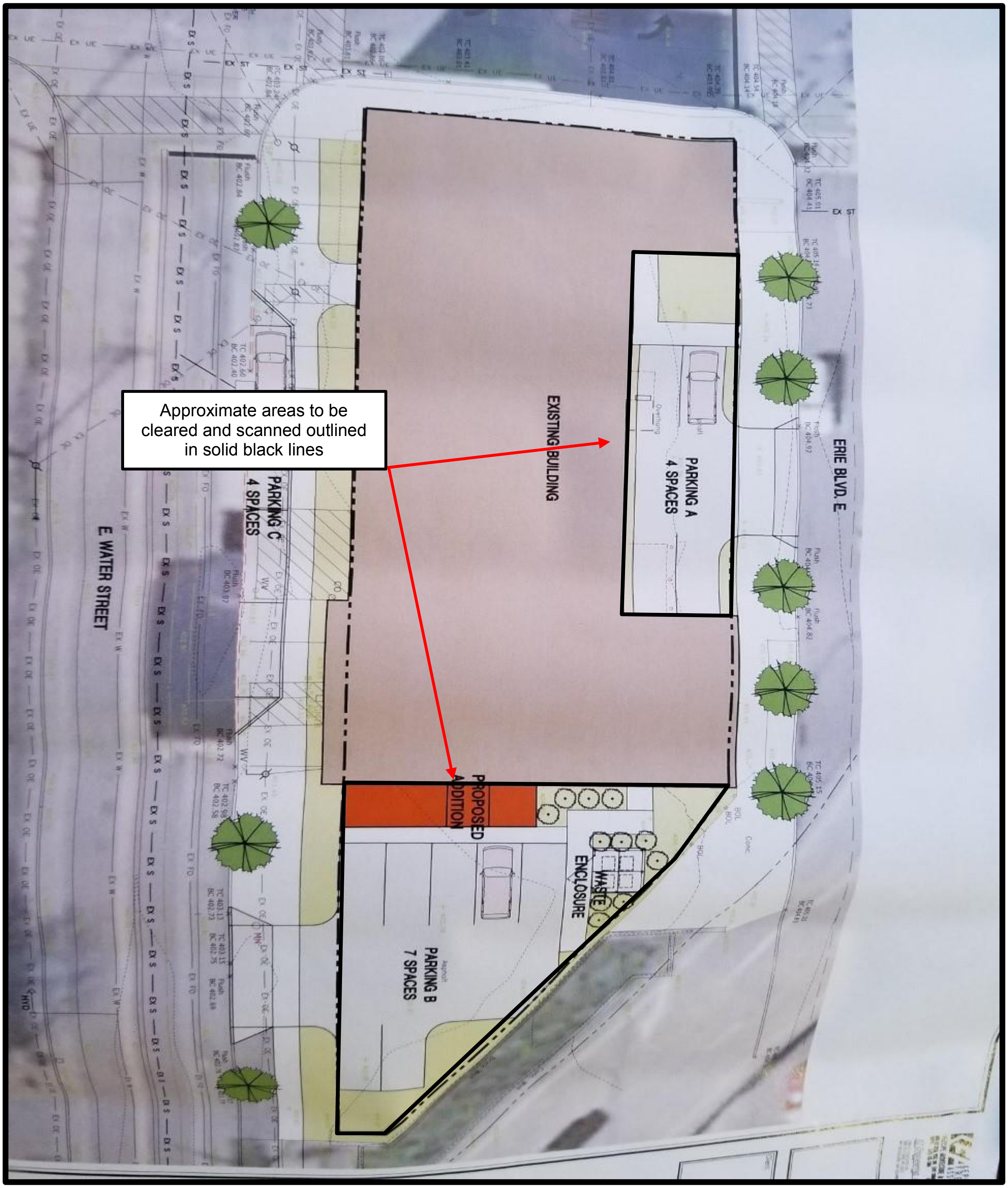
A visual inspection was performed in the area of concern to assess for utility structures. Utilizing the RD8000 in conductive, inductive, and power/radio modes, located and marked out utilities as shown in the area below. Sonde/Locatable Rodder was used within applicable utilities. Additional confirmation performed with the Noggin using the 250 and/or 500 MHz antenna. GPR signal reception varies depending upon soil conditions. Therefore, it is utilized in combination with various other geophysical tools for the most accurate verification of known/unknown utilities and/or structures.

Utilities were painted in appropriate color, marked with flags and depths provided where possible.

Vehicle congestion as well as dumpster and pallet locations in the side parking area severely restricted scanning abilities. Noted in google overview.

This report is back up to information relayed and marked on site at time of service. It is for informational purposes only.

Provided Mapping



Approximate areas to be cleared and scanned outlined in solid black lines

Field Report – Utility Location

Key

Blue	Water
Red	Power
Orange	Communications
Yellow	Gas/Flammable Fuel
White	Unknown
Green	Storm/Sanitary

Unknown concrete structures

Approximate areas to be cleared outlined with black

Manhole filled with dirt, contact sewer/water department.

Areas severely limited by parked vehicles and dumpster/pallet congestion delineated with dashed lines. See images below.

Field Report – Utility Location


GOODYEAR
Smith

Subsurface Limitations

Utility locating is the art and science of using non-intrusive methods to search for, find and mark out buried, unseen conduits or other objects. There are innumerable variables involved in locating underground utilities, such as topography, size and complexity of job site, depth and proximity of buried utilities, above ground obstructions, short turnaround schedules, changes in the scope of work, lack of (or outdated) blueprints and adverse weather conditions.

New York Leak Detection, Inc. (NYLD) has made a substantial financial investment in crossover technologies and training to meet our clients' needs when locating and mapping utilities. However, due to unpredictable factors that may affect the results, NYLD makes no guarantee, expressed or implied, with respect to the completeness or accuracy of the information provided. Any use or reliance on the information or opinion is at the risk of the user and NYLD shall not be liable for any damage or injury arising out of the use or misuse of the information provided.

NYLD strives to provide the highest quality utility location services possible with the technical expertise of our field specialists and state-of-the-art equipment used. Every effort is made to provide our clients with the most accurate information possible without adverse consequences.

NYLD makes no guarantee that all subsurface utilities and obstructions will be detected. GPR signal penetration might not be sufficient to detect all utilities. NYLD is not responsible for detecting subsurface utilities and obstructions that normally cannot be detected by the methods employed or that cannot be detected because of site conditions. NYLD is not responsible for maintaining mark-outs after leaving the work area. Mark-outs made in inclement weather and in high traffic areas may not last. Surveyor assumes responsibility of picking up data on site.

APPENDIX D

Community Air Monitoring Plan

COMMUNITY AIR MONITORING PLAN

Remedial Investigation Work Plan
The Smith Restaurant Building
City of Syracuse, New York

July 2020

TABLE OF CONTENTS

FIGURES

1.0 INTRODUCTION

A Community Air Monitoring Plan (CAMP) requires real-time observation / 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 investigative and remedial work activities. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and / or work shutdown.

Continuous monitoring will be required for all ground intrusive activities, including but not limited to, soil excavation and handling, trenching, and the installation of monitoring wells.

2.0 GENERAL SITE CONDITIONS

The prevailing wind generally blows from west to east. However, monitoring locations will be adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and at least one downwind monitoring station. The attached Figure 1 illustrates the likely location of monitoring stations associated with the site.

At this time, the primary chemicals of concern include the following:

- Gasoline-related compounds
- Diesel-related compounds
- Oil-related compounds
- Lead
- Chlorinated solvents

To date, the requestor has not investigated the site for PCBs, pesticides, or PFAS compounds, since these contaminants were not expected to be of primary of concern. As the investigation progresses and soil and groundwater data is collected for these other classes of chemicals (PCBs, pesticides, etc.), this CAMP will be updated to reflect this information.

3.0 VOC MONITORING, RESPONSE LEVELS, AND ACTIONS

VOCs will be monitored at the downwind perimeter of the immediate work area (i.e. – exclusion zone) on a continuous basis. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring of VOCs will be performed using a photo-ionization detector (PID), which will be calibrated daily. The PID will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below:

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level half the distance to the nearest potential receptor or residential / commercial structure (but not less than 20 feet), is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shut down.

All 15-minute readings will be recorded and be available for NYSDEC and NYSDOH personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

4.0 PARTICULATE MONITORING, RESPONSE LEVELS, AND ACTIONS

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the work area or exclusion zone at temporary particulate monitoring stations. The particulate monitoring will be performed using a DUSTTRAK™ Aerosol Monitor Model 8520 (or similar). The device will be capable of measuring particulate matter less than 10 micrometers in size (PM-10), integrating over a period of 15 minutes for comparison to the airborne particulate action level, and equipped with an audible alarm to indicate exceedance of the following action levels:

- 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 work area, then dust suppression techniques will 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 work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work will be stopped and an evaluation of activities will be initiated. Work will 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.

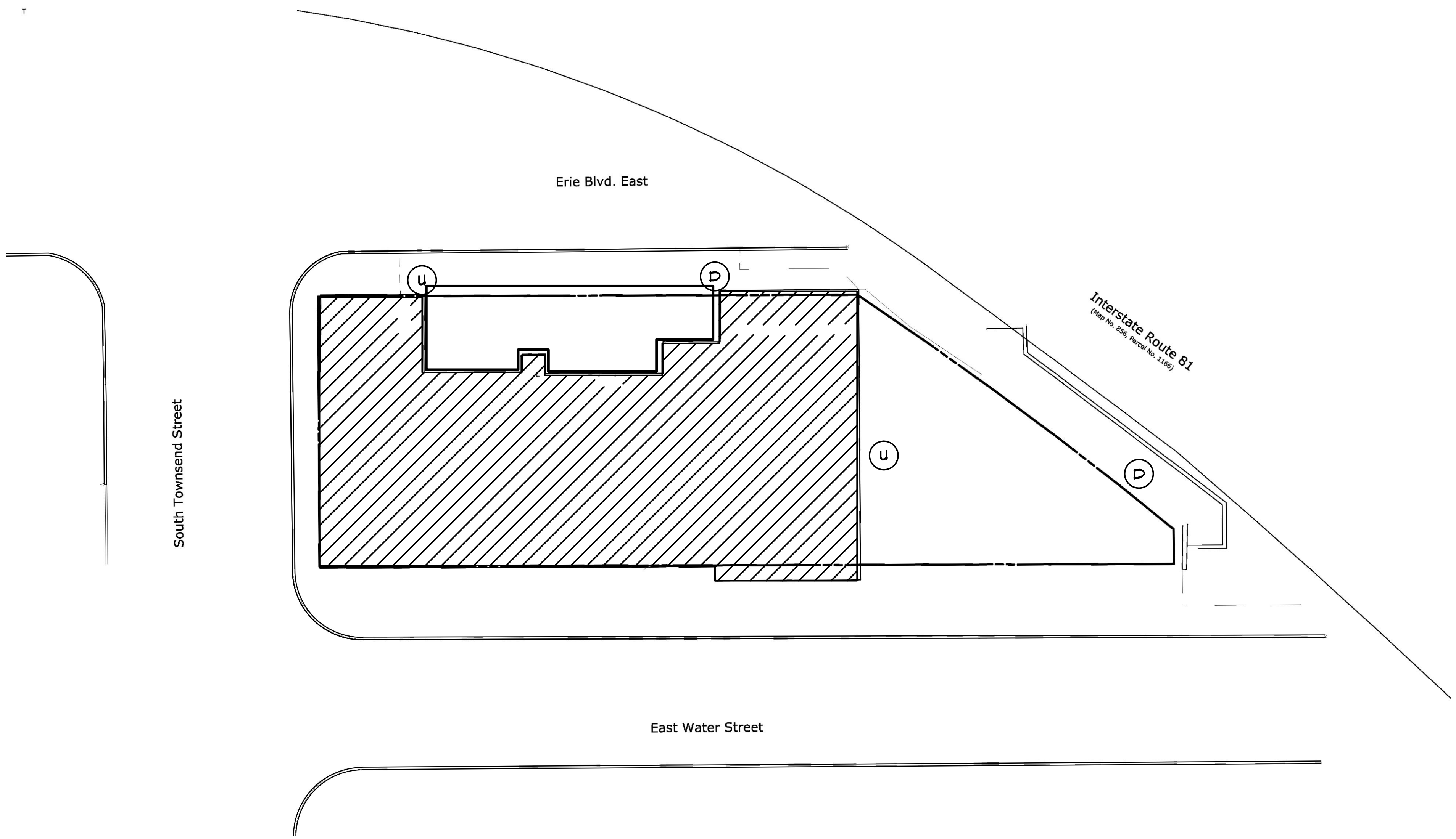
In addition, fugitive dust migration will be visually assessed during all work activities.

All readings will be recorded and be available for NYSDEC and NYSDOH review.

5.0 MONITORING DURING NON-INTRUSIVE ACTIVITIES

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of groundwater samples from monitoring wells. Periodic monitoring during non-intrusive sample collection will consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap, monitoring during well baling/purging, and taking a reading prior to leaving a sample location.

Figures



LEGEND:

— — — APPROXIMATE PROPERTY LINE / BROWNFIELD AREA EXTENT

▨ APPROXIMATE BUILDING FOOTPRINT

☐ APPROXIMATE / EXAMPLE WORK AREA BOUNDARY

Ⓤ EXAMPLE UPWIND MONITORING LOCATION

Ⓓ EXAMPLE DOWNWIND MONITORING LOCATION

NOTES:

1. PROPERTY LINE AND BUILDING PER ENGINEERING DOCUMENT PG 47 SITE PLAN, DATED JULY 2019 .
2. ALL LOCATIONS ARE APPROXIMATE.
3. MONITORING LOCATIONS SHOWN ARE INTENDED FOR EXAMPLE PURPOSES ONLY. ACTUAL MONITORING LOCATIONS WILL BE DETERMINED BY THE AIR SAMPLING TECHNICIAN AT THE TIME OF WORK ACTIVITIES AND BE INFLUENCED BY WORK AREA LAYOUT, WIND DIRECTION, BUILDING STRUCTURES WITH POTENTIAL TO INFLUENCE AIR FLOW, ACCESSIBILITY, AND WITH CONSIDERATION FOR TRAFFIC RELATED DUST, THE SAFETY OF ON-SITE PERSONNEL AND THE PUBLIC. THE EXAMPLE MONITORING LOCATIONS DEPICTED ASSUME WESTERLY WINDS.
4. ONE DOWNWIND MONITORING STATION PER ACTIVE WORK AREA IS EXPECTED TO BE ADEQUATE, BASED ON THE SIZE OF THE SITE AND ANTICIPATED WORK AREAS.

0 32'6"' 75'

GRAPHIC SCALE

AECC
ENVIRONMENTAL CONSULTING
Asbestos & Environmental
Consulting Corporation

6308 Fly Road
East Syracuse, NY 13057

PROJECT NO. 20-032
DRAWN: JUNE 2020
DRAWN BY: DB
CHECKED BY: RDM

Example Air Monitoring Locations

The Smith Restaurant Building
500 Erie Boulevard East
Syracuse, New York 13202

FIGURE
CAMP-1