REMEDIAL INVESTIGATION WORK PLAN

BCP Site # C633090

Former Rome Turney Development Site
109 Canal Street
City of Rome
Oneida County, New York

Prepared by:

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NOVEMBER 2021

REVISION	DATE	SUMMARY OF REVISION

CERTIFICATION

I, Robert G. Harner, 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).

ROBERT GEORGE HARNER
079435

November 8, 2021
Robert Harner

NYS Professional Engineer (#079435)
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.

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COMMON ACRONYMS AND ABBREVIATIONS

ACM – Asbestos-Containing Material
ASP – Analytical Services Protocol
ASTM – American Society for Testing Materials International
bgs – Below Ground Surface
CAMP – Community Air Monitoring Program
CP-51 – (NYSDEC) Commissioner's Policy #51 (Soil Cleanup Guidance)
DEC – Department of Environmental Conservation
DER – Division of Environmental Remediation
DOH – Department of Health
DQO – Data Quality Objectives
DUSR – Data Usability Summary Report
ELAP – Environmental Laboratory Accreditation Program
ESA – Environmental Site Assessment
ft - feet
GIS – Geographic Information Systems
GPS – Global Positioning System
GWS – Groundwater Standard
HASP – Health and Safety Plan
IRM – Interim Remedial Measure
LBP – Lead-Based Paint
NYCRR – New York Codes, Rules, and Regulations
NYSDEC – New York State Department of Environmental Conservation
NYSDOH – New York State Department of Health
NYSDOT – New York State Department of Transportation
PAH – Polycyclic Aromatic Hydrocarbons
PCB – Poly-Chlorinated Biphenyls
ppb – Parts Per Billion
ppm – Parts Per Million
QAPP – Quality Assurance Project Plan
QA/QC – Quality Assurance / Quality Control
REC – Recognized Environmental Condition
RSCO – Restricted Soil Cleanup Objective
SCO – Soil Cleanup Objective
STIP – Stipulation Agreement (Between DEC and Party accepting responsibility for cleanup of a spill)
SVOC – Semi-Volatile Organic Compound
SWPPP – Stormwater Pollution Prevention Plan
TOGS – Technical & Operational Guidance Series 1.1.1 (NYSDEC)
USEPA – United States Environmental Protection Agency
UST – Underground Storage Tank
VOC – Volatile Organic Compound

1.0 SITE AND PROJECT BACKGROUND

1.1 SITE LOCATION AND DESCRIPTION

The Former Rome Turney Development Site (Site) is located within the City of Rome, Oneida County, New York, and is identified by Tax Parcel ID # 242.066-0001-001 (see Figure 1).

1.1.1 Location

The Site is 1.40 acres in size. The BCP comprises of the entire property.

The center of the Site is situated at approximately 43° 12’ 29.9” latitude and -75° 27’ 27.9” longitude.

As shown in Figure 1, the Site is in a mixed residential and commercial area of the City of Rome. It is bordered to the north by a former railroad right-of-way, to the east by Erie Boulevard, to the south by a vacant parcel along Jasper Street, to the southwest by residential properties on the opposite site of Canal Street, and to the northwest by a parcel that supports a warehouse.

1.1.2 Site Features

The Site’s elevation is approximately 440 feet above mean sea level and is generally flat. The surrounding area is also relatively flat. The nearest surface water feature is located approximately 800 feet east of the Site (a south-flowing section of the Mohawk River connecting the Delta Reservoir, located 4.5 miles north of the Site, and Pools Brook (a.k.a. former Erie Canal), located 0.5 mile south of the Site, where the Mohawk River then flows east).

Former Site buildings were demolished in early 2020. Sections of the concrete building slabs, foundation concrete and bricks were removed and crushed at the site in early 2021. The remainder of the Site is comprised of a mix of asphalt, crushed stone and gravel, and a limited area of grass.

1.1.3 Current Zoning and Land Use

The Site is zoned “Waterfront”. The current and proposed uses are in accordance with existing zoning. The surrounding parcels to the northwest, east, and south are currently utilized for manufacturing and/or commercial purposes. The surrounding parcels to the southwest are residential. The Fort Stanwix historic site is located to the north (on the opposite side of Erie Boulevard).

1.2 OWNERSHIP AND USE

The Site was originally developed between 1884 and 1888 and has been used for industrial purposes since. Historic Sanborn fire insurance maps indicate that the original development consisted of portions of the R.M. Bingham and Co. carriage manufacturing operations, representing an extension of that company’s larger operations to the north of the Site. The R.M. Bingham operations to the north of the Site pre-date 1884. In 1888 and 1894, the Site was occupied by a blacksmith / forging building, and lumber piles associated with R.M. Bingham operations.

In 1899, the former blacksmith / forge building on the Site was occupied by The Electric Wire Works. An engine house was also located to the east of the building. The engine house building was later occupied by the Utica Industrial Co. machine shop in 1904.

In 1905, the Rome-Turney Radiator Co., a manufacturer of automobile radiators, began operations at the Site. The Rome-Turney Radiator Co. continued operations at the Site until approximately 2008. Other co-occupants in recent years (according to historical city directory information) included:

1992 – 1995:	Rome-Turney Radiator Co., Lynch Realty, The Music Factory (asphalt company)
1999 – 2003:	Rome-Turney Radiator Co. and The Music Factory
2008:	Rome-Turney Radiator Co. and the Elegrace Casket, Inc. (casket making)
2013:	The Music Factory

Documents provided by the NYSDEC and an internet search found that Rollerad occupied 109 Canal Street from at least 2008 to 2014, including the adjacent parcel to the south (100 Jasper Street) from at least 2008 to present time.

****Note that the adjacent parcel to the west, formerly known as 107 Canal Street, now shares the 109 Canal Street address. Earlier city directories and an internet search revealed two (2) companies with 109 Canal Street addresses, Serway Brothers Inc. – Plastic Laminating Division (cabinet making) and Rofin LLC (supplier of industrial coolers). These companies are/were actually located on the adjacent parcel. Therefore, it is possible that The Music Factory, Elegrace, and Rollerad were also located on the adjacent parcel.*

The Site is currently owned by the City of Rome, who has granted Rome Turney, LLC (the “Volunteer”) full access to the Site during the Remedial Investigation (see Appendix F).

The Site is currently vacant. The expectation is that post-remediation, the Site will be redeveloped for future residential (non-single family) and / or commercial use, in accordance with the City of Rome’s Comprehensive Action Plan and Community Profile (in accordance with its “Waterfront” zoning designation). Such usage will match the use of nearby properties (a mix of residential, hospitality, retail, and warehousing).

1.3 GEOLOGIC SETTING

According to New York State Geological Survey, the bedrock in the area of the Site is Utica shale (of the Lorraine, Trenton, and Black River Group – Middle Ordovician 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 investigations at the Site revealed the following general soil components:

- 0–0.5 ft bgs: topsoil
- 0.5–5 ft bgs: coarse to fine sand
- 5–10 ft bgs: clay to clayey-silt with banding of grey coarse to medium sands
- 10–15 ft bgs: clayey-silt overlying various grades of sand
- 15–20 ft bgs: various grades of sand

During previous investigations, groundwater was generally encountered at depths of approximately 7’ - 8’ bgs.

Based on groundwater elevations measured in 2018 (and ignoring the high water levels in the vicinity of the potentially leaking water line bisecting the Site), groundwater appears to flow in a general northwesterly direction.

There are no surface waters or wetlands on or in the immediate vicinity of the Site.

The Erie Canal was formerly present beneath Erie Boulevard (immediately to the northeast of the Site).

Additional groundwater investigation will be conducted during the remedial investigation, including measuring the depth of groundwater to better calculate the gradient and direction of groundwater flow through the Site (see Section 2.2.1).

1.4 SITE ENVIRONMENTAL HISTORY

1.4.1 Previous Environmental Investigations

The following environmental assessments have occurred at the Site:

1988 – Fuel Oil UST Removal

The earliest documented environmental investigation occurred in 1988 as a result of the discovery of free-phase No. 2 fuel oil within an observation well near two 5,000-gallon fuel oil USTs. Based on the NYSDEC PBS Database (#6-389331), the date of installation of these tanks is reportedly December 1975. As a result of this observation, indicating a potential release, the owner proceeded to have the USTs removed in 1988. At the time of removal approximately 50 tons of contaminated soils were removed and disposed of at Seneca Meadows Landfill. NYSDEC Spill# 88-02056 is associated with this UST removal.

1996 – Subsurface Investigation Report – Theal Environmental Services (TES)

Although NYSDEC repeatedly requested an investigation of the nature and extent of soil and groundwater contamination in the vicinity of the removed fuel oil USTs, no additional investigation was undertaken until 1995 (by TES under a STIP Agreement). The investigation consisted of a soil vapor study, and installation of four (4) soil borings and three (3) monitoring wells.

August 2015 – Phase I Environmental Site Assessment – Bergmann Associates (Bergmann)

Bergmann conducted a Phase I ESA in August 2015. The report identified several Recognized Environmental Conditions (RECs):

- Former Industrial Operations
- Petroleum and Hazardous Materials Storage
- Remaining Soil and Groundwater Contamination
- Adjoining Properties
- Historic Tannery Land Uses
- Solid Waste Disposal
- Radon
- Soil Vapor Encroachment

In addition, AECC's review of Bergman's Phase I ESA report revealed:

- An Inspection Form dated April 8, 2005 stating that the Rome-Turney Radiator Co. was inspected by NYSDEC on March 14 and 21, 2005. The facility was identified as a generator of hazardous waste (lead, acetone, xylene and assorted aerosol cans).
- A Notice of Violation dated April 11, 2005 from Mr. Edward Blackmer, Regional Solid & Hazardous Materials Engineer for NYSDEC Region 6 stating that the Site formerly operated as a Conditionally Exempt Small Quantity Generator (CESQG) and that the facility is closed due to a bankruptcy filing. The letter states that the facility is in violation of 6 NYCRR Part 371.1(c)(7) regarding a characteristic hazardous (lead) dross.

December 2015 – Draft Site Investigation Report – Bergmann

In December 2015, Bergmann performed a site investigation to investigate subsurface conditions near the site of the former fuel oil UST, another suspected gasoline UST grave near Canal Street, and the area located between both former UST locations. The investigation included a geophysical survey, the excavation of eight test pits (TP-1 to TP-8), advancement of eight soil borings (SB-1 to SB-8), and the installation of eight groundwater monitoring wells (MW-1 to MW-8). Based on site observations and laboratory results, Bergmann identified two Areas of Concern (AOCs):

- AOC#1 – Suspect USTs near SB-1/MW-1 and TP-6
- AOC#2 – UST Grave near TP-1, TP-2, and SB-5/MW-5
- *Note – The descriptions of the AOCs in the text of the report are reversed when compared to the referenced TPs and SBs*

2018 – Limited Subsurface Investigation – Asbestos & Environmental Consulting Corporation (AECC)

In September and October 2018, AECC advanced nineteen soil borings across the Site, and installed one temporary groundwater monitoring well adjacent to the former “dipping area” building. The investigation report concluded:

- The Site has an extensive manufacturing/industrial history, which has included the presence of USTs, gasoline and oil houses, transformer yard, and dipping room.
- Two fuel oil USTs were removed from an area adjacent to the buildings in 1988.
- A subsurface investigation was performed in 1996 by TES. The investigation revealed free product and dissolved-phase gasoline and fuel oil in the area where the USTs were removed in 1988. A soil gas survey revealed elevated concentrations of volatile vapors in the central portion of the yard.
- Subsurface investigations were performed in 2015 by Bergmann, and in 2018 by AECC. The investigations revealed:
  - Based on relative groundwater elevations, there may be two (2) separate aquifers present on Site: a shallow aquifer in the central portion of the yard (at MW-1 and MW-5), and a deeper aquifer throughout the Site. However, municipal water lines are in the vicinity of wells MW-1 and MW-5 (confirmed during utility mark-out activities). Furthermore, chemicals associated with municipal water supply (chloroform, dibromochloromethane, and bromodichloromethane) were detected in Site groundwater. Therefore, it is possible that a municipal water line leak is responsible for the shallow aquifer.
  - Laboratory analysis revealed that pesticides, herbicides, PCBs, and chlorinated VOCs are not primary chemicals of concern. However, during the AECC investigation, DDT and DDE

  - were detected at concentrations above Unrestricted SCOs in the one sample analyzed for pesticides.
  - Elevated PID readings exist in the western portion of the Site. The elevated readings correlate to the 1996 soil gas results and the location of known underground utilities.
  - VOC impacts in soils are limited; and SVOC (PAH) and metals impacts are widespread.
  - VOC, SVOC (PAH), and metals impacts in groundwater are widespread.
  - Non-aqueous phase liquid (NAPL) was observed in temporary monitoring well TW-11 (installed by AECC).

Sampling locations, including a summary of laboratory analysis results (cleanup criteria exceedances only), are illustrated in Figures 2A & 2B.

2018 – Limited Hazardous Material Pre-Demolition Survey – AECC

In October 2018, AECC completed a pre-demolition hazardous material survey of buildings located on the Site. The survey was performed in accordance with applicable State and Federal Regulations. The survey report concluded:

- Asbestos-containing materials (ACM) (containing more than 1% asbestos, by regulatory definition) were identified at the Site, including: pipe insulation, floor tile, vermiculite, transite panels, sheetrock/joint compound, electrical components, door/window caulk/glaze, and roofing materials.
- Lead-based paint (LBP) (containing a minimum of 0.5% lead by weight, by regulatory definition) was identified among three (3) specific paint applications at the Site.
- PCB-containing bulk materials (containing at least 50 ppm PCB, by regulatory definition) were not identified among caulk applications identified and tested at the Site.
- Various miscellaneous special / hazardous waste items were identified within the building at the Site, including: fluorescent light bulbs and ballasts, photo flash bulbs/lamps, flood lights, thermostats, elevator oils, insulating oils, cleaning products, solvents / paints / primers, gas cans, and tires.

2019 – Limited Remedial Activities – Barton & Loguidice, P.C.

Under a USEPA grant, in 2019, limited remedial activities were completed in the courtyard area located inside of the site access gates. Two (2) 15,000-gallon USTs were removed from the area adjacent to the western property border. A 10,000-gallon gasoline UST and gasoline house were noted in this area on historical Sanborn fire insurance maps. Contamination remained after excavations reached their designed dimensions. Specifically, staining and elevated PID readings existed in the sidewalls and bottoms, and free product was observed on groundwater. The excavations were advanced to 15-20 feet below grade.

Barton & Loguidice included the following information in their report (excerpts):

> *"To address subsurface petroleum impacts associated with the Former Rome-Turney courtyard area located within the site access gates, remedial efforts to excavate and dispose of petroleum contaminated soil was completed by Paragon Environmental Construction, Inc. during the period between August 13 and August 23, 2019. Two excavation areas were authorized by the City of Rome, resulting in the excavation, transportation, and disposal of 2,879.51 tons of petroleum contaminated soil and*

> *114,535 gallons of petroleum contaminated groundwater. Confirmation soil samples analyzed for TAL metals revealed contaminant impacts in excess of Part 375 Restricted Residential SCOs for cadmium, lead, and mercury, along with persistent detections of copper, iron, nickel, and zinc.*
>
> *The remedial confirmation soil sampling and elevated PID headspace readings indicate potential contamination beyond the bottom of AOC #1 excavation area and to the north, east, and south, and beyond the bottom of AOC #2 excavation area and to the south and west. It is also a potential that an additional underground tank exists due to an observed pipe that was discovered and capped along the western sidewall of AOC #2 excavation area. Further site characterization is recommended, and an easement [assessment] of remedial strategies and clean-up goals may be required. It is likely that further excavation of petroleum contaminated soil will be required under a subsequent remedial cleanup project."*

The excavation pits, sample locations and a summary of laboratory analysis results (cleanup criteria exceedances only), are illustrated in Figures 2A & 2B.

2019-2020 – Asbestos Abatement Project & Air Monitoring Report – AECC

Sullivan Contracting, Inc. and Diversified Construction Services, Inc. performed asbestos abatement activities at the Site in accordance with New York State Department of Labor (NYSDOL)-approved site-specific variance file #19-0987. AECC provided third-party oversight and air sampling services in accordance with applicable State regulations (12 NYCRR Part 56).

2020 – Limited Phase II ESA Report – AECC

In 2020, AECC prepared a Limited Phase II ESA report which detailed the previous investigations and remedial activities that occurred at the Site, including the Limited Subsurface Investigation completed by in 2018.

The locations of collected samples and a summary of laboratory analysis results are illustrated in Figures 2A & 2B.

2021 – Removal of Concrete Slabs / Foundations – AECC

In order to prepare for the execution of future environmental investigations, AECC was retained by the Owner to facilitate the removal of select areas of concrete slabs (see Figure 4). This work occurred in 2020/2021, prior to execution of the BCA.

Prior to the start of on-site activities, AECC collected composite samples from concrete foundations for laboratory analysis (TCLP - RCRA 8 Metals). Laboratory analysis revealed that the slabs/foundations did not contain metals at concentrations above RCRA (40 CFR Part 261) regulatory levels.

The portions of concrete slabs that are located above areas of environmental concern (former dipping room, etc.) were left in place. The portions of slabs that were not located above areas of environmental concern were subsequently removed and crushed by a qualified sub-contractor. AECC observed the removals to verify that soils beneath the removed slabs did not exhibit evidence of contamination (none was observed). The crushed material has since been staged into piles located in the southern portion of the Site, and will be eventually used as clean backfill on-Site and/or transported/re-used off-site in accordance with NYSDEC Part 360 regulations.

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 subject site. The previous assessments and investigations conducted by AECC and others 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, including among areas that have been previously inaccessible, to further assess the potential for off-site migration of constituents from the Site, and to obtain additional data of sufficient quantity and quality to complete a remedial alternatives analysis assessment.

See the Section 3.0 – Field Sampling Plan for additional details.

2.1 GENERAL PROTOCOLS

2.1.1 Site Preparation

The Site is currently secured by chain-link fencing around the perimeter. Lockable gates allow access from Canal Street on the southwestern portion of the Site. Fencing will remain in place for the duration of RI activities.

Once the proposed sample locations are accepted by NYSDEC, the coordinates of each location will be determined and marked in the field using a handheld GPS unit.

2.1.2 Soil Screening Methods

Visual, olfactory, and instrument-based soil screening will be performed by a qualified 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;
- 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) will be handled, transported and disposed of in accordance with applicable local, State, and Federal regulations.

Storage

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

- Soil stockpiles will be continuously encircled with a berm and/or silt fence.
- Stockpiles will always be kept covered using appropriately anchored tarps. Stockpiles will be routinely inspected, and damaged tarp covers will be replaced.

- At a minimum, stockpiles will be inspected once a week and after every storm event. Results of inspections will be recorded in the project logbook, which shall be maintained by the Environmental Consultant and available for inspection by NYSDEC.

Materials Re-Use

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

Soils Management

Soils excavated from test pits that show no obvious signs of contamination are to be placed back in the associated excavation. Excavated soils exhibiting nuisance characteristics (strong odors, staining, etc.) will be separated and staged on-site for subsequent characterization and off-site disposal.

Spoils generated during well installation will be segregated into “clean” and “contaminated” piles or drums. The contaminated spoils will be characterized for off-site disposal. The “clean” soils will be characterized and either re-used on-site, or disposed off-site.

Fluids Management

All liquids generated during the investigation, including excavation dewatering and groundwater monitoring well purge and development waters, will be observed for nuisance characteristics (strong odors, sheens, etc.). Liquids will be segregated into “clean” and “contaminated” containers (drums, frac tanks, etc.) for subsequent characterization.

If characterization of “clean” dewatering, purge and well development fluids does not reveal exceedances of TOGS 1.1.1 effluent water quality standards, and prior authorization is obtained by the NYSDEC, the “clean” fluids may be discharged to the ground at a controlled flow rate.

2.1.4 Stormwater Pollution Prevention

Although the total site is 1.40 acres in size, the area being disturbed during the Remedial Investigation will not exceed 1 acre in size. Therefore, a Storm Water Pollution Prevention Plan (SWPPP) that conforms to the requirements of NYSDEC Division of Water guidelines and NYS regulations is not required. However, the following “Best Management Practices” will be utilized 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 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 damaged silt fencing caused by weathering.
- Erosion and sediment control measures shall be followed to ensure that they are operating correctly. Any discharge locations or accessible points shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

2.1.5 Contingency Plans

If underground tanks or other previously unidentified contamination are found during the investigation, investigation activities in the area will be suspended until appropriate equipment is mobilized to the

Site. If deemed appropriate, an Interim Remedial Measure (IRM) Work Plan will be prepared for NYSDEC / NYSDOH authorization.

Sampling will be performed on product/contents, surrounding soils, groundwater, 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, PCBs, PFAS), unless the assumed nature of the contamination (i.e. fuel oil tank) is enough 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 contamination during invasive site work will be promptly reported to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. If applicable, these findings will also be summarized in the Remedial Investigation report.

2.1.6 Odor Control Plan

Nuisance odors that may arise as a result of remedial investigation activities will be managed to the maximum extent feasible. The following methods and control measures will be utilized:

- limiting the area of open excavations (test pits) and size of soil stockpiles;
- covering odorous soils with polyethylene sheeting or similar tarp/cover;
- shrouding open excavations with tarps and other covers; and,
- using foams to cover exposed odorous soils.

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 nuisance odors have been abated to an acceptable level. The NYSDEC and NYSDOH will be notified of odor events and other complaints received during the remedial investigation. If additional measures are implemented, they will be documented in the Remedial Investigation report.

If it becomes necessary, additional intensive odor-fighting measures may be applied. These measures include:

- direct load-out of soils to trucks for off-site disposal;
- use of chemical odorants in spray or misting systems; and,
- 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.

2.1.7 Dust Control Plan

Based on the nature of the proposed work, we do not anticipate that Remedial Investigation activities will generate dust that requires suppression. However, should on-site conditions dictate otherwise, the following dust mitigation provisions will be implemented:

- Dust suppression will be achieved via fire hose or on-site water truck. Either will be capable of spraying water directly onto off-road areas including excavations (test pits) and stockpiles.
- 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 areas where dust control measures will need to be implemented.

2.1.8 Noise

The contractor shall ensure compliance with local noise control ordinances.

2.2 REMEDIAL INVESTIGATION (RI) ACTIVITIES

2.2.1 On-Site Comprehensive Soil and Groundwater Investigation

The purpose of the “comprehensive” soil and groundwater investigation is to further determine the extent of contamination at the Site.

To this end, a total of 17 test pits will be advanced throughout the Site (see Figure 3A and Table 1), up to 3 feet below the groundwater interface (groundwater was typically observed at 7-8 feet below grade), or approximately 10 feet below grade, whichever is first encountered . Eight groundwater wells will be installed next to the corresponding test pit for groundwater sampling purposes and 4 pre-existing (installed in 2015) groundwater monitoring wells will be sampled (see Figure3B and Table 1).

Soil and groundwater samples will be collected from the following locations:

Test Pit / Well Identification	Analysis (see Table 1 for more detail)	Reason for Investigation & Sampling
MW-3 (Pre-existing Well)	Groundwater VOCs, SVOCs, metals, PCBs, pesticides, and herbicides,1,4-Dioxane, and PFAS	MW-3 was installed and sampled in 2015 and found to remain in a usable condition in 2018. MW-3 is situated near the west-northern perimeter of the Site, approximately 30’ from the limits of 2019 excavation activities that encountered contaminated groundwater. If the well remains in a usable condition it will be sampled for the parameters identified. If unusable, a new monitoring well will be installed at this location so that sampling can occur.
MW-4 (Pre-existing Well)	Groundwater VOCs, SVOCs, metals, PCBs, pesticides, and herbicides	MW-4 was installed and sampled in 2015 and found to remain in a usable condition in 2018. MW-4 is situated near the west-central perimeter of the Site, approximately 20’ from the limits of 2019 excavation activities that encountered contaminated groundwater. If the well remains in a usable condition it will be sampled for the parameters identified. If unusable, a new monitoring well will be installed at this location so that sampling can occur.

Test Pit / Well Identification	Analysis (see Table 1 for more detail)	Reason for Investigation & Sampling
MW-6 (Pre-existing Well)	Groundwater VOCs, SVOCs, metals, PCBs, pesticides, and herbicides	MW-6 was installed and sampled in 2015 and found to remain in a usable condition in 2018. MW-6 is situated at the southern corner of the Site and is in a strategically important location for the purposes of determining overall groundwater flow direction at the Site and for providing useful groundwater quality information in this area of the Site. If the well remains in a usable condition it will be sampled for the parameters identified. If unusable, a new monitoring well will be installed at this location so that sampling can occur.
MW-7 (Pre-existing Well)	Groundwater VOCs, SVOCs, metals, PCBs, pesticides, and herbicides,1,4-Dioxane, and PFAS	MW-7 was installed and sampled in 2015 and found to remain in a usable condition in 2018. MW-7 is situated near the eastern perimeter of the Site and is in a strategically important location for the purposes of determining overall groundwater flow direction at the Site and for providing useful groundwater quality information in this area of the Site. If the well remains in a usable condition it will be sampled for the parameters identified. If unusable, a new monitoring well will be installed at this location so that sampling can occur.
TP-9 MW-12	Soil & Groundwater VOCs, SVOCs, metals, PCBs, pesticides, herbicides	TP-9 is situated near the southwestern perimeter of the Site, approximately 5' from the limits of 2019 excavation activities that encountered contaminated groundwater, and approximately 10' from the former location of the 15,000-gallon USTs that were removed in 2019. TP-9 is also near a previous soil boring (SB-17, sampled in 2018) that exhibited contamination. Based on previous investigation data, it is estimated that groundwater at this location is hydraulically upgradient of the remainder of the Site. Soil and groundwater samples will be collected for the parameters identified. MW-12 will be advanced next to the TP-9 for the collection of groundwater samples and to further assess the groundwater flow throughout the Site.
TP-10	Soil VOCs, SVOCs, metals, PCBs, pesticides, and herbicides	A test pit will be advanced to further assess the unknown underground pipe that was discovered during the UST removal activities that occurred in 2019 (the pipe was cut and capped at that time). Soil from directly beneath the pipe (biased to location(s) where field screening / observation suggest possible contamination) will be sampled to determine if the pipe represents a point source of contamination at the Site, for the parameters identified.

Test Pit / Well Identification	Analysis (see Table 1 for more detail)	Reason for Investigation & Sampling
TP-11	Soil VOCs, SVOCs, metals, PCBs, pesticides, and herbicides	TP-11 is located along the western limits of the Site, within 10' of MW-4, and near the limits of the 2019 excavation activities. TP-11 will be used to further assess the subsurface conditions of the Sites soils along the western limits of the Site.
TP-12	Soil VOCs, SVOCs, metals, PCBs,1,4-Dioxane, and PFAS	TP-12 is located in the center of the courtyard area on the western portion of the Site, within 30' of MW-3, and near the limits of the 2019 excavation activities. TP-12 will be used to further assess the subsurface conditions of the Sites soils for the Sites western portion.
TP-13 MW-13	Soil VOCs, SVOCs, metals, and PCBs Groundwater VOCs, SVOCs, metals, PCBs, pesticides, and herbicides	TP-13 is located at the northwestern corner of the Site, the test pit will be used to further assess the subsurface conditions below the former buildings slab. MW-13 will be advanced next to TP-13 for the collection of groundwater samples and to further assess the groundwater flow throughout the Site.
TP-14 MW-14	Soil VOCs, SVOCs, metals, and PCBs Groundwater VOCs, SVOCs, metals, PCBs, pesticides, and herbicides	TP-14 is being advanced for several reasons: • It is located near the northern perimeter of the Site • It is located beneath the former building slab, in an area of the building formerly used as "Machine Shop" • It is in an area that was formerly not accessible and has not been previously investigated MW-14 will be advanced next to TP-14 for the collection of groundwater samples and to further assess the groundwater flow throughout the Site. Soil samples for VOCs, SVOCs, metals, and PCBs analysis will be collected from this location. Pesticides and Herbicides will not be collected from soils at this location since it is located beneath the former building foundation / slab.

Test Pit / Well Identification	**Analysis** **(see Table 1 for more detail)**	**Reason for Investigation & Sampling**
TP-15 MW-15	Soil VOCs, SVOCs, metals, and PCBs Groundwater VOCs, SVOCs, metals, PCBs, pesticides, and herbicides	TP-15 is being advanced for several reasons: • It is in an area that was formerly not accessible and has not been recently investigated; • It is located beneath the former building slab and was previously not accessible; • It is located within the area of a former UST that is possibly still in place. MW-15 will be advanced next to TP-15 for the collection of groundwater samples and to further assess the groundwater flow throughout the Site. Soil samples for VOCs, SVOCs, metals, and PCBs analysis will be collected from this location. Pesticides and Herbicides will not be collected from soils at this location since it is located beneath the former building foundation / slab.
TP-16	Soil VOCs, SVOCs, metals, and PCBs	TP-16 is being advanced for several reasons: • It is located near the northeast-central portion of the Site; • It is located beneath the former building slab, in an area of the building formerly used as “Production Area”; • It is in an area that was formerly not accessible and has not been previously investigated; and, • It is near previous soil borings (SB-18 and SB-36) that exhibited contamination. Soil samples for VOCs, SVOCs, metals, and PCBs analysis will be collected from this location. Pesticides and Herbicides will not be collected from this location since it is located beneath the former building foundation / slab.
TP-17	Soil VOCs, SVOCs, metals, PCBs, 1,4-Dioxane, and PFAS	TP-17 is being advanced for several reasons: • It is located near the southeast-central portion of the Site; • It is located beneath the former building slab, in an area of the building formerly used as “Production Area”; • It is in an area that was formerly not accessible and has not been previously investigated; and, • It is near previous soil borings (SB-7) that exhibited contamination. Soil samples for VOCs, SVOCs, metals, PCBs, and Emerging Contaminants analysis will be collected from this location. Pesticides and Herbicides will not be collected from this location since it is located beneath the former building foundation / slab.

Test Pit / Well Identification	Analysis (see Table 1 for more detail)	Reason for Investigation & Sampling
TP-18 MW-19	Soil VOCs, SVOCs, metals, and PCBs Groundwater VOCs, SVOCs, metals, PCBs, pesticides, and herbicides	TP-18 is being advanced for several reasons: • It is located near the southern perimeter of the Site; • It is located beneath the former building slab; and, • It is in an area that was formerly not accessible and has not been previously investigated. Soil samples for VOCs, SVOCs, metals, and PCBs analysis will be collected from this location. Pesticides and Herbicides will not be collected from soils at this location since it is located beneath the former building foundation / slab.
TP-19 MW-16	Soil VOCs, SVOCs, metals, and PCBs Groundwater VOCs, SVOCs, metals, PCBs, pesticides, and herbicides	TP-19 is being advanced for several reasons: • It is located near the center of the Site, and near the center of the former building; • It is located beneath the former building slab, in an area of the building formerly used as “Production Area”; • It is in an area that was formerly not accessible and has not been previously investigated; and, • It is located in an area that is estimated to be hydraulically cross-gradient or downgradient of 2019 excavation activities that encountered contamination. MW-16 will be advanced next to TP-19 for the collection of groundwater samples and to further assess the groundwater flow throughout the Site. Soil and groundwater samples for VOCs, SVOCs, metals, and PCBs analysis will be collected from this location. Pesticides and Herbicides will not be collected from soils at this location since it is located beneath the former building foundation / slab.
TP-20	Soil VOCs, SVOCs, metals, and PCBs	TP-20 is being advanced for several reasons: • It is located near the east-central portion of the Site; • It is located beneath the former building slab, in an area that formerly supported a “Dipping” Building (1914 Sanborn Map) and “hazardous material storage”; • It is in an area that was formerly not accessible and has not been previously investigated; and, Soil samples for VOCs, SVOCs, metals, and PCBs analysis will be collected from this location. Pesticides and Herbicides will not be collected from this location since it is located beneath the former building foundation / slab.

Test Pit / Well Identification	**Analysis** **(see Table 1 for more detail)**	**Reason for Investigation & Sampling**
TP-21	Soil VOCs, SVOCs, metals, and PCBs	TP-21 is being advanced for several reasons: • It is located beneath the former building slab, in an area of the building formerly used as "Shipping/Receiving"; • It is in an area that was formerly not accessible and has not been previously investigated; and, • It is located approximately 20' from the limits of 2019 excavation activities that encountered free product. Soil samples for VOCs, SVOCs, metals, and PCBs analysis will be collected from this location. Pesticides and Herbicides will not be collected from this location since it is located beneath the former building foundation / slab. This test pit will be extended (as a trench) to the former (2019) excavation limits to investigate the nature and extent of the free product noted during prior remedial actions.
TP-22 MW-18	Soil & Groundwater VOCs, SVOCs, metals, PCBs, pesticides, and herbicides	TP-22 is situated near the center of the Site, immediately adjacent to the limits of 2019 excavation activities that encountered contaminated groundwater. TP-22 is also near previous soil borings and monitoring wells (SB-14, SB-34, TW-11) that exhibited contamination. MW-18 will be advanced next to TP-22 for the collection of groundwater samples and to further assess the groundwater flow throughout the Site. This test pit will be extended outwards (as a trench) from the former (2019) excavation limits to investigate the nature and extent of the free product noted during prior remedial actions.

Test Pit / Well Identification	Analysis (see Table 1 for more detail)	Reason for Investigation & Sampling
TP-23 MW-17	<u>Soil</u> VOCs, SVOCs, metals, and PCBs <u>Groundwater</u> VOCs, SVOCs, metals, PCBs, pesticides, and herbicides	TP-23 is being advanced for several reasons: • It is located near the center norther portion of the Site; • It is located beneath the former building slab, in an area of the building formerly used as "Hazardous Material Storage"; • It is in an area that was formerly not accessible and has not been previously investigated; • It is located approximately 10-15' from the limits of 2019 excavation activities that encountered contamination; and, • It is located approximately 15-20' from the location of former USTs that were removed from the Site in 1988 (where contamination was documented at that time). MW-17 will be advanced next to TP-23 for the collection of groundwater samples and to further assess the groundwater flow throughout the Site. Soil and groundwater samples for VOCs, SVOCs, metals, and PCBs analysis will be collected from this location. Pesticides and Herbicides will not be collected from soils at this location since it is located beneath the former building foundation / slab.
TP-24	<u>Soil</u> VOCs, SVOCs, metals, PCBs, pesticides, and herbicides	TP-24 will be advanced along the southern limits of the Site, to further assess the subsurface conditions below the former building slab which was previously not accessible or assessed.
TP-25	<u>Soil</u> VOCs and SVOCs	TP-25 will be advanced to further assess the subsurface conditions in the vicinity of two former fuel oil USTs.

Soil samples will be collected at the following depth(s) for surface soil, shallow soil, and soils at depth from each sample location:

- Surface samples will be collected with the general methodology below:
  - Immediately beneath the existing concrete slab/foundation (where applicable)
  - VOCs: 0-2" beneath existing ground level where no concrete slab/foundation is present
  - SVOCs and inorganics: 2-6" beneath existing ground level where no concrete slab/foundation is present
- Shallow soil samples will be collected with the general methodology below:
  - Collected approximately 1-5' beneath existing ground level / surface (above the expected groundwater smear zone)
  - Collected from areas emitting elevated PID readings, odors, and/or visibly impacted
- Deep soil sampled will be collected with the general methodology below:

  - At / near the groundwater interface (estimated 6-8' beneath existing ground level / surface)
  - Collected from areas emitting elevated PID readings, odors, and/or visibly impacted

One groundwater sample will be collected from each groundwater well for the analyses. The presumed hydraulically upgradient and downgradient wells (MW-7 and MW-3, respectively) will be sampled for emergent contaminants (1,4-Dioxane and PFAS).

NOTE: It may become necessary to alter the location of test pits, and/or monitoring well installations based on field observations, site conditions, and/or other unforeseen circumstances. Similarly, the suite of analytical parameters to be investigated may also be subject to change. If significant relocation or changes to sampling parameters occur, the NYSDEC Project Manager will be notified and provided with the changes and the justification for the decisions. Deviations from the approved RIWP will be documented in the Site Log and RI Report.

Where sampling and analysis of soils and/or groundwater reveals contamination at concentrations above applicable standards (Part 375 Unrestricted Use standards and/or Part 375 Restricted-Residential Use standards for soils, and TOGS 1.1.1 standards/guidelines for groundwater), Rome Turney, LLC and the NYSDEC will discuss whether additional investigation is necessary, and if so, negotiate a supplemental sampling plan. For example, if contaminants commonly associated with dense non-aqueous phase liquid (DNAPL) plumes (ex: chlorinated solvents) are detected in shallow groundwater at concentrations above applicable TOGS 1.1.1 standards, the supplemental sampling plan could include the installation and sampling of deep wells. Deep groundwater depths would be measured (and flow direction determined) if deep groundwater wells are installed.

Note that if the results of the comprehensive sampling and analysis identify additional concerns, AECC and Rome Turney, LLC will consult with the NYSDEC to determine potential additions to the scope proposed herein.

2.2.2 Soil Vapor Evaluation

If the comprehensive sampling and analysis described above identifies elevated concentrations of VOCs as a potential concern for the Site, AECC will consult with the NYSDEC to determine future actions. The VOC contamination will be addressed as part of the Remedial Action and/or Site Management Plan and could include either removal of contaminated soils / groundwater to extent feasible to reduce vapor concentrations and/or the installation of a vapor intrusion mitigation system for any buildings constructed on the Site.

2.2.3 Off-Site Investigation Activities

No off-site investigation activities are currently planned as part of the RI. However, as a Volunteer in the Brownfield Cleanup Program, the applicant is required to fully investigate and characterize the nature and extent of contamination that has migrated or emanated from the site to off-site locations per 6 NYCRR Part 375- 3.8(b)(2)(ii). For example, if any of the proposed test pits located near the site boundary lines identify soils meeting DEC's "grossly contaminated" definition (6 NYCRR Part 375-1.2 (u)) or if the associated soil sample analysis indicates concentrations above the applicable soil cleanup objectives, sufficient data may be required to perform a qualitative exposure assessment of the contamination that has migrated from the site in accordance with ECL 27-1415(2)(b) and Department guidance. In such a case, Rome Turney, LLC and the NYSDEC will discuss whether additional investigation is necessary, and if so, negotiate a off-site sampling plan.

2.3 QUALITATIVE HEALTH EXPOSURE / RISK ASSESSMENT

To assess potential site impacts on human health and the environment, a qualitative human health exposure assessment will be completed. The assessment will include five elements associated with exposure pathways, including:

- a description of the contaminant source(s) including the location of the contaminant release to the environment (any waste disposal area or point of discharge) or if the original source is unknown, the contaminated environmental medium (soil, indoor or outdoor air, water) at the point of exposure;
- an explanation of the contaminant release and transport mechanisms to the exposed population;
- identification of all potential exposure point(s) where actual or potential human contact with a contamination may occur;
- description(s) of the route(s) of exposure (i.e., ingestion, inhalation, dermal absorption); and,
- a characterization of the receptor populations who may be exposed to contaminants at a point of exposure.

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 is accurate and defensible.

2.5 REPORT PREPARATION

Upon the completion of the RI activities and following receipt of laboratory analysis, AECC will prepare the RI Report. The report will summarize RI field activities and laboratory analyses results. The RI report will identify or otherwise address the amount, concentration, persistence, mobility, state, and other relevant characteristics of the contaminants identified at the site (see also, Section 4.0 – Reporting). Electronic data deliverables (EDDs) for each report will also be submitted in EQuIS format.

2.6 PROJECT SCHEDULE

Rome Turney, LLC proposes the following project schedule. Note that due to the iterative nature of the investigation work and the required coordination between State and Federal agencies, additional time to obtain approvals and complete each phase of the field work may be necessary. In such a case, Rome Turney, LLC will inform the NYSDEC of the impact to the project schedule.

Incorporate DEC Comments to Final RIWP	November 2021
DEC Approval of Remedial Investigation Work Plan	November 2021
Begin Investigation Field Work	November 2021
Complete Investigation Field Work	December 2021
Laboratory Results / DUSR	January 2021
Submit Draft Remedial Investigation Report	**February 2022**
Significant Threat Determination / Fact Sheet	February 2022
Incorporate DEC Comments to Final RI Report	March 2022
DEC Approval of Remedial Investigation Report	March 2022

Submit Draft Remedial Action Work Plan (w/ Alternatives Analysis)	**March 2022**
End 45 Day Comment Period	April 2022
Incorporate DEC Comments into Final RAWP	April 2022
DEC Approval of Remedial Action Work Plan	April 2022
Submit Fact Sheet Announcing Start of Construction	May 2022
Begin Remediation	**May 2022**
Begin Construction	**June 2022**
Submit Draft Environmental Easement Package	June 2022
Submit Draft Site Management Plan	**July 2022**
Submit Executed Environmental Easement Package	August 2022
Incorporate DEC Comments into SMP	August 2022
DEC Approval of Site Management Plan	August 2022
Environmental Easement Recorded	September 2022
Complete Remediation	**September 2022**
Submit Draft Final Engineering Report	**October 2022**
Incorporate DEC Comments into FER	November 2022
DEC Approval of Draft Final Engineering Report	November 2022
Submit Fact Sheet Announcing Final Engineering Report	November 2022
Certificate of Completion	**December 2022**
Fact Sheet Describing Institutional/Engineering Controls	January 2023
Complete Construction	**May 2023**

3.0 SAMPLIING AND ANALYSIS PLAN

The Sampling and Analysis Plan documents the sampling procedures and methods that will be used during the collection of soil and groundwater on the project, the procedures and methods utilized by the laboratory, and Quality Assurance / Quality Control (QA/QC) procedures that will ensure the accuracy and precision of data collected during the project.

RI activities will be documented by on-site personnel each day using a Daily Site Log form. The form will include, at a minimum: personnel on-site, dates and times, weather conditions, location(s) of activities, and activity description (soil sampling, well installation, etc.). Sampling log forms will be used for Test Pit advancement and groundwater well installation and sampling. Photographs will also be taken by on-site personnel to supplement daily logbook entries.

3.1 FIELD SAMPLING PLAN

As described in Section 2.2, RI activities will include the advancement of test pits, for the collection of soil samples and installation of monitoring wells for groundwater sampling.

Sample locations will be demarcated using wooden or metal stakes and flags (in soil), or spray paint (on asphalt or concrete) and clearly labeled. A GPS will be used to document locations of each test pit and groundwater monitoring well. Locations will be marked on a sampling plan figure similar to Figures 3 A/B.

3.1.1 Sampling Objectives

Field sampling at the site will be designed to obtain representative samples of environmental media to assess the potential impact on human health and the environment. The field sampling plan will include media sampling for groundwater, surface soils, and subsurface soils. Note that no soil vapor samples will be collected during the investigation as soil vapor concerns will be addressed through the installation of Vapor Intrusion Mitigation Systems within future Site buildings. The goal of the investigation is to establish the nature and extent of contamination present at the site.

3.1.2 Standard Operating Procedures

Soil sampling at the site will be conducted in accordance with the following standard operating procedures (SOPs) presented within Appendix A:

SOP #101:	Surface and Shallow Soil Sampling
SOP #102:	Environmental Sample Handling, Packaging, and Shipping
SOP #103:	Equipment Decontamination
SOP #106:	Groundwater Sampling
SOP #107:	Monitoring Well Construction, Installation, and Development
SOP #108:	Environmental Sample Labeling and Chain of Custody Completion
SOP #110:	Field Monitoring Equipment Calibration
SOP #116:	Core Drilling
SOP #117:	Saw Cutting
SOP #118:	Test Pit Soil Sampling

3.1.3 Sample Identification

Soil and groundwater samples will be identified and labeled. Each label shall include the site name, the sample location, and the sampling time and date. The following alphanumeric system will be utilized to identify each sample and will correspond to sample locations to identified on a field-generated sampling diagrams:

Sample Type +	Location No. +	Depth(s) =	Example Sample I.D
Soil – Surface Soil	SS-01, 02…	N/A	SS-01
Soil – Test Pit	TP-01, 02…	(# - #’)	TP-01 (5-6’)
Soil – Boring	SB-01, 02…	(# - #’)	SB-01 (3-4’)
Groundwater	MW-01, 02…	N/A	MW-01
Blind Duplicate	TP, MW, etc…	N/A	TP-D1, TP-D2, MW-D1…

3.2 QUALITY ASSURANCE PROJECT PLAN

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 REPORTING

4.1 REMEDIAL INVESTIGATION REPORT

After the RI fieldwork has been completed, a comprehensive RI report will be generated. The RI report will be consistent with the NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation, and will include the following:

- Introduction and project background;
- Site description;
- Description of field procedures and methods employed;
- Discussion of the nature and rationale for any significant deviations from the RI Work Plan;
- Summary of data collected, including a comparison to applicable cleanup criteria and DUSR summary;
- Evaluation of environmental impacts to media being investigated (soil and groundwater);
- Conclusions of the qualitative health exposure assessment; and
- Supporting materials (i.e. site plans, boring logs, monitoring well construction details / as-builts, laboratory reports, etc.).

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

4.2 REMEDIATION ALTERNATIVES ANALYSIS ASSESSMENT

Based on the results of the RI, a remediation alternatives and analysis assessment will be prepared. The Alternatives Analysis Assessment will include a list of remedial action objectives, based on the findings of the RI, Agency input, public comment, and will include consideration of the following:

- Overall protection of human health and the environment
- Compliance with applicable Cleanup Standards, Criteria, and Guidance
- Short-term and long-term effectiveness
- Implement ability / Feasibility
- Cost effectiveness

At this time, it is anticipated that the Alternatives Analysis Assessment will be included within the Remedial Action Work Plan.

5.0 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 while performing work at the Site. The HASP includes an Emergency Response Plan, which presents the procedures to be followed in the event of an emergency.

The site-specific Health and Safety Plan is presented in this report 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 stop 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 (test-pitting). CAMP monitoring is not required for this project when using hand tools for shallow soil sampling or during groundwater sampling activities (provided that such activities do 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 in this report 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

Table 1: Sample and Analysis Summary

Table 1: Sample and Analysis Summary

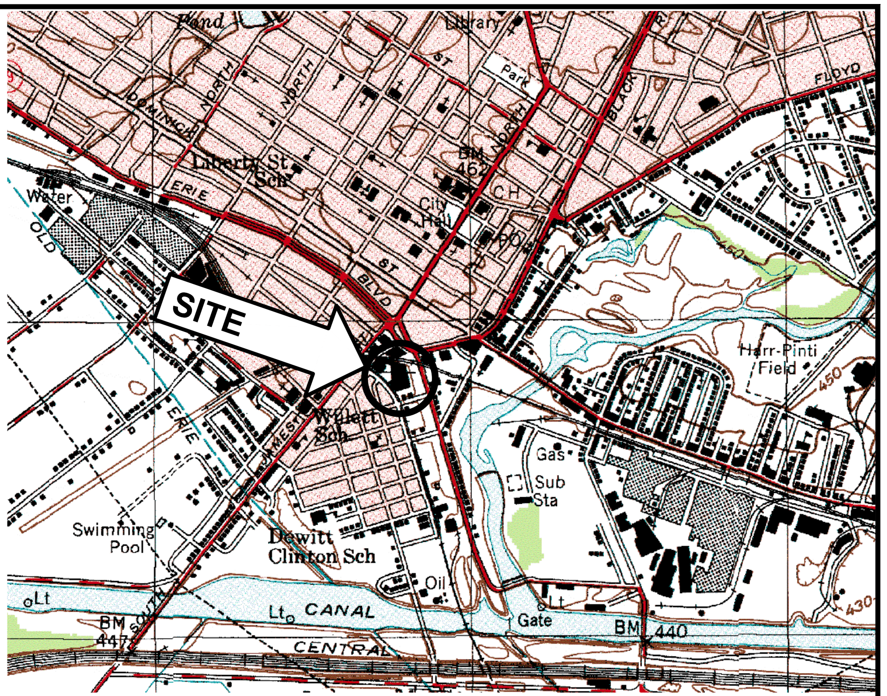
Boring/Well Location	Sampled Media	Analysis							
		TCL VOCs	TCL SVOCs	TAL Metals	TCL PCBs	TCL Pesticides	TCL Herbicides	1,4-Dioxane	PFAS
TP-9 MW-12	Surface Soil	X	X	X	X	X	X		
	Shallow Soil	X	X	X	X	X	X		
	Deep Soil	X	X	X	X	X	X		
	Groundwater	X	X	X	X	X	X		
TP-10	Surface Soil	X	X	X	X	X	X		
	Shallow Soil	X	X	X	X	X	X		
	Deep Soil	X	X	X	X	X	X		
TP-11	Surface Soil	X	X	X	X	X	X		
	Shallow Soil	X	X	X	X	X	X		
	Deep Soil	X	X	X	X	X	X		
TP-12	Surface Soil	X	X	X	X	X	X	X	X
	Shallow Soil	X	X	X	X	X	X	X	X
	Deep Soil	X	X	X	X	X	X	X	X
TP-13 MW-13	Surface Soil	X	X	X	X				
	Shallow Soil	X	X	X	X				
	Deep Soil	X	X	X	X				
	Groundwater	X	X	X	X	X	X		
TP-14 MW-14	Surface Soil	X	X	X	X				
	Shallow Soil	X	X	X	X				
	Deep Soil	X	X	X	X				
	Groundwater	X	X	X	X	X	X		
TP-15 MW-15	Surface Soil	X	X	X	X				
	Shallow Soil	X	X	X	X				
	Deep Soil	X	X	X	X				
	Groundwater	X	X	X	X	X	X		
TP-16	Surface Soil	X	X	X	X				
	Shallow Soil	X	X	X	X				
	Deep Soil	X	X	X	X				
TP-17	Surface Soil	X	X	X	X			X	X
	Shallow Soil	X	X	X	X			X	X
	Deep Soil	X	X	X	X			X	X
TP-18 MW-19	Surface Soil	X	X	X	X				
	Shallow Soil	X	X	X	X				
	Deep Soil	X	X	X	X				
	Groundwater	X	X	X	X	X	X		
TP-19 MW-16	Surface Soil	X	X	X	X				
	Shallow Soil	X	X	X	X				
	Deep Soil	X	X	X	X				
	Groundwater	X	X	X	X	X	X		

Table 1: Sample and Analysis Summary

TP-20	Surface Soil	X	X	X	X				
	Shallow Soil	X	X	X	X				
	Deep Soil	X	X	X	X				
TP-21	Surface Soil	X	X	X	X				
	Shallow Soil	X	X	X	X				
	Deep Soil	X	X	X	X				
TP-22 MW-18	Surface Soil	X	X	X	X	X	X		
	Shallow Soil	X	X	X	X	X	X		
	Deep Soil	X	X	X	X	X	X		
	Groundwater	X	X	X	X	X	X		
TP-23 MW-17	Surface Soil	X	X	X	X				
	Shallow Soil	X	X	X	X				
	Deep Soil	X	X	X	X				
	Groundwater	X	X	X	X	X	X		
TP-24	Surface Soil	X	X	X	X				
	Shallow Soil	X	X	X	X				
	Deep Soil	X	X	X	X				
TP-25	Surface Soil	X	X	X	X	X	X		
	Shallow Soil	X	X	X	X	X	X		
	Deep Soil	X	X	X	X	X	X		
MW-3 (pre-existing)	Groundwater	X	X	X	X	X	X	X	X
MW-4 (pre-existing)	Groundwater	X	X	X	X	X	X		
MW-6 (pre-existing)	Groundwater	X	X	X	X	X	X		
MW-7 (pre-existing)	Groundwater	X	X	X	X	X	X	X	X

- 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



SITE LOCATION

LEGEND:

—— – – —— APPROXIMATE PROPERTY LINE (BROWNFIELD AREA EXTENT)

NOTES:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH WEBSITE(OCTOBER, 2017).
2. APPROXIMATE PROPERTY LINE BASED ON GISCLOUD WEBSITE.
3. ALL LOCATIONS ARE APPROXIMATE.

0 40' 80'
GRAPHIC SCALE

AECC
ENVIRONMENTAL CONSULTING
Asbestos & Environmental
Consulting Corporation

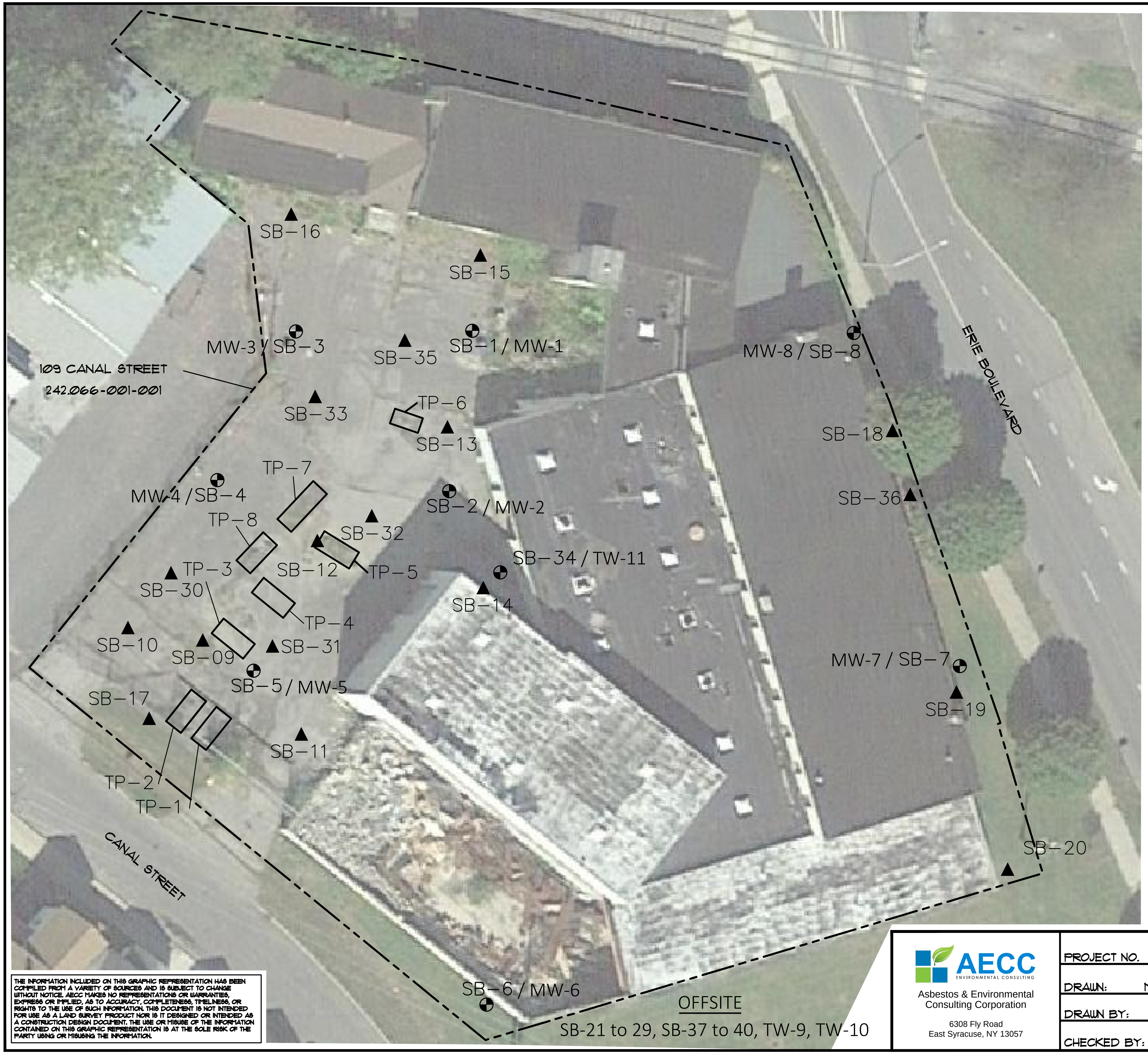
6308 Fly Road
East Syracuse, NY 13057

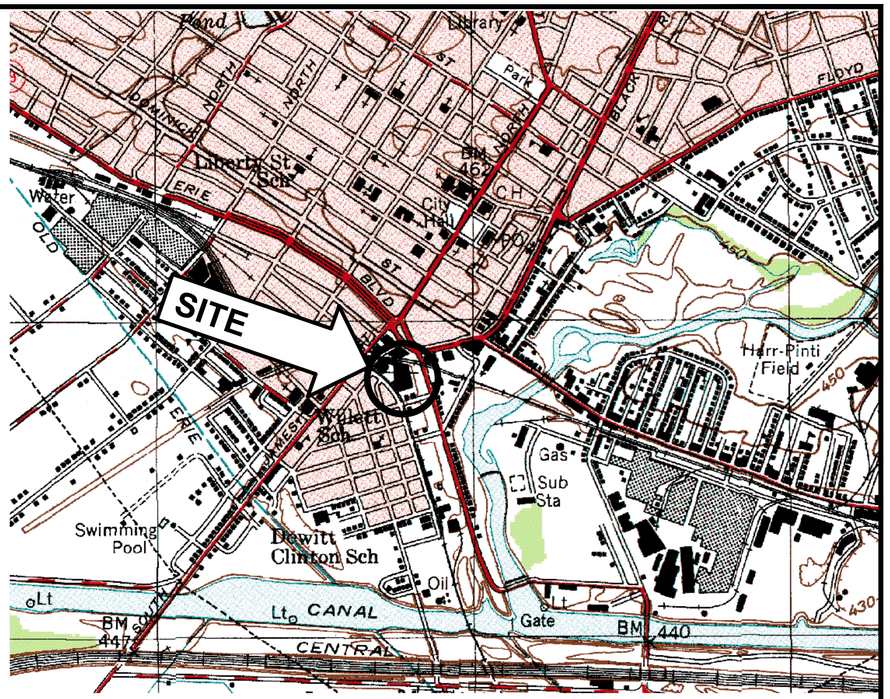
PROJECT NO. 20-037
DRAWN: JULY 2020
DRAWN BY: NP
CHECKED BY: DB

SITE AND LOCATION PLAN

THE FORMER ROME TURNEY DEVELOPMENT SITE
109 CANAL STREET
CITY OF ROME, NEW YORK 13440

FIGURE
1A





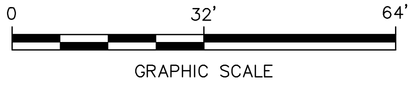
SITE LOCATION

LEGEND:

— — —	PROPERTY LINE
▲	SOIL BORING LOCATION
◒	SOIL BORING WITH INSTALLED MONITORING WELL
▭	TEST PIT LOCATION

NOTES:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH WEBSITE.
2. APPROXIMATE PROPERTY LINE BASED ON GISCLOUD WEBSITE.
3. ALL LOCATIONS ARE APPROXIMATE.



AECC
ENVIRONMENTAL CONSULTING
Asbestos & Environmental
Consulting Corporation

6308 Fly Road
East Syracuse, NY 13057

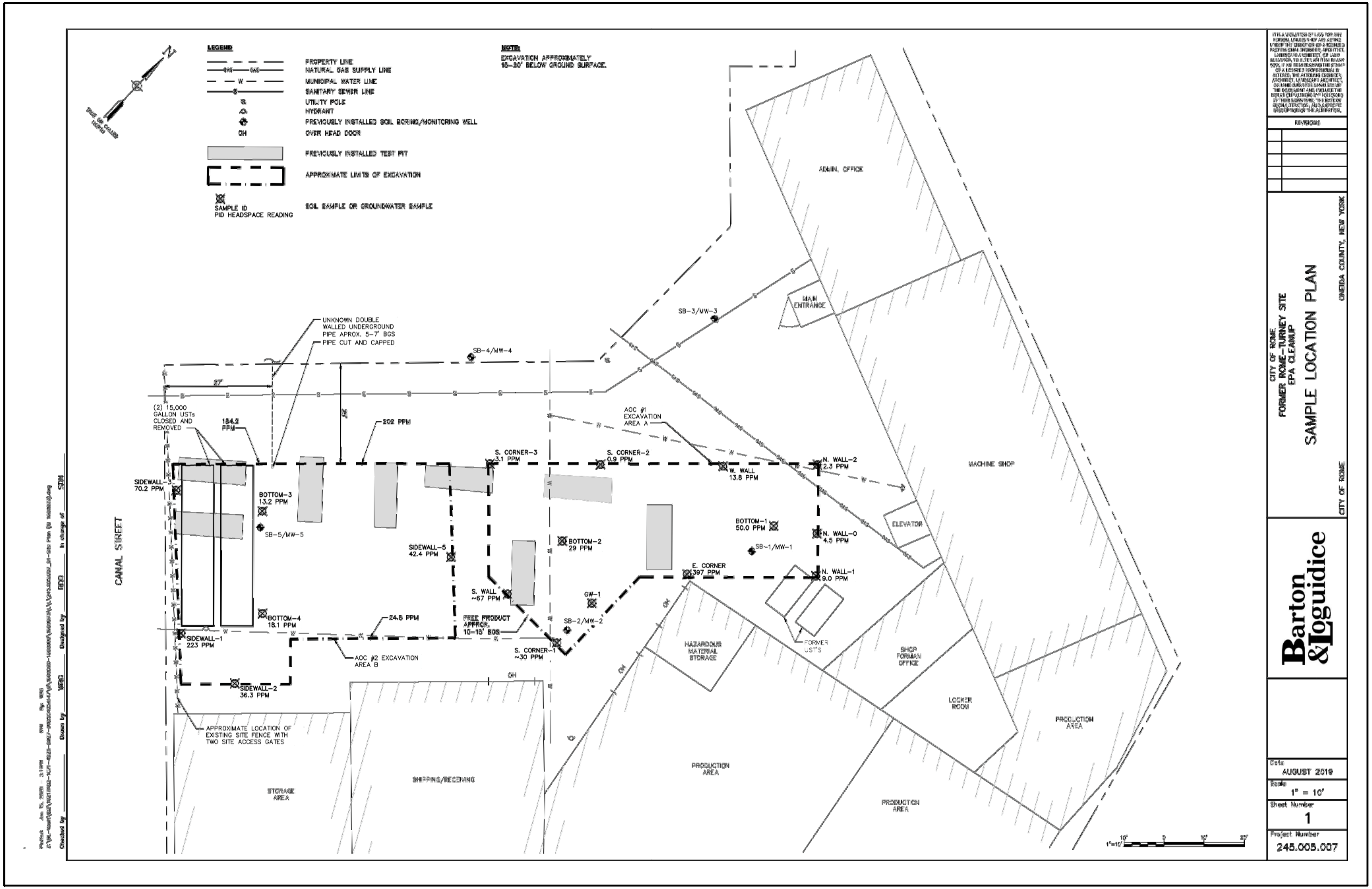
PROJECT NO.	18-046
DRAWN:	MAR 2020
DRAWN BY:	NP
CHECKED BY:	RM

Previous Test Pit and Boring Location Plan

FORMER ROME TURNEY RADIATOR COMPANY
109 CANAL STREET
ROME, NEW YORK 13440

FIGURE

1B



AECC
ENVIRONMENTAL CONSULTING
Asbestos & Environmental
Consulting Corporation

6308 Fly Road
East Syracuse, NY 13057

PROJECT NO. 20-037
DRAWN: NOV. 2021
DRAWN BY: SWP
CHECKED BY: RM

2019 REMEDIAL EXCAVATION
SAMPLE LOCATION PLAN

THE FORMER ROME TURNEY DEVELOPMENT SITE
109 CANAL STREET
CITY OF ROME, NEW YORK 13440

FIGURE
1C

Sample ID / Location			SB-16
Sampling Date			9/11/2018
Sample Depth (feet bgs)			0-2
Max PID Reading			1.4
Compound	SCO	C-RSCO	CONC
Cadmium	2.5	9.3	3.81
Lead	63	1000	503
Mercury	0.18	2.8	3.93

Sample ID / Location			SB-3
Sampling Date			11/11/2015
Sample Depth (feet bgs)			2-4
Max PID Reading			45
Compound	SCO	C-RSCO	CONC
Acetone	0.05	500	0.26
2-Methylnaphthalene	0.41	N/A	1.3 J

Sample ID / Location			SB-33
Sampling Date			10/30/2018
Sample Depth (feet bgs)			2-3
Max PID Reading			<1
Compound	SCO	C-RSCO	CONC
Arsenic	***13***	***16***	***40.1***
Cadmium	***2.5***	***9.3***	***40.9***
Lead	***63***	***1000***	***1470***
Mercury	***0.18***	***2.8***	***28.4***

Sample ID / Location			S-CORNER-2
Sampling Date			8/15/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			0.9
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			S-CORNER-3
Sampling Date			8/20/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			3.1
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			SB-4
Sampling Date			11/11/2015
Sample Depth (feet bgs)			2-4
Max PID Reading			8.3
Compound	SCO	C-RSCO	CONC
Acetone	0.05	500	0.0782
Cadmium	2.5	9.3	3.79
Mercury	0.18	2.8	0.924

Sample ID / Location			SB-30
Sampling Date			10/30/2018
Sample Depth (feet bgs)			2-3
Max PID Reading			---
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			SB-10
Sampling Date			9/11/2018
Sample Depth (feet bgs)			2-3
Max PID Reading			259
Compound	SCO	C-RSCO	CONC
2-Methylnaphthalene	0.41	N/A	290 RE
Dibenzofuran	7	350	9.7
Napthtalene	12	500	65
Arsenic	***13***	***16***	***29***
Cadmium	2.5	9.3	3.73
Lead	63	1000	840
Mercury	0.18	2.8	0.626

Sample ID / Location			SIDEWALL-3
Sampling Date			8/22/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			70.2
Compound	SCO	C-RSCO	CONC
Selenium	3.9	1500	4.08

Sample ID / Location			W-WALL
Sampling Date			8/15/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			13.8
Compound	SCO	C-RSCO	CONC
Cadmium	2.5	9.3	2.64

Sample ID / Location			BOTTOM-1
Sampling Date			8/15/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			50
Compound	SCO	C-RSCO	CONC
Mercury	0.18	2.8	1.27

Sample ID / Location			N-WALL-2
Sampling Date			8/15/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			2.3
Compound	SCO	C-RSCO	CONC
Cadmium	2.5	9.3	12.1

Sample ID / Location			SB-15
Sampling Date			11/12/2015
Sample Depth (feet bgs)			0-2
Max PID Reading			11.6
Compound	SCO	C-RSCO	CONC
Benzo(a)anthracene	1	5.6	1.5 J
Benzo(a)pyrene	***1***	***1***	***1.6 J***
Benzo(b)fluoranthene	1	5.6	2.1
Chrysene	1	56	1.7 J
Dibenz(a,h)anthracene	0.33	0.56	0.5 J
Indeno(1,2,3-cd)pyrene	0.5	5.6	1.2 J
Cadmium	2.5	9.3	3.17
Lead	63	1000	205
Sample ID / Location			SB-15
Sampling Date			9/11/2018
Sample Depth (feet bgs)			7-9
Max PID Reading			53
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			N-WALL-0
Sampling Date			8/15/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			4.5
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			N-WALL-1
Sampling Date			8/15/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			9
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			E-CORNER
Sampling Date			8/15/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			397
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			S-CORNER-1
Sampling Date			8/15/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			30
Compound	SCO	C-RSCO	CONC
Cadmium	2.5	9.3	3.72

Sample ID / Location			SB-8
Sampling Date			11/12/2015
Sample Depth (feet bgs)			2-4
Max PID Reading			13
Compound	SCO	C-RSCO	CONC
Benzo(a)anthracene	1	5.6	4 D
Benzo(a)pyrene	***1***	***1***	***3.4 D***
Benzo(b)fluoranthene	1	5.6	3.9 D
Benzo(k)fluroanthene	0.8	3.9	1.8 JD
Chrysene	1	56	4 D
Dibenz(a,h)anthracene	0.33	0.56	0.49 JD
Indeno(1,2,3-cd)pyrene	0.5	5.6	1.7 JD
Lead	63	1000	201
Mercury	0.18	2.8	0.269

Sample ID / Location			SB-34
Sampling Date			10/30/2018
Sample Depth (feet bgs)			13-15
Max PID Reading			1410
Compound	SCO	C-RSCO	CONC
Xylenes	0.26	500	1.4
2-Methylnaphthalene	0.41	N/A	20 RE

Sample ID / Location			SB-18
Sampling Date			9/11/2018
Sample Depth (feet bgs)			12-14
Max PID Reading			121
Compound	SCO	C-RSCO	CONC
2-Methylnaphthalene	0.41	N/A	1.5

Sample ID / Location			SB-14
Sampling Date			9/11/2018
Sample Depth (feet bgs)			8-10
Max PID Reading			1143
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			SB-36
Sampling Date			10/30/2018
Sample Depth (feet bgs)			6-7
Max PID Reading			20
Compound	SCO	C-RSCO	CONC
1,2,4-Trimethylbenzene	3.6	190	4.4
Napthtalene	***12***	***500***	***520***
Xylenes	0.26	500	4.5 J
Di-n-butylphthlate	0.014	N/A	0.29
Lead	63	1000	280
Mercury	0.18	2.8	0.26

Sample ID / Location			SB-7
Sampling Date			11/12/2015
Sample Depth (feet bgs)			2-4
Max PID Reading			63
Compound	SCO	C-RSCO	CONC
Benzo(a)anthracene	1	5.6	1.4
Benzo(a)pyrene	***1***	***1***	***1.1***
Benzo(b)fluoranthene	1	5.6	1.3
Chrysene	1	56	1
Indeno(1,2,3-cd)pyrene	0.5	5.6	0.54
Lead	63	1000	217

Sample ID / Location			SB-19
Sampling Date			9/11/2018
Sample Depth (feet bgs)			0-2
Max PID Reading			1.7
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			SB-20
Sampling Date			---
Sample Depth (feet bgs)			---
Max PID Reading			---
Compound	SCO	C-RSCO	CONC
Not Sampled (Refusal)	---	---	---

Sample ID / Location			BOTTOM-2
Sampling Date			8/15/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			29
Compound	SCO	C-RSCO	CONC
Cadmium	2.5	9.3	7.98

Sample ID / Location			S-WALL
Sampling Date			8/20/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			67
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			SIDEWALL-5
Sampling Date			8/23/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			42.4
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			SIDEWALL-2
Sampling Date			8/21/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			36.3
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

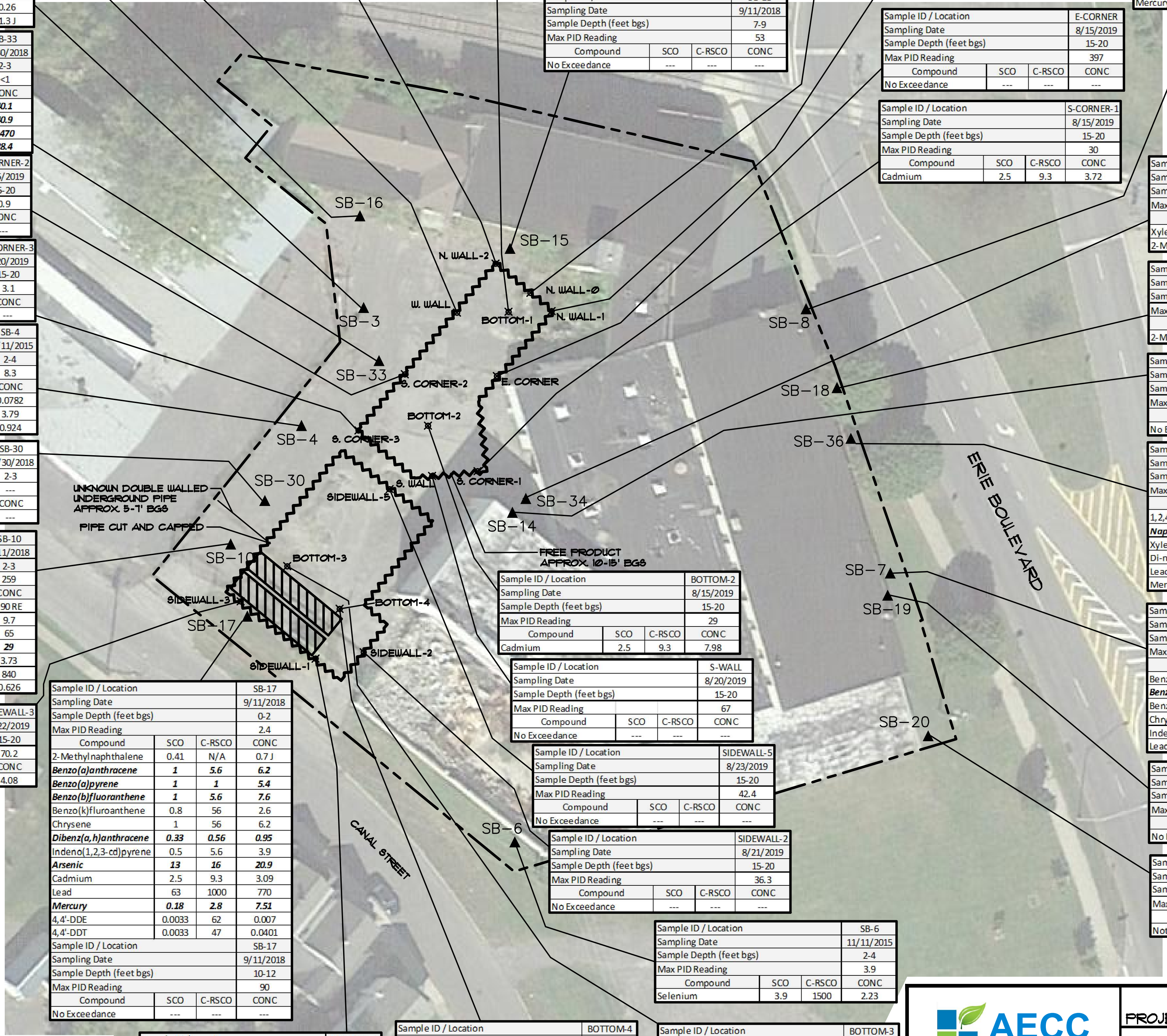
Sample ID / Location			SB-17
Sampling Date			9/11/2018
Sample Depth (feet bgs)			0-2
Max PID Reading			2.4
Compound	SCO	C-RSCO	CONC
2-Methylnaphthalene	0.41	N/A	0.7 J
Benzo(a)anthracene	***1***	***5.6***	***6.2***
Benzo(a)pyrene	***1***	***1***	***5.4***
Benzo(b)fluoranthene	***1***	***5.6***	***7.6***
Benzo(k)fluroanthene	0.8	56	2.6
Chrysene	1	56	6.2
Dibenz(a,h)anthracene	***0.33***	***0.56***	***0.95***
Indeno(1,2,3-cd)pyrene	0.5	5.6	3.9
Arsenic	***13***	***16***	***20.9***
Cadmium	2.5	9.3	3.09
Lead	63	1000	770
Mercury	***0.18***	***2.8***	***7.51***
4,4'-DDE	0.0033	62	0.007
4,4'-DDT	0.0033	47	0.0401
Sample ID / Location			SB-17
Sampling Date			9/11/2018
Sample Depth (feet bgs)			10-12
Max PID Reading			90
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			SIDEWALL-1
Sampling Date			8/21/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			223
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---

Sample ID / Location			BOTTOM-4
Sampling Date			8/22/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			18.1
Compound	SCO	C-RSCO	CONC
Naphthalene	12	500	16.8
Lead	63	1000	713
Mercury	0.18	2.8	0.2

Sample ID / Location			SB-6
Sampling Date			11/11/2015
Sample Depth (feet bgs)			2-4
Max PID Reading			3.9
Compound	SCO	C-RSCO	CONC
Selenium	3.9	1500	2.23

Sample ID / Location			BOTTOM-3
Sampling Date			8/22/2019
Sample Depth (feet bgs)			15-20
Max PID Reading			13.2
Compound	SCO	C-RSCO	CONC
No Exceedance	---	---	---



LEGEND:

— — —	PROPERTY LINE / BCP AREA
SB–## ▲	SOIL BORING LOCATION & ID (PAST INVESTIGATIONS)
WALL-• ⊠	SOIL SAMPLE COLLECTED DURING 2019 SITE ACTIVITIES
▨	LOCATION OF TWO (2) 15,000-GALLON USTs REMOVED IN 2019
〰	APPROXIMATE LIMITS OF EXCAVATION (AUGUST 2019)

TABLE NOTES:

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

ALL CONCENTRATIONS IN THE TABLES SHOWN EXCEEDS APPLICABLE SCO.

SCO - NYSDEC UNRESTRICTED USE SOIL CLEANUP OBJECTIVE

C-RSCO - NYSDEC (COMMERCIAL) RESTRICTED USE SOIL CLEANUP OBJECTIVE

J - ESTIMATED VALUE (THE CONCENTRATION IS GREATER THAN THE METHOD DETECTION LIMIT)

RE - VALUE FOR THIS COMPOUND IS THE RESULT OF A RE-ANALYSIS

BOLD & ITALICIZED - CONCENTRATION EXCEEDS APPLICABLE C-RSCO VALUE

DUE TO SPACE LIMITATIONS, METAL EXCEEDANCES ARE LIMITED TO RCRA 8 METALS. COMPLETE SUMMARY TABLES ARE AVAILABLE FOR REVIEW IN THE LIMITED PHASE II ESA REPORT.

NOTES / DISCLAIMERS:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH WEBSITE.
2. APPROXIMATE PROPERTY LINE BASED ON ONEIDA COUNTY GISCLOUD WEBSITE.
3. ALL LOCATIONS ARE APPROXIMATE.
4. ALL SITE BUILDINGS HAVE BEEN DEMOLISHED.

0 50' 100'

GRAPHIC SCALE

AECC
ENVIRONMENTAL CONSULTING
Asbestos & Environmental
Consulting Corporation

6308 Fly Road
East Syracuse, NY 13057

PROJECT NO. 20-037
DRAWN: MAY 2020
DRAWN BY: NP
CHECKED BY: RM

PRIOR INVESTIGATIVE RESULTS - SUMMARY OF HISTORICAL SAMPLING EXCEEDANCES IN SOIL

FORMER ROME TURNEY DEVELOPMENT SITE
109 CANAL STREET
CITY OF ROME, NEW YORK 13440

FIGURE
2A

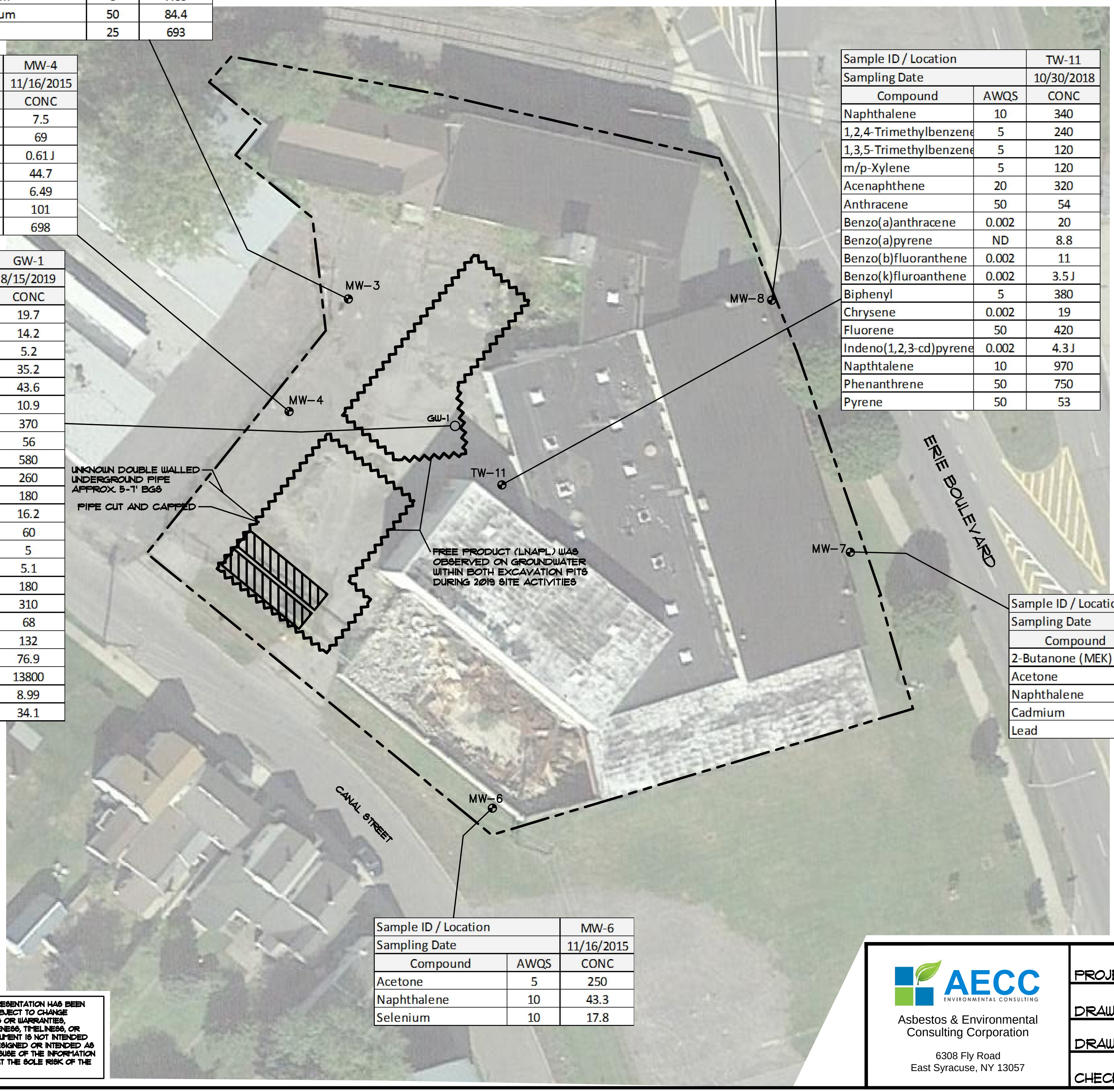
Sample ID / Location		MW-3
Sampling Date		11/16/2015
Compound	AWQS	CONC
Acetone	5	38.9
Chloroform	5	6.1
Dibromochloromethane	0.4	1.9
Arsenic	25	52.5
Barium	1000	2210
Cadmium	5	7.85
Chromium	50	84.4
Lead	25	693

Sample ID / Location		MW-8
Sampling Date		---
Compound	AWQS	CONC
Not Sampled (Dry)	---	---

Sample ID / Location		MW-4
Sampling Date		11/16/2015
Compound	AWQS	CONC
2-Butanone (MEK)	3	7.5
Acetone	5	69
Dibromochloromethane	0.4	0.61 J
Arsenic	25	44.7
Cadmium	5	6.49
Chromium	50	101
Lead	25	698

Sample ID / Location		TW-11
Sampling Date		10/30/2018
Compound	AWQS	CONC
Naphthalene	10	340
1,2,4-Trimethylbenzene	5	240
1,3,5-Trimethylbenzene	5	120
m/p-Xylene	5	120
Acenaphthene	20	320
Anthracene	50	54
Benzo(a)anthracene	0.002	20
Benzo(a)pyrene	ND	8.8
Benzo(b)fluoranthene	0.002	11
Benzo(k)fluroanthene	0.002	3.5 J
Biphenyl	5	380
Chrysene	0.002	19
Fluorene	50	420
Indeno(1,2,3-cd)pyrene	0.002	4.3 J
Napthtalene	10	970
Phenanthrene	50	750
Pyrene	50	53

Sample ID / Location		GW-1
Sampling Date		8/15/2019
Compound	AWQS	CONC
n-Butylbenzene	5	19.7
sec-Butylbenzene	5	14.2
tert-Butylbenzene	5	5.2
Ethylbenzene	5	35.2
Isopropylbenzene	5	43.6
p-Isopropyltoluene	5	10.9
Naphthalene	10	370
n-Propylbenzene	5	56
1,2,4-Trimethylbenzene	5	580
1,3,5-Trimethylbenzene	5	260
m/p-Xylene	5	180
o-Xylene	5	16.2
Acenaphthene	20	60
Benzo(a)anthracene	0.002	5
Chrysene	0.002	5.1
Fluorene	50	180
Phenanthrene	50	310
Arsenic	25	68
Cadmium	5	132
Chromium	50	76.9
Lead	25	13800
Mercury	1	8.99
Selenium	10	34.1



UNKNOWN DOUBLE WALLED UNDERGROUND PIPE APPROX. 5-7' BGS

PIPE CUT AND CAPPED

FREE PRODUCT (LNAPL) WAS OBSERVED ON GROUNDWATER WITHIN BOTH EXCAVATION PITS DURING 2019 SITE ACTIVITIES

Sample ID / Location		MW-7
Sampling Date		11/16/2015
Compound	AWQS	CONC
2-Butanone (MEK)	3	3.5 J
Acetone	5	21
Naphthalene	10	45.9
Cadmium	5	7.37
Lead	25	1550

Sample ID / Location		MW-6
Sampling Date		11/16/2015
Compound	AWQS	CONC
Acetone	5	250
Naphthalene	10	43.3
Selenium	10	17.8

LEGEND:

— — — —	PROPERTY LINE / BCP AREA
MW-# ◐	GROUNDWATER MONITORING WELL LOCATION & ID
GW-• ○	GROUNDWATER SAMPLE COLLECTED DURING 2019 SITE ACTIVITIES
▨	LOCATION OF TWO (2) 15,000-GALLON USTs REMOVED IN 2019
∿∿∿∿	APPROXIMATE LIMITS OF EXCAVATION (AUGUST 2019)

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)

NOTES / DISCLAIMERS:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH WEBSITE.
2. APPROXIMATE PROPERTY LINE BASED ON ONEIDA COUNTY GISCLOUD WEBSITE.
3. ALL LOCATIONS ARE APPROXIMATE.
4. ALL SITE BUILDINGS HAVE BEEN DEMOLISHED.

0 50' 100'
GRAPHIC SCALE

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Consulting Corporation

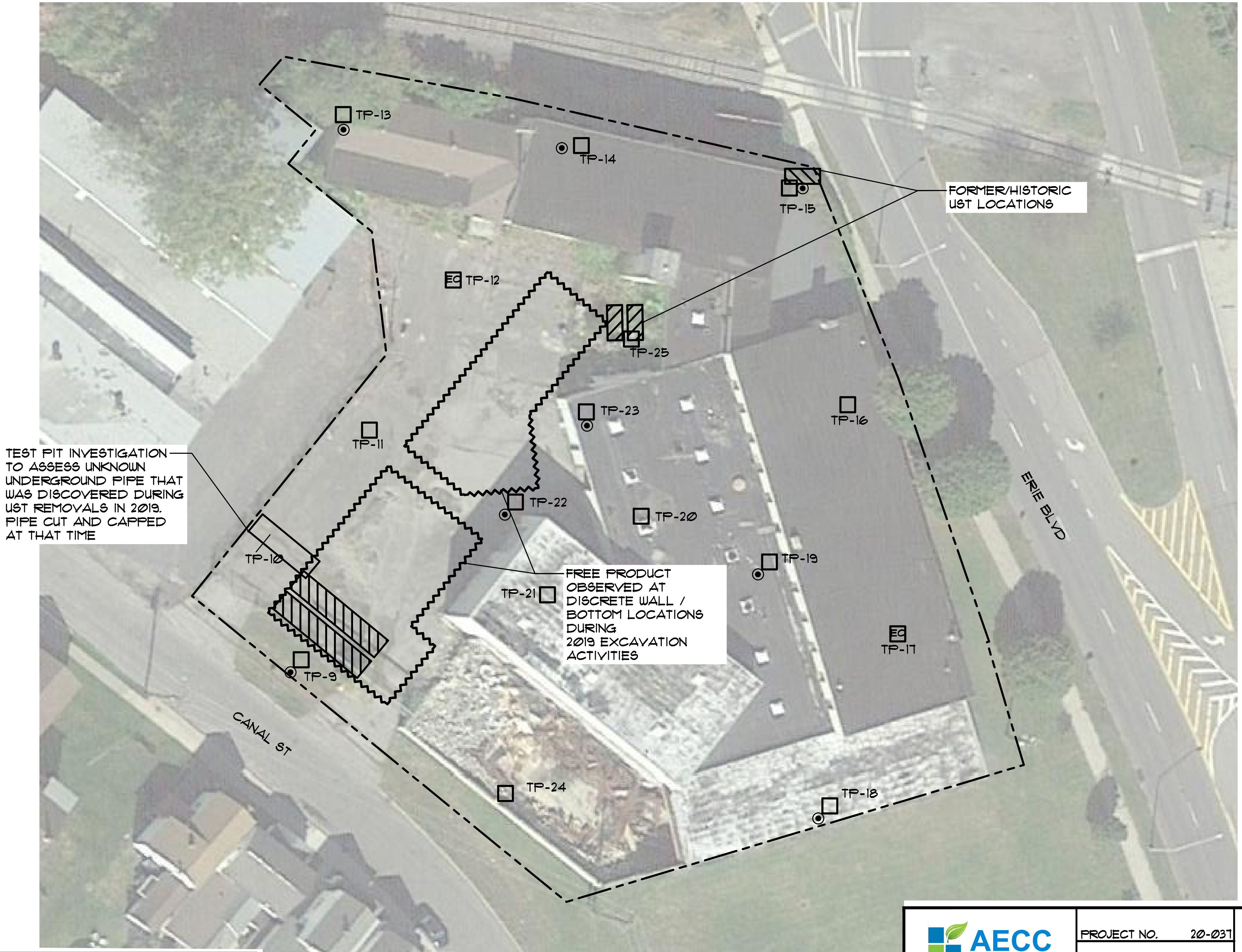
6308 Fly Road
East Syracuse, NY 13057

PROJECT NO. 20-037
DRAWN: MAY 2020
DRAWN BY: NP
CHECKED BY: RM

PRIOR INVESTIGATIVE RESULTS - SUMMARY OF HISTORICAL SAMPLING EXCEEDANCES IN GROUNDWATER

FORMER ROME TURNEY DEVELOPMENT SITE
109 CANAL STREET
CITY OF ROME, NEW YORK 13440

FIGURE
2B



FORMER/HISTORIC UST LOCATIONS

TEST PIT INVESTIGATION TO ASSESS UNKNOWN UNDERGROUND PIPE THAT WAS DISCOVERED DURING UST REMOVALS IN 2019. PIPE CUT AND CAPPED AT THAT TIME

FREE PRODUCT OBSERVED AT DISCRETE WALL / BOTTOM LOCATIONS DURING 2019 EXCAVATION ACTIVITIES

LEGEND:

— — — —	APPROXIMATE PROPERTY LINE / BCP AREA
☐	PROPOSED TEST PIT LOCATION
▨	LOCATION OF TWO (2) 15,000-GALLON USTs REMOVED IN 2019
﹏﹏	APPROXIMATE LIMITS OF EXCAVATION (AUGUST 2019)
⊙	PROPOSED LOCATION OF GROUNDWATER WELL TO BE INSTALLED NEXT TO SELECT TEST PIT
EC	SOIL TO BE ANALYZED FOR EMERGING CONTAMINANTS

NOTES:

1. TP-1 THRU TP-8 WERE COMPLETED AS PART OF AN INVESTIGATION CONDUCTED IN OCTOBER 2015

NOTES / DISCLAIMERS:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH WEBSITE.
2. APPROXIMATE PROPERTY LINE BASED ON ONEIDA COUNTY GISCLOUD WEBSITE.
3. ALL LOCATIONS ARE APPROXIMATE.
4. ALL SITE BUILDINGS HAVE BEEN DEMOLISHED (CONCRETE SLABS REMAIN).

0 50' 100'

GRAPHIC SCALE

AECC
ENVIRONMENTAL CONSULTING
Asbestos & Environmental
Consulting Corporation

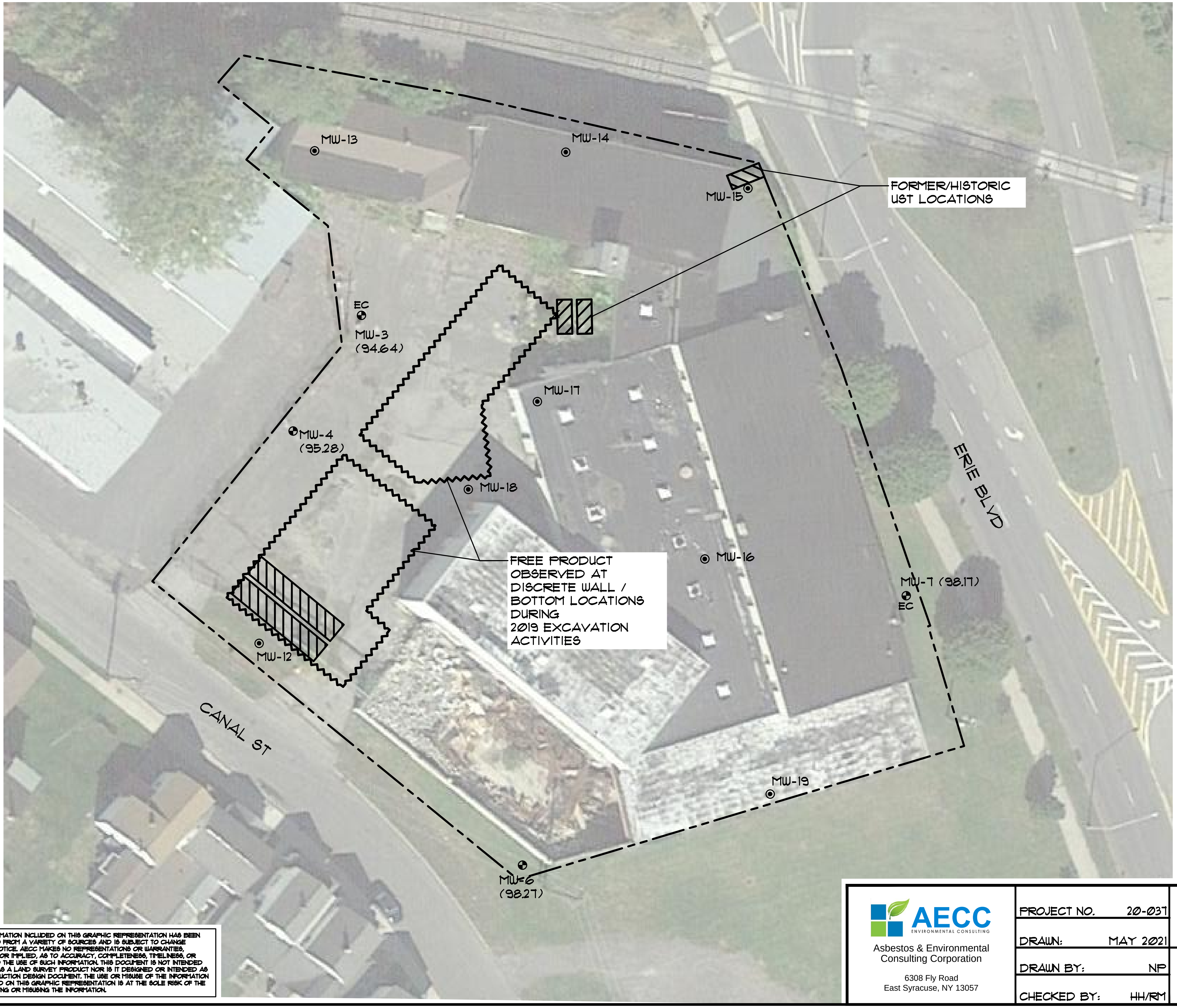
6308 Fly Road
East Syracuse, NY 13057

PROJECT NO. 20-037
DRAWN: MAY 2021
DRAWN BY: NP
CHECKED BY: HH/RM

PROPOSED REMEDIAL INVESTIGATION - SOIL SAMPLING PLAN

FORMER ROME TURNEY DEVELOPMENT SITE
109 CANAL STREET
CITY OF ROME, NEW YORK 13440

FIGURE
3A



LEGEND:

— — —	APPROXIMATE PROPERTY LINE / BCP AREA
●	GROUNDWATER WELL LOCATION INSTALLED IN 2015 TO BE SAMPLED
(98.17)	GROUNDWATER ELEVATION MEASURED IN 2018
▨	LOCATION OF TWO (2) 15,000-GALLON USTs REMOVED IN 2019
〰	APPROXIMATE LIMITS OF EXCAVATION (AUGUST 2019)
◉	PROPOSED RI 2021 GROUNDWATER WELL LOCATION TO BE INSTALLED
EC	GROUNDWATER TO BE ANALYZED FOR EMERGING CONTAMINANTS

NOTES:

1. PRIOR MONITORING WELLS MW-1, MW-2, AND MW-5 WERE DESTROYED DURING EXCAVATIONS IN 2019.
2. EXISTING MONITORING WELL MW-8 HAS BEEN DETERMINED TO BE DRY DURING PREVIOUS INVESTIGATIONS.
3. TEMPORARY MONITORING WELLS TW-9 AND TW-10 WERE LOCATED ON THE ADJACENT PARCEL TO THE SOUTH.
4. TEMPORARY MONITORING WELL TW-11 WAS REMOVED AFTER SAMPLING IN 2018.

NOTES / DISCLAIMERS:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH WEBSITE.
2. APPROXIMATE PROPERTY LINE BASED ON ONEIDA COUNTY GISCLOUD WEBSITE.
3. ALL LOCATIONS ARE APPROXIMATE.
4. ALL SITE BUILDINGS HAVE BEEN DEMOLISHED (CONCRETE SLABS REMAIN).

0 50' 100'
GRAPHIC SCALE

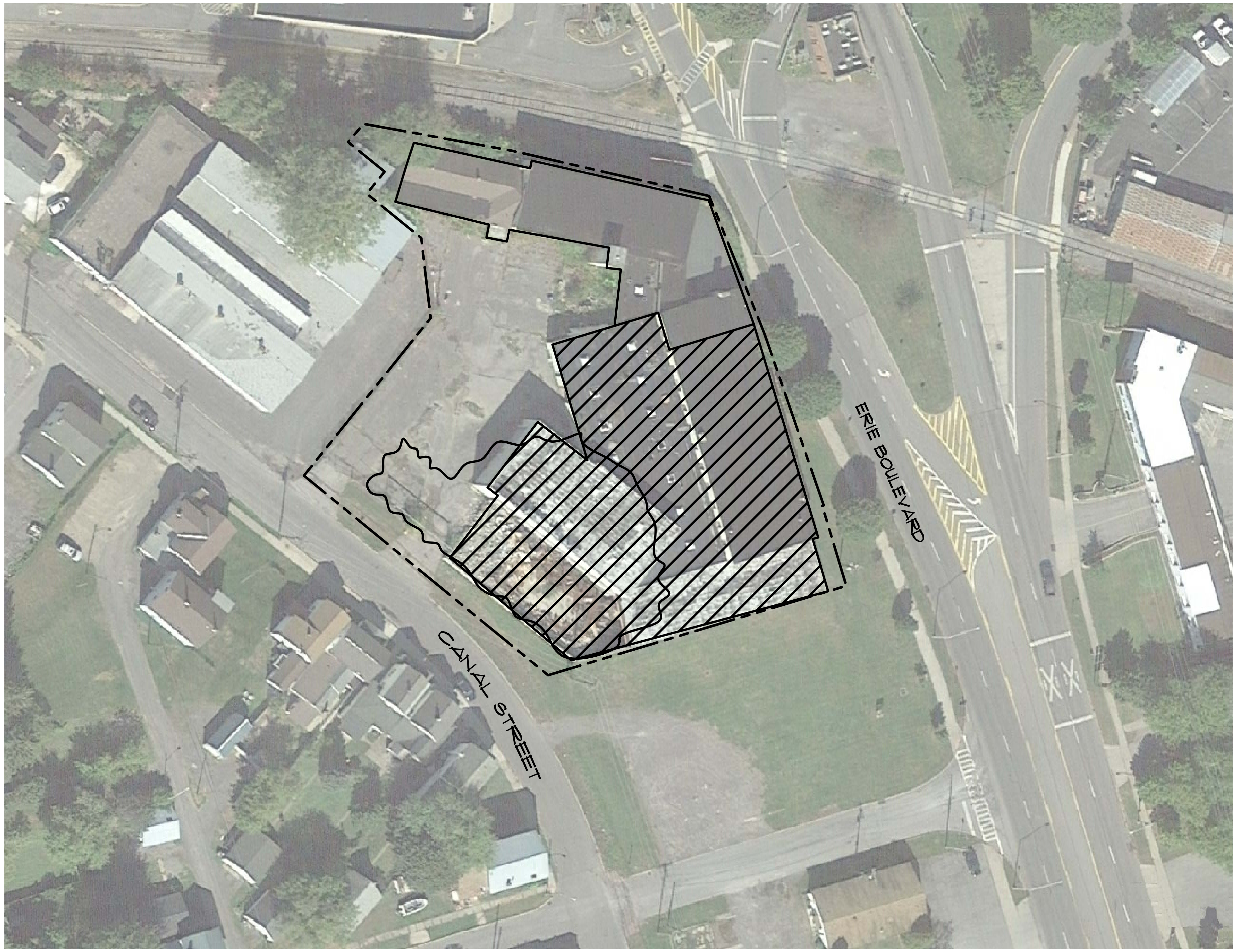
AECC
ENVIRONMENTAL CONSULTING
Asbestos & Environmental
Consulting Corporation
6308 Fly Road
East Syracuse, NY 13057

PROJECT NO.	20-037
DRAWN:	MAY 2021
DRAWN BY:	NP
CHECKED BY:	HH/RM

PROPOSED REMEDIAL INVESTIGATION -
GROUNDWATER SAMPLING PLAN

FORMER ROME TURNEY DEVELOPMENT SITE
109 CANAL STREET
CITY OF ROME, NEW YORK 13440

FIGURE
3B



LEGEND:

— - —	APPROXIMATE PROPERTY LINE (BROWNFIELD AREA EXTENT)
∿∿∿	AREA OF FOUNDATION DEBRIS PILES (CRUSHED CONCRETE)
▨	AREA OF REMOVED SLABS
—	LIMITS OF EXISTING SLABS

NOTES:

1. IN DECEMBER 2020 SELECT AREAS OF FORMER BUILDINGS FOUNDATIONS WERE REMOVED, CRUSHED AND STAGED IN DEBRIS PILES ON THE SOUTHERN PORTION OF THE SITE

NOTES / DISCLAIMERS:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH WEBSITE(OCTOBER, 2017).
2. APPROXIMATE PROPERTY LINE BASED ON GISCLOUD WEBSITE.
3. ALL LOCATIONS ARE APPROXIMATE.

0 40' 80'

GRAPHIC SCALE

AECC
ENVIRONMENTAL CONSULTING
Asbestos & Environmental
Consulting Corporation

6308 Fly Road
East Syracuse, NY 13057

PROJECT NO. 20-037
DRAWN: MAY 2020
DRAWN BY: NP
CHECKED BY: RM

FORMER AND CURRENT BUILDING FOUNDATION PLAN

FORMER ROME TURNEY DEVELOPMENT SITE
109 CANAL STREET
CITY OF ROME, NEW YORK 13440

FIGURE

4

Appendix A

Standard Operating Procedures

AECC	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP No. 101
			Initial Issue Date	November 2011
			Revision Date:	11/4/2021
SOP#101 – SURFACE AND SHALLOW SOIL SAMPLING			Revision No.	2
			Next Revision Date:	TBD
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 soil samples from varying depths, typically those that may be easily reached with hand tools. 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 considerably 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 a collection pan or sample container (if loosely consolidated), sampled with a terra-core (or equivalent) sampler, or be removed with a clean decontaminated spoon or scoop and transferred into the appropriate container.

Collection Pan – A soil collection pan or equivalent is often used as an intermediate between removal of soil from the ground and filling the sample containers/soil jars.

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
- Photoionization detector (PID) meter, (if volatile or semi-volatile organic compounds (VOCs / SVOCs) are expected)

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.

A separate (duplicate/split) sample should be collected for headspace analysis.

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 to reach the required sampling 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 containerized 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.

Related AECC SOPs

SOP # 102 Sample Handling, Packaging, and Shipping
SOP # 103 Equipment Decontamination
SOP # 104 Split Spoon Sampling
SOP # 105 Direct-Push Soil Sampling
SOP # 106 Groundwater Sampling
SOP # 108 Sample Labeling & COC Completion
SOP # 109 Surface Water Sampling
SOP # 113 Taking Field Notes
SOP # 116 Core Drilling
SOP # 117 Saw Cutting
SOP # 118 Test Pit Soil Sampling
SOP # 120 Headspace Analysis

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 **<u>ONLY</u>** 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.

	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP No. 103
			Initial Issue Date	September 2012
			Revision Date:	January 2021
SOP#103 – EQUIPMENT DECONTAMINATION			Revision No.	1
			Next Revision Date:	As Needed
Preparation:	Authority:	Issuing Dept: Environmental Group	Page:	1 of 4

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 (from a municipal or private source that has been tested and shown to meet New York State drinking water standards for PFOA and PFOS)
- 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.

AECC ENVIRONMENTAL CONSULTING	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP No. 104
			Initial Issue Date	September 2012
			Revision Date:	November 2021
SOP# 104 – SPLIT SPOON SOIL SAMPLING			Revision No.	1
			Next Revision Date:	As Needed
Preparation:	Authority:	Issuing Dept: Environmental Group	Page:	1 of 6

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
- Headspace analysis containers:
    - Glass jars and aluminum foil, or
    - Sealable plastic bags (ie – Ziploc® bags)
- Photoionization Detector (PID) or Flame Ionization Detector, (if volatile or semi-volatile organic compounds (VOCs / SVOCs) 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 for 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.

Standard Penetration Test

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 (see below), the soils should be placed into a sample collection pan and homogenized, or placed directly into the appropriate sample container(s). Headspace analysis of a duplicate / split sample can be completed at this point (see SOP #120 – Headspace Analysis).

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/headspace screening with a PID or FID, 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.

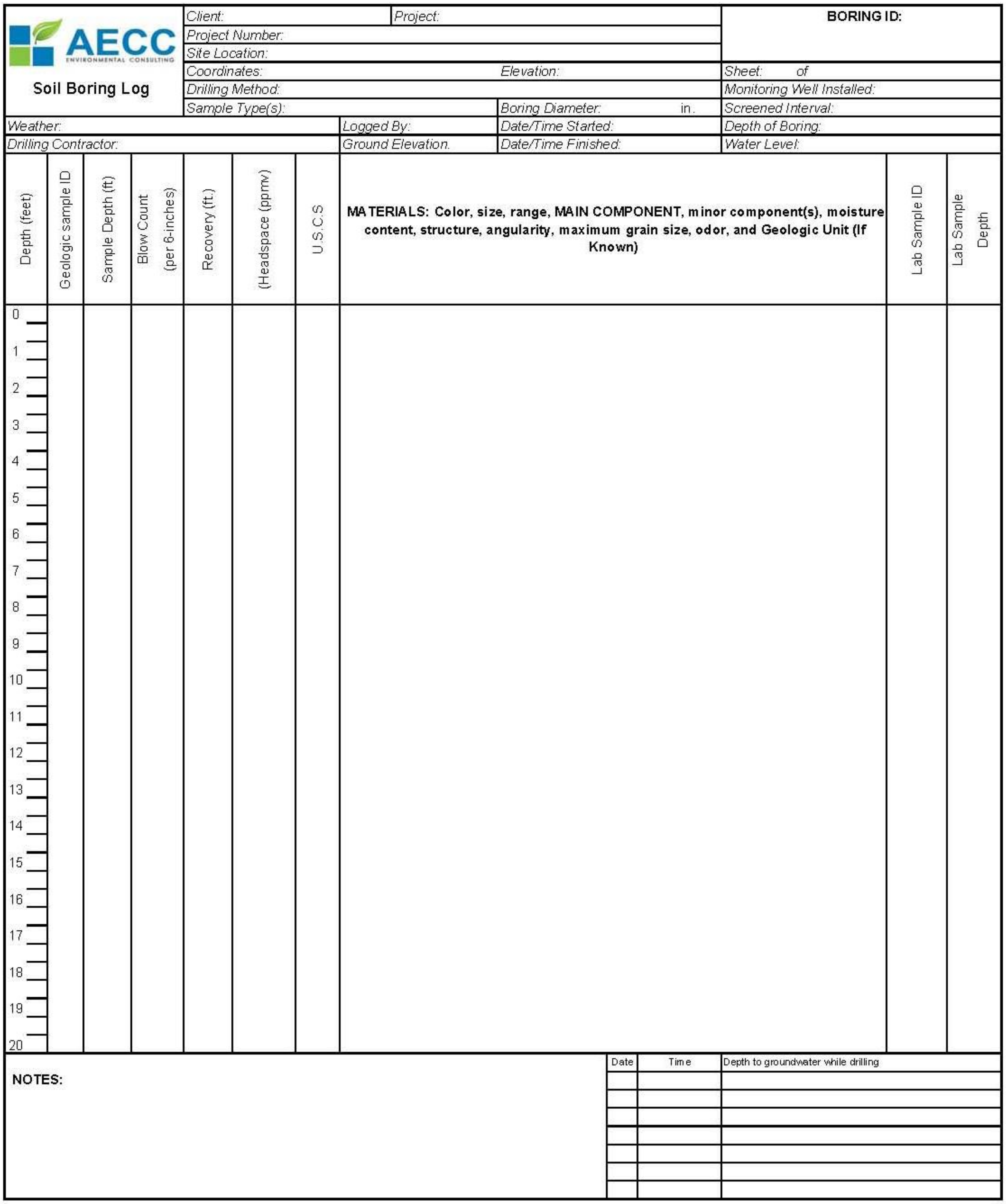
Documentation

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



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
			Revision Date:	November 2021
SOP# 105 – DIRECT-PUSH SOIL SAMPLING			Revision No.	1
			Next Revision Date:	TBD
Preparation:	Authority:	Issuing Dept: Environmental Group	Page:	1 of 6

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.
- Headspace analysis containers:
    - Glass jars and aluminum foil, or
    - Sealable plastic bags (ie – Ziploc® bags)
- Photoionization Detector (PID) or Flame Ionization Detector, (if volatile or semi-volatile organic compounds (VOCs / SVOCs) are expected)
- 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). Headspace analysis of a duplicate / split sample can be completed at this point (see SOP #120 – Headspace Analysis).

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.

	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.

<u>Sampling with a Submersible Pump</u>

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.

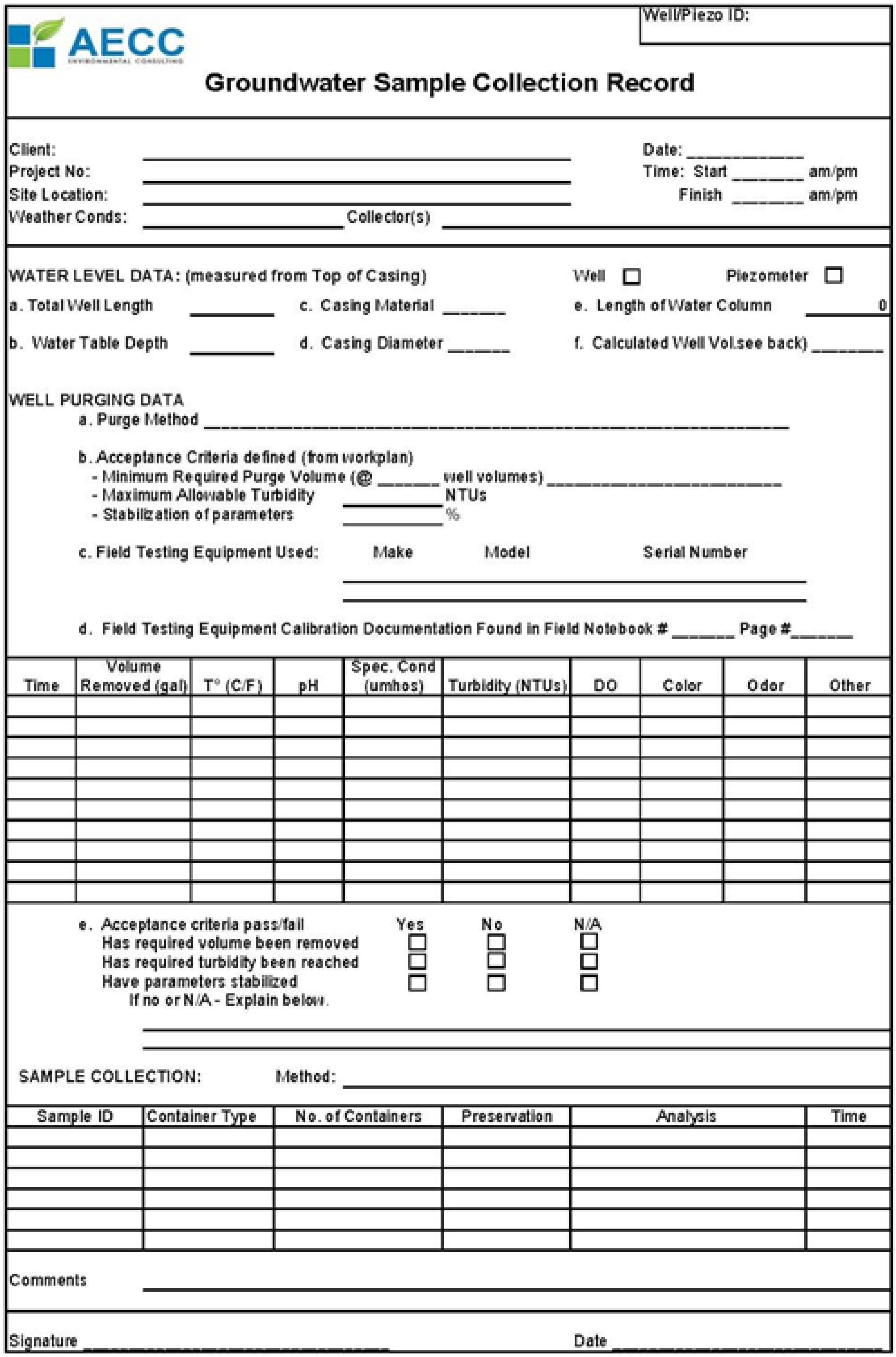
Documentation

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.

Related AECC SOPs

SOP # 102 Sample Handling, Packaging, and Shipping
SOP # 103 Equipment Decontamination
SOP # 108 Sample Labeling & COC Completion
SOP # 113 Taking Field Notes

FIGURE 1 Groundwater Sample Collection Record



Well/Piezo ID:

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: ______________________________

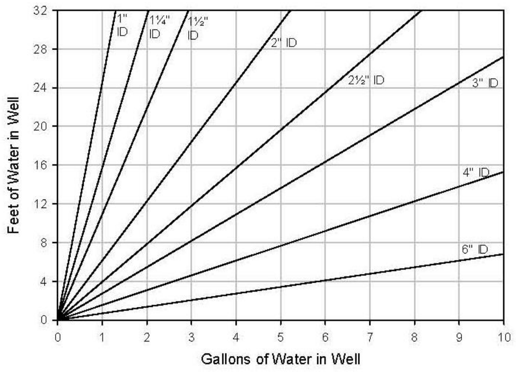
Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time

Comments ____
____

Signature ______________________________ Date ______________________

FIGURE 1 (Cont'd) Groundwater Sample Collection Record

Purge Volume Calculation

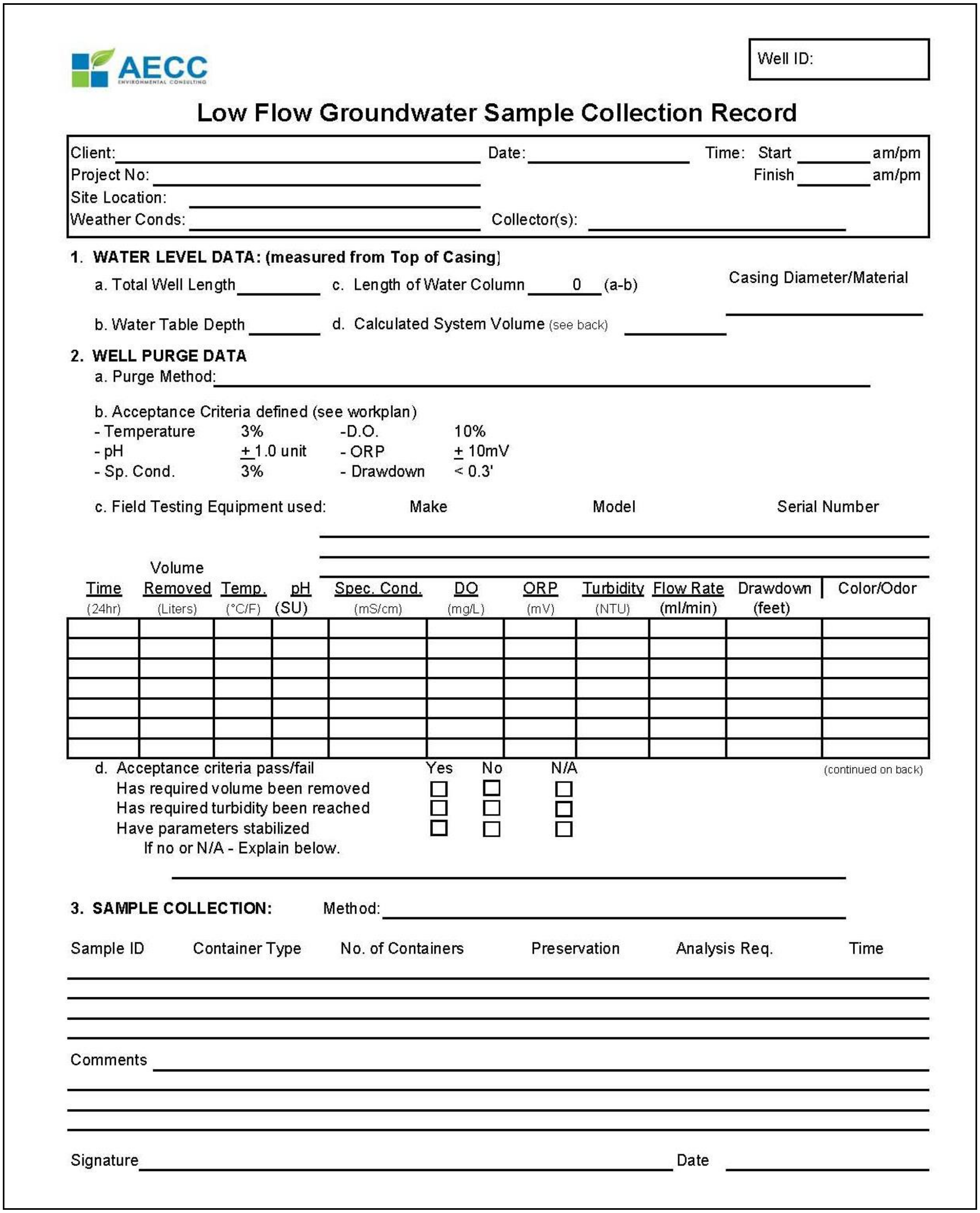


Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600

(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

(continued on back)

d. 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.

______

3. SAMPLE COLLECTION: Method: ______

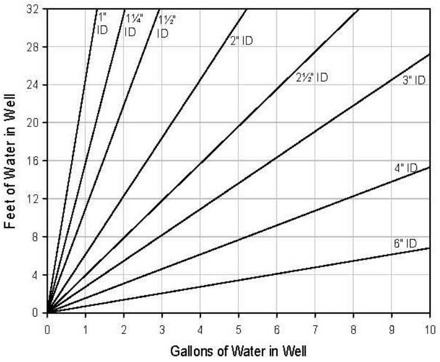
Sample ID	Container Type	No. of Containers	Preservation	Analysis Req.	Time

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

AECC ENVIRONMENTAL CONSULTING	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.

<u>Monitoring Well Development:</u>

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.).

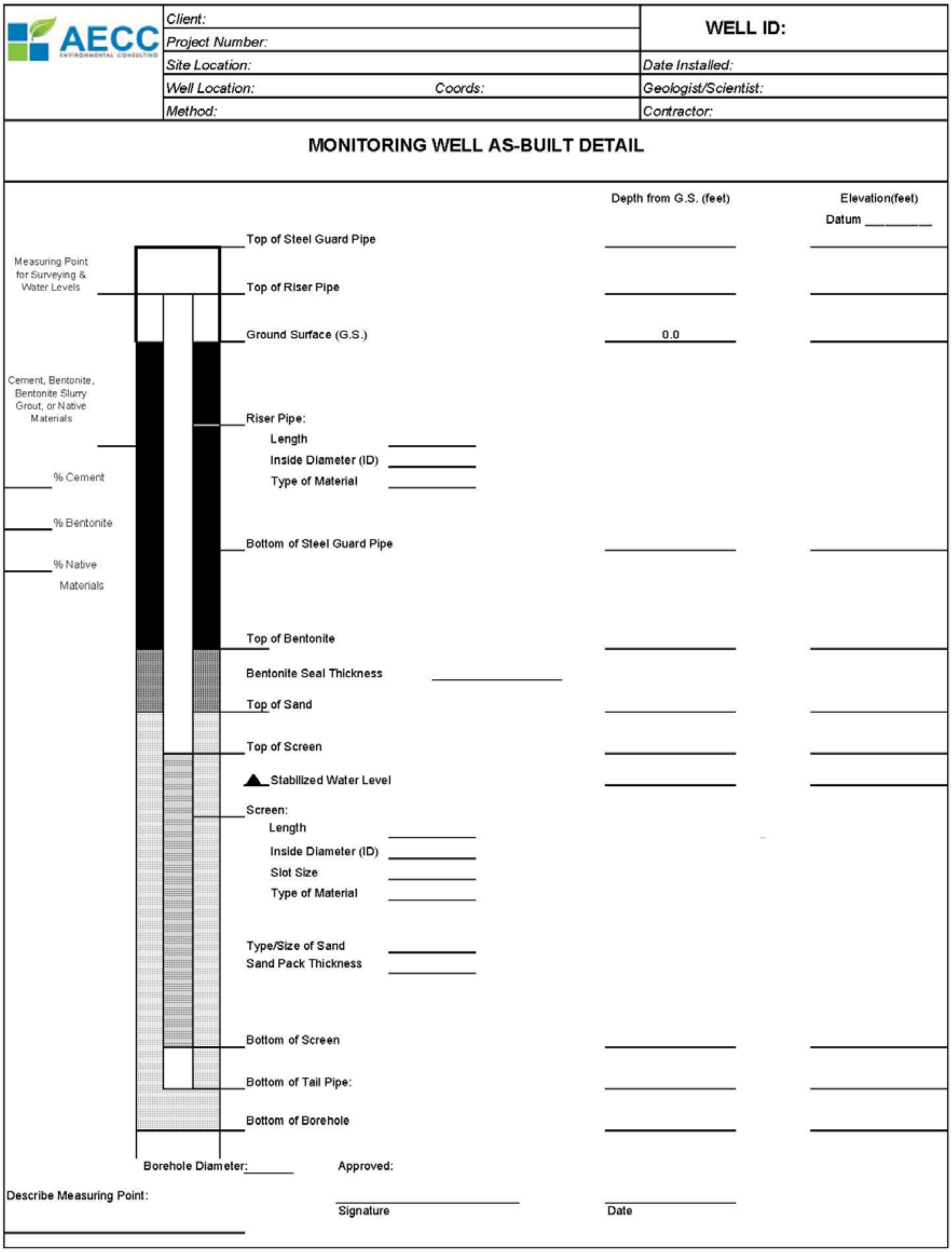
Documentation

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:

WELL ID:

Site Location:

Date Installed:

Well Location: Coords:

Geologist/Scientist:

Method:

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:

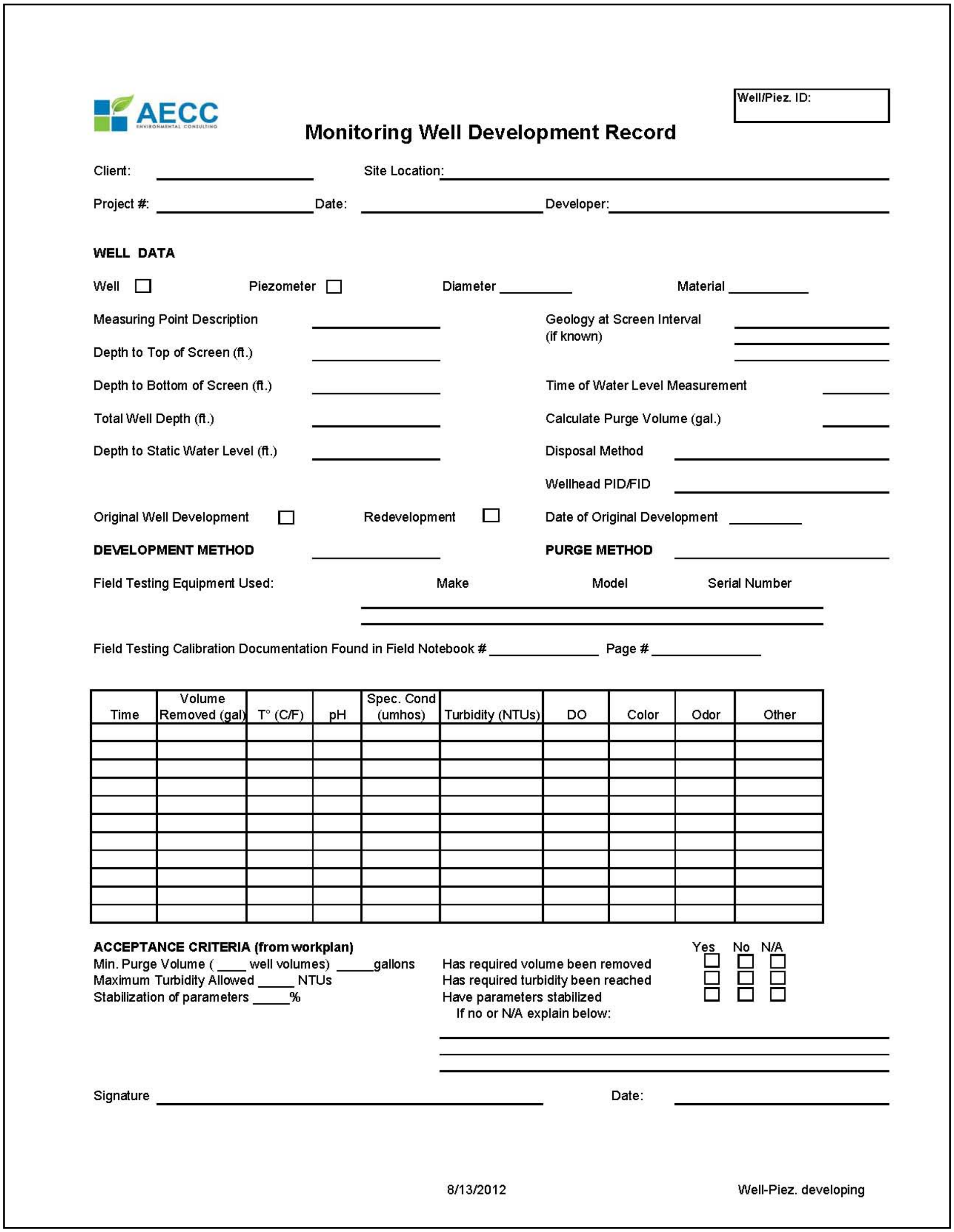
________ Signature

________ Date

Describe Measuring Point:

____

Figure 2
Monitoring Well Development Record



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 _____%

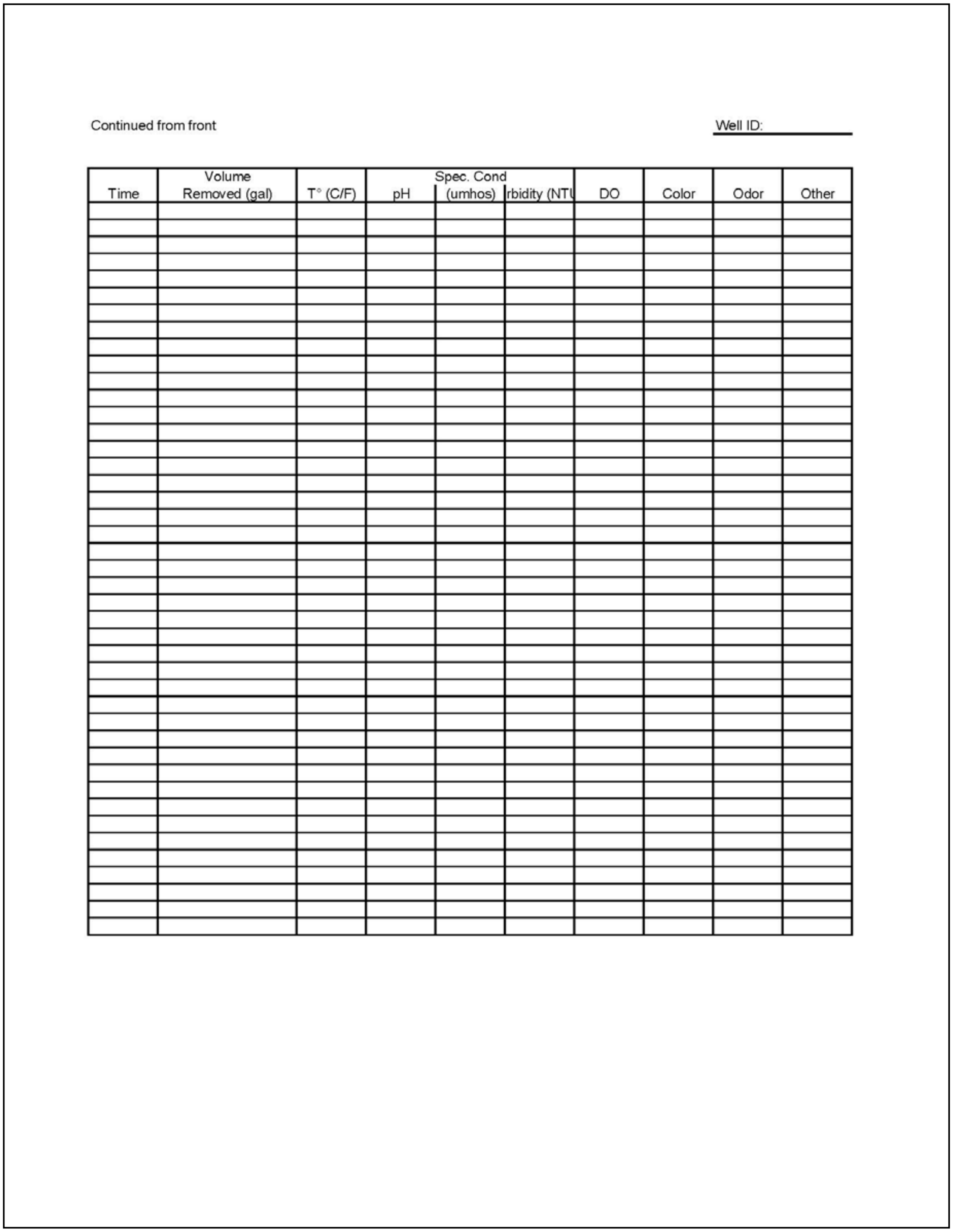
	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

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

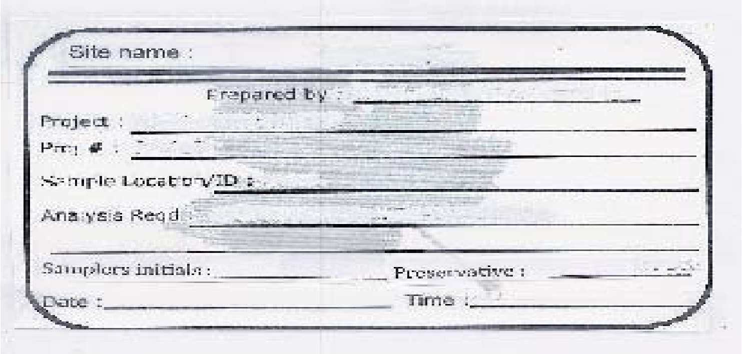
Sample containers shall be pre-labeled with blank adhesive label before samples are collected. The container shall be labeled using the adhesive labels provided by the analytical laboratory

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 :

Project : [redacted]

Proj # :

Sample Location/ID :

Analysis Reqd :

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

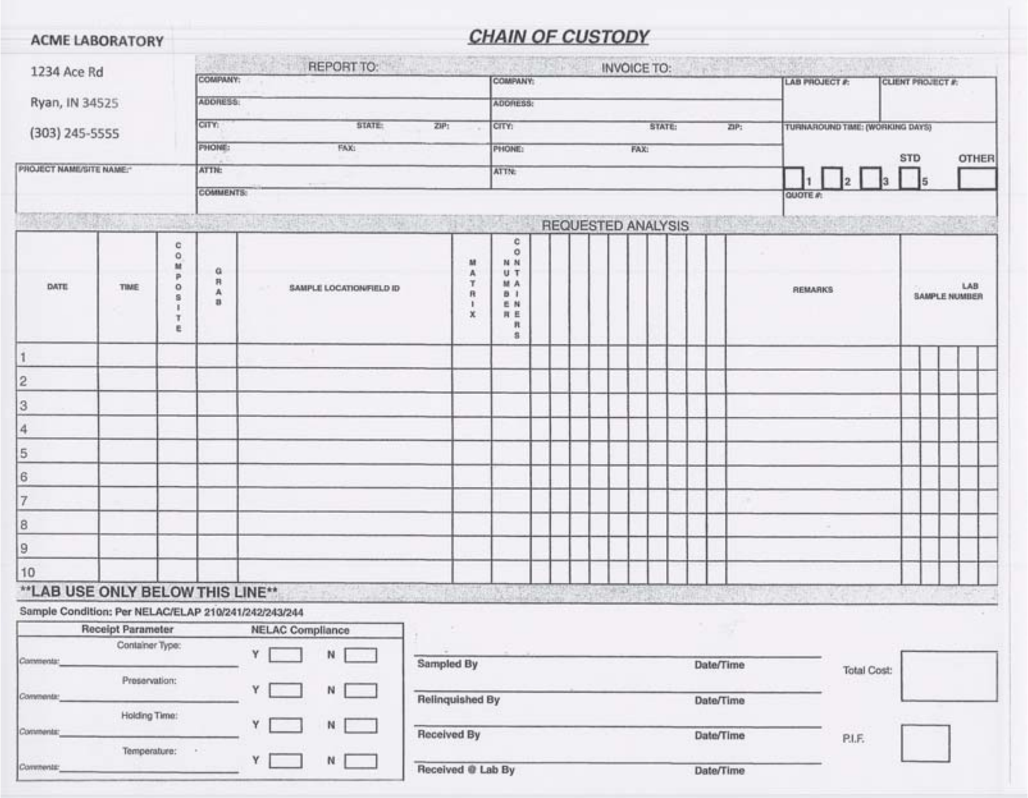
Prior to affixing a container label to a sample container, and then completing the label, the sampler shall review the project sampling plan/scope of work to ensure that the required label information has been recorded on the label.

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:

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

COMMENTS:

PROJECT NAME/SITE NAME:*

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

DATE	TIME	COMPOSITE	GRAB	SAMPLE LOCATION/FIELD ID	MATRIX	NUMBER CONTAINERS	REQUESTED ANALYSIS										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. ☐

	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	April 2021
			Revision Date:	Initial Version
SOP#116 – CORE DRILLING			Revision No.	0
			Next Revision Date:	As Needed
Preparation: Bryan Airel/Drew Brantner/George Fischer, Health and Safety Officer	Authority: Bryan Bowers, President	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)
- 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
- Appropriate cleanup and patching materials
    - Wet Vacuum
    - Rags, heavy duty towels, absorbent pads
    - Wire mesh
    - Patch / fill material (asphalt, mortar mix / concrete, bentonite)
    - Garbage bags or suitable disposal media

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, asphalt, 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, wet methods, HEPA filtration, etc.).
7. Have spotter positioned for safe work observation, including lower floor levels, as necessary.
8. Setup Core Drill in area of work per manufacturer's recommendations. Confirm anchors are securely fastened to drill rig.
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. Ensure the drill anchors or vacuum base is secured, 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 and water.
13. Begin coring at a slow pace. DO NOT rush or force through a concrete surface. If the drill has an amp / load meter, observe readings to ensure load does not exceed manufacturer's recommendations.
14. Pay attention to the amount of water being used and the speed of the drill. Maintain a steady and safe pace. Remove excess water as needed with shop vac / absorbent pads.
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 and water.
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.

Related AECC SOPs

SOP # 101 Surface and Shallow Soil Sampling
SOP # 102 Sample Handling, Packaging, and Shipping
SOP # 103 Equipment Decontamination
SOP # 108 Sample Labeling & COC Completion

<table>
<tr><td rowspan="3"></td><td colspan="2" rowspan="3">Asbestos & Environmental Consulting Corporation
Standard Operating Procedures</td><td>Doc No:</td><td>SOP #117</td></tr>
<tr><td>Initial Issue Date</td><td>April 2021</td></tr>
<tr><td>Revision Date:</td><td>Initial Version</td></tr>
<tr><td colspan="3" rowspan="2">SOP#117 – SAW-CUTTING (CONCRETE/ASPHALT/ETC.)</td><td>Revision No.</td><td>0</td></tr>
<tr><td>Next Revision Date:</td><td>As Needed</td></tr>
<tr><td>Preparation:
George Fischer, Health and Safety Officer</td><td>Authority: Bryan Bowers, President</td><td>Issuing Dept:
Environmental Group</td><td>Page:</td><td>1 of 3</td></tr>
</table>

Scope and Application

The purpose of this document is to establish a uniform set of procedures for saw-cutting through concrete building foundations, slabs, or similar materials in order to access the underlying material for assessment/screening/sampling. 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.

Saw-cutting is an effective method for allowing access to soil and groundwater beneath a building foundation or concrete slab.

Equipment/Apparatus/Supplies

Required materials include the following:

- Saw
- Saw blades (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 or face shields
    - 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

When using concrete or masonry cutting or drilling equipment:

- **always** follow the manufacturer’s instructions for safe use;
- **always** use the correct blade size recommended by the manufacturer. Oversize blades are dangerous;
- **never** remove the guards;
- Use a scaffold if the work cannot be safely reached from the ground; **never** work off ladders, milk crates, steel drums or chairs.
- **never** hold a hand-held saw or drill higher than shoulder height; and
- **never** use a hand-held saw for inverted cutting or drilling.

This procedure describes the general step-by-step process for performing saw-cutting activities. There are various models / types of saws 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 cut has no obstructions or utilities (review blueprints, provided plans, perform direct field observation, and perform other suitable means), or verify that obstructions may be cut and are not energized.
2. Obtain and only use the appropriate blades required for the substrate that is to be cut (concrete, asphalt, etc.).
3. Identify safe and appropriate electrical power and potable/amended water supply (as appropriate for the type of investigation being performed). **NEVER** dry-cut concrete or asphalt.
4. Cordon off work area, at least 10' on all sides surrounding the saw-cutting equipment if possible.
5. Don appropriate PPE (as defined in the HASP and manufacturers documentation), 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 saw in area of work.
9. Keep work area clear of excess water. Make sure electrical cords do not come in contact with water while cutting. Have wet-vac and absorbent pads or booms nearby to collect water, and wear footwear with slip-resistant soles.
10. Once all appropriate safety measures are in place and the operator and spotter are prepared, saw-cutting can begin.
11. Start the motor in rough alignment with the proposed cut.
12. Keep hands and feet away from saw blade.
13. Begin cutting 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 saw. Maintain a steady and safe pace. Always pay attention to the cutting conditions.
15. Pay attention to changes in the saw speed; changes in the material being cut will affect the cutting action. Reduce the speed of cut if necessary.
16. Once the end of the cut is reached, carefully extract the blade, turn off the water and shut down the saw. If additional cuts are required, reset for subsequent cuts and repeat.
17. Use wet vac and/or absorbent pads/booms to collect water and dispose of materials appropriately.
18. Decontaminate saw blade and other equipment before moving to other locations or prior to demobilization from the site.
19. Carefully remove the section(s) of slab (concrete/asphalt) to expose the underlying material for assessment/screening/sampling. It may be necessary to complete several cuts to keep slab pieces to manageable size. The use of spud bars for prying cut pieces out of the cut may be necessary. Pay careful attention to pinch points. Where possible,

the use of hydraulic equipment such as a mini excavator for removal of debris is encouraged.

20. Follow appropriate related AECC SOPs for sample collection or related activities.

Quality Assurance/Quality Control

All equipment must be operated in accordance with operating instructions as supplied by the manufacturer.

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

Saw-cutting 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.

Related AECC SOPs

SOP # 101 Surface and Shallow Soil Sampling
SOP # 102 Sample Handling, Packaging, and Shipping
SOP # 103 Equipment Decontamination
SOP # 108 Sample Labeling & COC Completion
SOP # 118 Test Pit Soil Sampling

	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP # 118
			Initial Issue Date	April 2021
			Revision Date:	November 2021
SOP# 118 – TEST PIT SOIL SAMPLING			Revision No.	1
			Next Revision Date:	TBD
Preparation: G. Fischer, Health and Safety Officer	Authority: Bryan Bowers, President	Issuing Dept: Environmental Group	Page:	1 of 5

Scope and Application

The purpose of this SOP is to lay out the specific standardized procedure to be used for collecting soil samples from test pits, trenches, or longwall cuts. Soil sampling conducted in accordance with this SOP will promote consistency in sampling and provide a basis for sample representativeness.

Test pit sampling involves the excavation of areas of soil, typically defined during the remedial investigative phase of a project. There may be instances where test pits are investigated during other phases of remediation as needed.

Test pit sampling methods are generally applicable to unconsolidated soil/fill materials to a depth of approximately 12-16 feet (or excavator reach) 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 defined based on individual project requirements throughout the depth of the test pit.

Test pit 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 excavation subcontractor performing the test pit activities is responsible for notifying Dig Safely New York or another Underground Facilities Protective Organization (UFPO).

The ability to excavate to a desired depth depends on the density and composition of the soil and the power of the hydraulic equipment. In most cases, a mini excavator will be adequate for excavation of test pits. In rare circumstances a larger piece of equipment may be needed if subsurface conditions reveal substantial debris (large pieces of concrete, steel, etc.).

At the direction of the project geologist/scientist, the excavation contractor will excavate the indicated test pit area and stage spoils on polyethylene sheeting as material is removed from the test pit. The project geologist/scientist will indicate to the excavation subcontractor's operator when material to be sampled is encountered and will collect samples directly from the excavator bucket as determined by the project geologist/scientist.

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 excavation subcontractor.

The project geologist/sampling engineer is also responsible for the collection of representative environmental characterization samples once the material has been removed from the test pit.

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

Excavation Subcontractor

The excavation subcontractor is responsible for providing the necessary equipment for obtaining subsurface soil samples. This generally includes the excavation equipment. It is the excavator subcontractor's responsibility to provide and maintain their own test pit 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)
- Stainless steel spoons, spatulas, soil mixing pans etc.
- Headspace analysis containers:
    - Glass jars and aluminum foil, or
    - Sealable plastic bags (ie – Ziploc® bags)
- Photoionization Detector (PID) or Flame Ionization Detector, (if volatile or semi-volatile organic compounds (VOCs / SVOCs) are expected)
- 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 Test Pit Sampling Procedure

1. Don PPE as per the project HASP.
2. Stage excavation equipment and polyethylene sheeting at the proposed test pit location.
3. 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.

4. At the direction of the project geologist/scientist, the excavation subcontractor will start excavation of the test pit, placing spoils from the test pit onto the polyethylene sheeting.
5. The project geologist/scientist will observe the excavation and maintain visual/auditory communication with the operator.
6. As targeted material is encountered, the project geologist/scientist will direct the operator to either place spoils on the polyethylene sheeting or stage the excavator bucket for visual classification/description, field screening and/or sampling for laboratory analysis.
7. Upon completion of the test pit, the hole is backfilled with spoils previously staged on the polyethylene sheeting.

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 excavator bucket has been staged for screening/sampling, the soils contained within can be sampled for laboratory analysis and classified. 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). Headspace analysis of a duplicate / split sample can be completed at this point (see SOP #120 – Headspace Analysis).

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 material from the test pit. 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 excavating test pits for collecting soil samples for VOC analysis, the excavation subcontractor shall not perform additional excavation until directed by the project geologist/scientist.

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

Test pit 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 test pit log. Occasionally, sample collection records are used to supplement test pit 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.

Related AECC SOPs

SOP # 101 Surface and Shallow Soil Sampling

SOP # 102 Sample Handling, Packaging, and Shipping
SOP # 103 Equipment Decontamination
SOP # 108 Sample Labeling & COC Completion
SOP # 109 Surface Water Sampling
SOP # 113 Taking Field Notes
SOP # 117 Saw Cutting
SOP # 120 Headspace Analysis

AECC ENVIRONMENTAL CONSULTING	Asbestos & Environmental Consulting Corporation Standard Operating Procedures		Doc No:	SOP #120
			Initial Issue Date	November 2021
			Revision Date:	Initial Version
SOP #120 – Headspace Analysis			Revision No.	0
			Next Revision Date:	As Needed
Preparation: George Fischer, Health and Safety Officer	Authority: Bryan Bowers, President	Issuing Dept: Environmental Group	Page:	1 of 8

Scope and Application

The purpose of this procedure is to establish a uniform set of procedures for collecting ambient concentrations of volatile vapors using a Photoionization Detector (PID) or Flame Ionization Detector (FID). The SOP is designed to be a step-by-step procedure for collecting the appropriate data. Equipment shall be operated in accordance with the manufacturer's operator's manual.

Typically, the vapors monitored by AECC personnel during environmental investigation / remediation projects can be divided into two general categories: organic vapors from petroleum products, and non-petroleum vapors such as vapors from chlorinated compounds. Vapors are monitored for a variety of reasons, including:

- Monitoring vapor levels in soil from borings/excavations as a means of establishing whether the material is contaminated and the approximate level of contamination.
- Monitoring vapor levels in the unsaturated (vadose) zone of in-situ soils as an indicator of whether the material is contaminated and the approximate level of contamination.
- Monitoring vapor levels in soil from excavations to establish whether the material must be considered hazardous and, therefore, disposed of accordingly.

Equipment/Apparatus/Supplies

Required materials include the following:

- Headspace analysis containers:
    - Glass jars and aluminum foil, or
    - Sealable plastic bags (ie – Ziploc® bags)
- Photoionization detector (PID) or Flame Ionization Detector
- Personal protective equipment (as required in HASP), including but not limited to:
    - Hard Hat
    - Safety Glasses or face shields
    - Steel toe boots with slip-resistant soles
    - Hearing protection
    - Gloves
    - High-Visibility Safety Vest
- Field project notebook/pen

Procedures

For the purpose of environmental assessment of soils during environmental investigation / remediation projects, two general methods monitor vapors can be identified: 1. headspace screening of collected soil samples, and 2. measurement of in-situ soil vapors (i.e., soil gas survey). The methodology for conducting a soil gas survey to monitor in-situ vapors is fully discussed in SOP #115, and therefore is not presented here.

AECC field personnel commonly conduct soil sampling for subsequent headspace sampling (commonly referred to as headspace screening). Similar methodology is also used at times to screen water samples to indicate the presence of dissolved phase contaminants. This practice is not however recommended for water except as a preliminary indicator, and as such it is not considered reliable. Even when performed on soils, headspace screening is qualitative at best, and should be used as a preliminary indicator of contamination for the selection of samples that will be laboratory analyzed. The following are recommended procedures for conducting headspace screening of volatile contaminated soil samples using a portable photoionization detector (PID) or flame ionization detector (FID).

This procedure is used to monitor vapor concentrations in collected soil samples (i.e., samples collected from boreholes during drilling or from open excavations while digging):

- The person(s) who are performing the sampling should not be wearing perfumes or colognes, as associated vapors may erroneously be recorded by the FID/PID. Similarly, the use of markers (i.e. – Sharpies®) should be avoided to the extent possible.
- Insert probe into sample container (glass jar or sealable plastic bag (ie – Ziploc® bags). Verify that the PID/FID reading is ‘zero’ (i.e. – that no vapors are emanating from the container).
- Half-fill the bag / jar with the sample to be analyzed.
- Quickly seal the bag, or cover the jar top with a sheet of clean aluminum foil and subsequently apply screw caps to tightly seal the jars. Bags / jars with a volume of 16 oz. (approx. 500 ml) or greater are preferred; bags / jars less than 8 oz. (approx. 250 ml) total capacity are not recommended.
- Allow headspace development for at least 10 minutes.
- Vigorously shake the bag / jar for 15 seconds both at the beginning and end of the headspace development period.
- Where ambient temperatures are below 32 F (0 C), headspace development should be within a heated vehicle or building. Soil samples should be at 50 F(10 C) or warmer.
- Note temperature and background VOC levels in field notes during screening.
- Subsequent to headspace development:
    - Bags: Create a small opening in the seal, and insert probe into the jar to about one-half of the headspace depth
    - Jars: Remove screw lid and expose foil seal. Quickly puncture foil seal with instrument sampling probe, and insert probe into the jar to about one-half of the headspace depth.
- Exercise care to avoid uptake of water droplets or soil particles
- Following probe insertion, record the highest meter response as the headspace concentration. For reference, gasoline-related compounds may achieve a maximum

response at about 2 to 5 seconds, while oil-related compounds may achieve a maximum response at about 10-15 seconds.

- Note that instrumentation with digital (LED/LCD) displays may not be able to discern maximum headspace response unless equipped with a "maximum hold" feature or strip-chart recorder.
- Erratic meter response may occur at high organic vapor concentrations or conditions of elevated headspace moisture, in which case headspace data should be discounted.
- When monitoring for petroleum hydrocarbon vapors, PID and FID field instruments shall be operated and calibrated to yield "total organic vapor" in ppm (v/v) as benzene, and PID/FID instruments must be operated with a 10.2* eV (=/-) lamp source.
    - Reference the operator's manual to verify if 10.2 eV is the correct energy level for optimum detection of the chemicals of concern. Many chlorinated solvents require higher (11.7) eV lamp.
- Operation, maintenance, and calibration shall be performed in accordance with the manufacturer's specifications. For jar headspace analysis, instrument calibration shall be checked/adjusted no less than once every 10 analyses, or daily, whichever is more frequent.
- Record all vapor measurements, other than those taken during drilling, onto a relevant form used to record project data, making certain to fully describe the sample location and sampling conditions so that the vapor monitoring procedure can be duplicated, if necessary.
- Measurements taken during drilling should be noted on the associated Boring Log (see SOPs #104 and/or #105, if applicable)
- Deviations, departures and/or additions to the above procedures will be considered on a case-by case basis by the regulatory representative, on-site coordinator or project manager. In such cases, compelling technical justification must be presented and documented by the methodology proponent.

Equipment Use

Calibration

One of the most important steps in analyzer operation is proper calibration of the instrument. Various calibration techniques may be used depending on the sample's physical or chemical property requiring measurement. Frequency of calibration depends largely on the application, degree of accuracy, and reliability expected. The following general procedures apply to calibration of field instruments typically used for field vapor monitoring (i.e., PIDs and FIDs):

- Perform calibration using a standard reference sample and utilize the analyzer adjustments recommended by the manufacturer.

- Consult the instrument supplier to determine the calibration procedure necessary for the particular analysis involved as preliminary instrument adjustments using zero and upscale standards may be necessary. Charts and calibration curves are essential and should be routinely verified.
- The standard used for calibration must be as representative as possible of the compound(s) to be analyzed (e.g., isobutylene to simulate benzene), although it cannot always contain representations of all potential interfering substances. Use a calibration standard of known concentration.
- Check all operating parameters of the system in accordance with the instrument specifications and data for specific analysis.
- Allow sufficient time for the analyzer to reach equilibrium as indicated by a stable output.
- Introduce the standard reference sample into the analyzer using the recommended instrument operational procedure. After sufficient standard has been allowed to flow through the analyzer, adjust the readout to conform with the benchmark value (this applies to the use of both zero gas and calibration gas). This establishes a single calibration point. Many newer instruments calibrate their readouts automatically during this procedure. Continue introducing standard sample and record analysis after a stable response is achieved. Discard any standard when any change in composition is detected.
- Specific instructions for calibrating each type of instrument are presented in the operational procedures presented below.

Flame Ionization Detectors (FIDs)

FIDs generate electrical current when gases containing carbon atoms are oxidized to carbon dioxide in a hydrogen flame and potential is applied across the flame. The magnitude of the electric current generated is termed the detector response. FIDs are responsive to hydrocarbon contaminants in a vapor stream and are commonly employed for this purpose. FIDs are durable for field use, and have a wide linear range and nearly uniform response to organic gas species. FIDs are generally unresponsive to inorganic gases and water vapor. Although versatile, these detectors are not selective for halogenated compounds (i.e., chlorinated organics). Also, They require supplies of fuel gas which require careful safety practices in handling and flame ignition. Older models of FIDs have analog (needle gauge) readouts while newer models are generally digital. The older models also contain more manual controls and adjustments while the newer computerized instruments perform certain standard functions (such as flame ignition and shut-down) automatically. The following are general procedures for operating a typical FID.

Procedures will vary from one brand to another and one model to another, so these procedures may not all apply to a specific instrument. A field instrument should never be used without first reading through the owner’s manual because improper operation of an FID is potentially dangerous and is likely to yield erroneous data.

- Review owner’s manual before use.

- CAUTION: The FID uses hydrogen gas which is extremely flammable and potentially explosive. Great care should be taken to avoid all external sources of ignition when re-filling the gas cylinder and when operating the instrument. Follow start-up and shut-down procedures exactly to avoid leakage of hydrogen gas. And follow all safety regulations for transporting flammable pressurized gases when transporting or shipping an FID.
- Always start with a fully charged battery and a half to full supply of hydrogen in the gas cylinder.
- Turn the instrument on and follow the designated start-up procedure for the specific unit: it will involve a sequence that includes opening the gas cylinder valve (some instruments will inform the user when to open the gas valve).
- Once the gas is turned on it must be ignited, either using a manual ignition switch or automatically by the instrument itself.
- Wait the appropriate time before igniting the flame (some instruments will prompt the user when ready for ignition).
- Observe flame (ignition) indicator; if the indicator does not show that the flame has ignited, repeat the flame ignition procedure according to instrument instructions.
- Once the flame has been ignited, allow the unit to stabilize for at least 5 minutes.
- Follow manufacturer’s instructions to calibrate the instrument to a zero reading. This will involve connection of the instrument probe to a container of ‘zero gas’ (i.e., ultra-clean air) which allows the instrument to be ‘zeroed’. If zero air gas is unavailable, the instrument can be zeroed to clean ambient air (i.e., move away from work areas, storage facilities, motor vehicles and any other potential source of vapors before calibrating).
- Follow manufacturer’s instructions to calibrate the instrument using a standard calibration gas. This will involve connection of the instrument probe to a container of calibration gas (standard calibration gas is a known concentration of isobutylene in air). Generally, the ‘response’ of the calibration gas against the actual contaminant (e.g., isobutylene to benzene) must be entered into the calibration sequence - the owner’s manual should provide a procedure and conversion table to facilitate this. This will adjust the instrument’s response so that it will read the concentration of the actual contaminant correctly.
- When calibration is completed, the instrument is ready to use.
- If the instrument has a manual range setting (e.g., readout x10, x100, x1,000) set it for the anticipated contaminant concentrations.
- Place the end of the sampling probe near the material being tested. Air will be drawn into the probe by suction.
- Read vapor concentrations on the appropriate scale.
- DO NOT allow pressure in the gas cylinder to drop below a prescribed amount (about 50 psi) because loss of pressure will cause contamination of the cylinder.

- When finished using the instrument, check the amount of charge left in the battery and the pressure in the gas cylinder.
- Follow the manufacturer's instructions for shutting the instrument off. It is extremely important to be certain the flame has been properly extinguished and the gas flow turned completely off.
- If gas in the cylinder is not sufficient for another day's use, refill the cylinder with hydrogen gas following all safety precautions involving hydrogen.
- If the battery is not sufficiently charged for another day's use, recharge it. Note in the owner's manual if there is a maximum allowable recommended charging time and don't exceed it (some battery chargers automatically shut off and some don't). Also, certain types of batteries last longer if fully discharged before recharging while others can be damaged by fully discharging them. Find out what kind of battery your instrument has and treat it accordingly.
- Most instruments have one or more filters (air inlet and/or outlet filters) that should be removed, inspected and cleaned between daily uses.

Photoionization Detectors (PIDs)

PIDs employ ultraviolet radiation to ionize contaminant molecules. Positive ions and free electrons are formed which migrate to the detector electrode(s), resulting in an electric current that is proportional to contaminant concentration at the detector. PIDs are extremely sensitive to aromatic hydrocarbons due to the great efficiency of ionization of pi bonds under ultraviolet radiation. Efficiency of ionization of sigma bonds is lower, resulting in a higher PID detection limit for aliphatic hydrocarbons. The selectivity of the method can be adjusted by selecting lamps of different energies, causing a change in response of contaminants with fixed ionization potentials to changing lamp energies. Tables exist of ionization potentials of compounds within classes common to vapor-phase contaminants. Methane has an ionization potential higher than the energies of commercially available lamps, limiting the PID to detection of compounds other than methane. PIDs are further limited by their tendency to conceal the presence of low-sensitivity compounds when high sensitivity compounds (aromatics) are present. PID response can be impacted by condensation of water vapor in the lamp. As with FID, older models of PIDs have analog (needle gauge) readouts and manual controls while newer models are generally computerized and digital. The following are general procedures for operating a typical PID.

Procedures will vary from one brand to another and one model to another, so these procedures may not all apply to a specific instrument. A field instrument should never be used without first reading through the owner's manual because improper operation of an PID can yield erroneous readings.

- Review owner's manual before use.
- Check to see that the battery is properly charged before use.
- Follow manufacturer's instructions to calibrate the instrument to a zero reading. This will involve connection of the instrument probe to a container of 'zero gas'(i.e., ultra-clean air) which allows the instrument to be 'zeroed'. If zero air gas is unavailable, the

instrument can be zeroed to clean ambient air (i.e., move away from work areas, storage facilities, motor vehicles and any other potential source of vapors before calibrating).

- Follow manufacturer's instructions to calibrate the instrument using a standard calibration gas. This will involve connection of the instrument probe to a container of calibration gas (standard calibration gas is a known concentration of isobutylene in air). Generally, the 'response' of the calibration gas against the actual contaminant must be entered into the calibration sequence - the owner's manual should provide a procedure and conversion table to facilitate this. Also PIDs generally have a 'span' setting that is used to calibrate the instrument to a known gas. Follow manufacturer instructions regarding the proper span setting as this is critical for obtaining accurate readings.
- When calibration is completed, the instrument is ready to use. If the instrument has a manual range setting (e.g., readout x10, x100, x1,000) set it for the anticipated contaminant concentrations.
- Place the end of the sampling probe near the material being tested. The internal fan will draw an air sample through the probe tip. Avoid placing the probe too close to the sample to reduce the intake of excessive soil and dirt which may damage the probe or cause the fan to lock.
- PID readings are relative to the ambient air temperature; the same sample will yield a higher concentration reading at a higher ambient air temperature than at a lower air temperature. For consistency, monitor all soil samples at room temperature (not less than 70 degrees F (21o C)).
- Record the ambient air temperature at which the samples were measured.
- Be particularly careful not to allow the probe to suck in moisture. Even a small amount of moisture can condense on the lamp and affect its performance (or cause it to stop working). If this happens, shut off the instrument and follow the owner's manual procedures for disassembling, inspecting and cleaning the lamp. Be extremely careful not to scratch or mar the surface of the lamp when cleaning or drying it Use only a very soft cloth or tissue. In-line moisture traps are available for use in wet conditions.
- Some PIDs are sensitive to air currents; widely fluctuating readings will usually indicate air movement past the end of the probe.
- When finished using the instrument, check the amount of charge left in the battery. Follow the manufacturer's instructions for shutting the instrument off. If the battery is not sufficiently charged for another day's use, recharge it. Follow manufacturer's instructions regarding recommended battery charge/discharge procedures.
- Inspect the lamp between daily uses to make sure its surface is clean, dry and undamaged. If cleaning is necessary, follow the owner's manual procedures for disassembling, inspecting and cleaning the lamp. Be extremely careful not to scratch or mar the surface of the lamp when cleaning or drying it Use only a very soft cloth or tissue. If the lamp surface is scratched, inform the person in charge of instrument maintenance.
- Most instruments have one or more filters (air inlet and/or outlet filters) that should be removed, inspected and cleaned between daily uses.
- PIDs are outfitted with 10.2 eV lamps for monitoring petroleum hydrocarbon vapors. This lamp will not detect methane nor will it detect the volatilized halogenated (chlorinated)

compounds. To monitor chlorinated compounds, an 11.7 eV lamp must be used. The 11.7 eV lamp cannot be used to monitor petroleum hydrocarbons.

Documentation

All data must be documented on field data sheets and/or field notes. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

Related AECC SOPs

SOP # 101 Surface and Shallow Soil Sampling Using Hand-Operated Sampling Equipment
SOP # 104 Split-Spoon Soil Sampling
SOP # 105 Direct-Push Soil Sampling
SOP # 110 Field Monitoring Equipment Calibration
SOP # 115 Vapor Sampling
SOP # 118 Test Pit Soil Sampling

Appendix B

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

Remedial Investigation

NYSDEC BCP #C633090

Former Rome Turney Development Site
City of Rome, Oneida County, New York

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 Former Rome Turney Development 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 # C633090, which was executed on March 12, 2021.

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).

Project Manager

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 Leader

The Field Team Leader has responsibility for implementation of specific project tasks identified at the Site, including supervision of project field personnel, subconsultants, and subcontractors. The Field Team Leader reports directly to the Project Manager and 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 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
Bryan Bowers	Rome Turney, LLC	315.432-9400	Owner Contact
Peter Taylor	NYSDEC	315.785.2511	Regional HW Engineer
Rachel K. Gardner	NYSDEC	315.785.2522	DEC Project Coordinator
Stephanie Selmer	NYSDOH	518.402.7860	DOH Project Coordinator
Richard McKenna	AECC	315.432.9400	Project Manager
Robert G. Harner	Lakeside Engineering	607.725.5824	Project Engineer
George Fischer	AECC	315.432.9400	Health & Safety Officer
Richard McKenna	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 sampling was performed previously in 2019 and 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 forth in 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.

DATA QUALITY OBJECTIVES FORM - SOIL

Site Name/Location: The Former Rome Turney Development Site (BCP Site # C633090)
109 Canal Street
City of Rome
Oneida County, New York

Sample Objectives: Determine nature and extent of soil contamination.

Sampled Media:

__Groundwater __Sediment __Surface water _X_Soils __Waste Material

Data Use:

_X_Site characterization __Health and Safety __Monitoring
__Risk assessment __Evaluate remediation alternatives

Data Types:

_X_ SW-846 _X_PCB _X_VOCs _X_Semi-VOCs (including 1,4-dioxane)
_X_Metals (including mercury and lead) _X_Herbicides _X_Pesticides
_X_PFAS

Parameters:

__pH __Sp.Cond __Turb __Temp __Do __ORP

Level of Analysis: _X_ Level I: Field Screening
Portable instruments providing real-time data
1. Photo Ionization Device (PID)

___ Level II: Field Analysis
Portable analytical instruments in an on-site laboratory or transported to site

___ Level III: ASP Analytical Methods
Samples will be analyzed in accordance with NYSDEC-ASP 2005 (see below)

_X_ Level IV: ASP Reportables/Deliverables
NYSDEC-ASP 2005 Category B Reportables/Deliverables

Sampling Procedures:
Sampling Procedures are described within the Sampling and Analysis Plan (within the text of the Remedial Investigation Work Plan).

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

QA/QC Samples:
_X_Duplicate (Split) _X_Matrix Spike _X_Matrix Spike Duplicate
___Field Blank ___Trip Blank ___Equipment Blank

DATA QUALITY OBJECTIVES FORM - WASTE

Site Name/Location: The Former Rome Turney Development Site (BCP Site # C633090)
109 Canal Street
City of Rome
Oneida County, New York

Sample Objectives: To collect data that allows a disposal facility to accept waste material.

Sampled Media:

_X_Groundwater __Sediment __Surface water _X_Soils _X_Waste Material

Data Use:

__Site characterization __Health and Safety __Monitoring
__Risk assessment __Evaluate remediation alternatives _X_Disposal

Data Types:

__ SW-846 __ TCLP __ SCLP X Other: As requested by disposal facility

__ TCL VOCs __ TCL SVOCs __ TAL Metals __ PCBs __ Herbicides __ Pesticides
__ Cyanide __Mercury __ Lead __TPH X Other: As requested by disposal facility

Parameters:

__pH __Sp.Cond __Turb __Temp __Do __ORP

Level of Analysis:

__ Level I: Field Screening
Portable instruments providing real-time data
1. Photo Ionization Device (PID)

___ Level II: Field Analysis
Portable analytical instruments in an on-site laboratory or transported to site

_X_ Level III: ASP Analytical Methods
Samples will be analyzed in accordance with NYSDEC-ASP 2005 (see below)

__ Level IV: ASP Reportables/Deliverables
NYSDEC-ASP 2005 Category B Reportables/Deliverables

Sampling Procedures:
Sampling Procedures will be dictated by the disposal facility.

Data Quality Factors:
Analytical Detection Limits will be consistent with the requirements of the disposal facility.

QA/QC Samples:
__ Duplicate (Split) __ Matrix Spike __ Matrix Spike Duplicate
__ Trip Blank __Equipment Blank

DATA QUALITY OBJECTIVES FORM - GROUNDWATER

Site Name/Location: The Former Rome Turney Development Site (BCP Site # C633090)
109 Canal Street
City of Rome
Oneida County, New York

Sample Objectives: Determine nature and extent of groundwater contamination.

Sampled Media:

_X_Groundwater __Sediment __Surface water ___Soils __Waste Material

Data Use:

_X_Site characterization __Health and Safety __Monitoring
__Risk assessment __Evaluate remediation alternatives

Data Types:

_X_ SW-846 _X_PCB _X_VOCs _X_Semi-VOCs (including 1,4-dioxane)
_X_Metals (including mercury and lead) _X_Herbicides _X_Pesticides
_X_PFAS

Parameters:

_X_pH _X_Sp.Cond _X_Turb _X_Temp _X_Do _X_ORP

Level of Analysis:

___ Level I: Field Screening
Portable instruments providing real-time data

_X_ Level II: Field Analysis
Portable analytical instruments in an on-site laboratory or transported to site

1. Multi-parameter groundwater quality meter for field parameters

___ Level III: ASP Analytical Methods
Samples will be analyzed in accordance with NYSDEC-ASP 2005 (see below)

_X_ Level IV: ASP Reportables/Deliverables
NYSDEC-ASP 2005 Category B Reportables/Deliverables

Sampling Procedures:
Sampling Procedures are described within the Sampling and Analysis Plan (within the text of the Remedial Investigation Work Plan).

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

QA/QC Samples:
_X_Duplicate (Split) _X_Matrix Spike _X_Matrix Spike Duplicate
___Field Blank _X_Trip Blank ___Equipment Blank

Appendix C

Health and Safety Plan

HEALTH AND SAFETY PLAN

Remedial Investigation Work Plan
Former Rome Turney Development Site (#C633090)
109 Canal Street, City of Rome, Oneida County, New York

EMERGENCY CONTACT NUMBERS	
Emergency Response Number	911
Poison Control Center	(800) 222-1222
Rome Police Department	(315) 339-7780

NEAREST HOSPITAL	
Rome Memorial Hospital 1500 North James Street Rome, New York 13440	(315) 338-7000

OWNER		
City of Rome (315) 336-6000	Public Safety Commissioner	Frank Retrosi (315) 339-7655

ENVIRONMENTAL CONSULTANT		
Lakeside Engineering (607)725-5824	Field Team Manager	Robert G. Harner, P.E.
Asbestos & Environmental Consulting Corporation (AECC) (315) 432-9400	Project Manager	Richard McKenna
	Safety Coordinator	George Fischer (315) 569-0474

DRILLING SUBCONTRACTOR		
TBD	HSO	TBD
	Supervisor	TBD
	Operator	TBD

August 2021

REVISION #	DATE	SUMMARY OF REVISION

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FIGURES

ATTACHMENTS

1.0 INTRODUCTION

A Brownfield Cleanup Program remedial investigation is being performed at the Former Rome Turney Development Site (hereafter "Site", see Figure 1).

This project-specific Health and Safety Plan (HASP) sets forth requirements for maintaining the health and safety of persons 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 on-site work activities. Any Contractors or 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 Section, which presents the procedures to be followed in the event of an emergency.

2.0 GENERAL DEFINITIONS

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

- *Contamination Reduction Zone* – Transition area between the contaminated Exclusion Zone and clean Support Zone. Decontamination stations are in this zone.
- *Contractor* – Any contractor responsible for performing work that will disturb contaminated Site soils / groundwater or involve management of other contaminated waste streams such as IDW or decontamination residues.
- *Environmental Consultant* – A consultant to the Owner / Volunteer 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.
- *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 contaminated or potentially contaminated media (soil, groundwater, etc.) (i.e., investigations and potential interim remedial measures).
- *Site* – The subject property where the disturbance of contaminated media may occur.
- *Subcontractor* – All subcontractors to the Environmental Consultant and / or 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 shall be staged 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		
City of Rome (315) 336-6000	Public Safety Commissioner	Frank Retrosi (315) 339-7655
VOLUNTEER		
Rome Turney, LLC (315) 432-9400	BCP Volunteer	Bryan Bowers
ENVIRONMENTAL CONSULTANTS		
Lakeside Engineering (607)725-5824	Field Team Manager	Robert G. Harner, P.E.
Asbestos & Environmental Consulting Corporation (AECC) (315) 432-9400	Project Manager	Richard McKenna
	Safety Coordinator	George Fischer
	Field Scientist	TBD
DRILLING / EXCAVATION SUBCONTRACTOR		
TBD	HSO	
	Supervisor	
	Operator	
GOVERNMENTAL AGENCIES		
NYS Department of Environmental Conservation (NYSDEC) (315) 785-2522		Rachel K. Gardner
NYS Department of Health (NYSDOH) (518) 402-7860		Stephanie Selmer

This HASP will be periodically reviewed by all parties throughout the project to verify that it is applicable to operations being conducted at the site. Changes in site conditions or changes in the remedial approach at the site may require modification of the HASP. The Subcontractor's HSO shall contact the Environmental Consultant and Contractor if site conditions warrant modifications to the HASP, and vice versa. Changes, modifications, and amendments to the HASP will be documented in the Summary of Revision table found on the cover page of this document.

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

- Verifying 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 logbook 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 & safety briefings at the Site
- Verify that first aid kits, eye wash kits, and fire extinguishers are present 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
- Maintain required documents for recordkeeping purposes

4.0 SITE HAZARDS EVALUATION

4.1 Chemical Hazards

Soil and groundwater from discrete areas of the site have been sampled for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), heavy metals, PCBs, pesticides, and herbicides. Additionally, petroleum-contaminated soil and groundwater was observed during the removal of underground storage tanks (USTs) at the site, resulting in a total of approximately 2,900 tons of petroleum-contaminated soil and 115,000-gallons of petroleum-contaminated groundwater being excavated, transported, and disposed of in 2019.

The associated laboratory analysis and on-site observations revealed that the following chemicals / materials of concern exist / remain at the Site.

- VOCs (petroleum/gasoline-related compounds)
- SVOCs (petroleum/oil-related compounds and Polycyclic Aromatic Hydrocarbons - PAHs)
- Select Metals (Arsenic, Cadmium, Chromium, Lead, Mercury, and Selenium)
- Pesticides (DDT and DDE)

Fact sheets for the compounds listed above are presented in Appendix A.

As the remedial investigation progresses and additional data is collected, HASP shall be updated accordingly.

The chemicals of potential concern may enter the human body in several ways. The chemical routes of exposure anticipated from remedial activities at this Site include:

- *Absorption* - Dermal (skin) contact with impacted soil and groundwater 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 HASP will minimize risks of exposure at the Site.
- *Ingestion* - 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.

- *Inhalation* – Chemicals of concern, both volatilized and attached to dust and particulates, become airborne by wind and are subsequently inhaled through the nose and / or mouth. This exposure route is the most likely cause for worker exposure to occur on-site. The Contractor shall employ excavation methods that minimize the creation of dust and utilize dust suppression techniques to minimize airborne dust and particulates. The Subcontractor is solely responsible for personal air monitoring of their employees.

4.2 Physical Hazards

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

- The use of 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 operated only by trained, experienced personnel. Personnel must remain outside the turning radius of large, moving equipment, unless necessary. 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 listed above represents those anticipated to be utilized during on-site work activities but is not meant to be all-inclusive. Similar precautions should be used around all mechanical equipment.
- 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).
- 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 to identify and remove slip, trip, and fall hazards prior to the commencement of 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, asked to avoid it during work activities.
- The potential for fire and / or explosion is always a concern. 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 should be handled by professionals. The proper authorities should be notified in these instances.
- Persons working outdoors in temperatures at or below freezing may be subject to frostbite. Extreme cold 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 to extremities are categorized:

  - 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 that may arise during summer. Heat stress can be the result of several contributing factors, including environmental conditions, clothing, and workload as well as the overall physical condition of the individual. Since heat stress is one of the most common injuries / symptoms associated with outdoor work, and 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 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.
- It should be noted that there are no known overhead or underground utilities within or adjacent to the proposed remedial work areas.

4.3 Biological Hazards

It is anticipated that biological hazards will be present on the project site. Poisonous plants may be found along the tree lines, and adjacent to structures, along with ticks and other biting insects. Stinging insects, such as bees and wasps may build nests inside of monitoring wells or be within proximity of the work zone. Below is a discussion of the most common biological hazards found on project sites, and those anticipated being of concern here.

During field work employees are at risk of being exposed to poisonous plants, insects, spiders and snakes. The two most prevalent biological hazards are poison ivy and ticks.

Ticks
Ticks transmit bacteria that cause illnesses such as Lyme disease or Rocky Mountain spotted fever. Ticks wait for host from the tips of grasses and shrubs (not from trees). When brushed by a moving person, they quickly let go of the vegetation and climb onto the host. Ticks can only crawl; they cannot fly or jump. Tick season typically lasts from April through October; peak season is May through July; seasons can vary depending on climate. Ticks can be active on winter days when the ground temperatures are about 45° F.

The best way to protect yourself against tick borne illness is to avoid tick bites. This includes avoiding known tick-infested areas. However, if you visit wooded areas or areas with tall grass and weeds, follow these precautions to help prevent tick bites and decrease the risk of disease:

- Wear protective clothing such as long-sleeved shirts, long trousers, boots or sturdy shoes and a head covering. (Ticks are easier to detect on light-colored clothing.)
- Tuck trouser cuffs in socks. Tape the area where pants and socks meet so ticks cannot crawl under clothing.
- Apply insect repellent containing 10 percent to 30 percent DEET or 5 percent to 10 percent picaridin primarily to clothes. Apply sparingly to exposed skin. Do not spray directly to the face; spray the repellent onto hands and then apply to face. Avoid sensitive areas like the eyes, mouth and nasal membranes. Be sure to wash treated skin after coming indoors.
- Use repellents containing permethrin to treat clothes (especially pants, socks and shoes) but not skin. Always follow label directions; do not misuse or overuse repellents.
- Those who wish to avoid the use of insect repellent or treated clothing should consider the use of the Original Bug Shirt® and pants, and tick/chigger garters.
- Personnel should carefully inspect themselves each day for the presence of ticks or any rashes. This is important since prompt removal of the tick can prevent disease transmission. Removal of the tick is important in that the tick should not be crushed and care must be taken so that the head is also removed. Contact the RSHEM for guidelines on removing ticks.
- If prompt removal by proper methods is not possible, it is better to remove the tick, even if the head remains embedded in the skin. The body will react to the embedded head similar to a splinter. Typical redness and swelling may develop at the bite site.
- DO NOT burn or cover the tick with petroleum jelly, soap, etc. to force the tick to withdraw. In order to withdraw, a tick must regurgitate, thus increasing the chance of infectious disease.
- Report tick exposure and bites to your supervisor.

Wasps and Bees

Wasps (hornets and yellow jackets) and bees (honeybees and bumblebees) are common insects that may pose a potential hazard to the field team if work is performed during spring, summer, or fall. Honeybees tend to build their hives in aboveground cavities such as tree hollows, soffits, and wall cavities. Wasps make a football-shaped, paper-like nest either below or above the ground. Yellow jackets tend to build their nests in the ground while hornets tend to build their nests in trees and shrubbery. To avoid bees and wasps:

- If you see insects flying to and from a particular place, avoid it
- If you are going to be in an area where disturbing a nest is likely, wear long pants and a long-sleeved shirt. Insect repellent applied to your skin or clothing will not deter these stinging insects.
- Wear light colored clothing.
- Remain as calm as possible if a bee or wasp lands on your skin. If you don't want to wait for it to leave, gently and slowly brush it away. Crushing it can release pheromones that could trigger hivemates to swarm / attack.
- It is best not to wear perfume, cologne, or other scented soaps or scented shampoos as this attracts bees and wasps.

- Never swing, strike or run rapidly away since quick movement often provokes attack and painful stings.

When a wasp or a bee stings a person, it injects a venomous fluid under the skin. The venom causes a painful swelling that may last for several days. A single wasp may sting multiple times. Honeybee typically sting once, leaving their stinger lodged in the skin. Try not to rub or scratch the sting site. Wash the sting site with soap and water. Apply a cold or ice pack wrapped in cloth for a few minutes. If stung by a honeybee, gently scrape the area of the sting using a blunt object like a fingernail or a credit card to remove the stinger. If removed within 15 seconds of the sting, the severity of the sting is reduced.

If you develop hives, difficulty breathing or swallowing, wheezing or similar symptoms of allergic reaction, SEEK MEDICAL ATTENTION IMMEDIATELY. People with known allergies to insect stings should NEVER work alone. A person with a history of severe allergic reaction to an insect sting may be advised by their physician to carry an insect sting allergy kit to counteract the allergic reaction whenever they may encounter stinging insects. Also, they should consider wearing a medical ID bracelet and notify others on the field team.

Poisonous Plants

Persons working on the site should be aware of the possible presence of poisonous plants. Poison ivy is a climbing plant with leaves that consist of three glossy, greenish leaflets. Poison ivy has conspicuous red foliage in the fall. Small yellowish-white flowers appear in May through July at the lower leaf axils of the plant. White berries appear from August through November. The leaves, roots, stems and fruit of these poisonous plants contain urushiol, which binds to skin cells within 30 – 120 minutes after contact. Typically 1-3 days after contact with the irritating oil, the area of contact exhibits an intensely itching skin rash and characteristic blister-like lesions. The oil can be transmitted on soot particles when burned and may be carried on the fur of animals, equipment and apparel.

Proper identification of these plants is the key to preventing contact and subsequent dermatitis (see below).

Poison Ivy • Grows in West, Midwest, Texas, East • Several forms – vine, trailing shrub, or shrub • Three leaflets (can vary 3-9) • Leaves green in summer, red in fall • Yellow or green flowers • White berries	

Wear long sleeves and pants when working in vegetated areas. In areas of known infestation, wear Tyvek coveralls and gloves. Oils are easily transferred from one surface to another if contact is made with these poisonous plants. Wash all exposed surface areas (plastic sheeting, tools, glove, equipment, etc.) in contact with poison ivy with cool soapy water or product specifically designed to remove / neutralize urushiol (Tecnu Poison Oak-n-Ivy Cleanser or similar).

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 always be worn by on-site personnel when tasks are performed which DO NOT INVOLVE dermal exposure, or contact with chemical hazards:

- Standard outer garments (i.e. long pants and shirts with sleeves)
- Durable leather steel-toed work boots
- Eye protection
- Hard hat
- Hearing protection as required

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 of contaminated or potentially contaminated soils:

- 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 with rubber booties or steel-toed rubber work boots
- Disposable nitrile gloves. Personnel will frequently verify the integrity of their gloves by checking for holes or tears.
- Eye protection
- Hard hat
- Hearing protection as required

Respirator use is not anticipated for 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 Environmental Consultant’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 enough grounds to preclude personnel from conducting work activities where respiratory protection is required.

6.0 PERSONNEL TRAINING

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 Subcontractor 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 Subcontractor’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.

6.2 Site Orientation Meeting

Subcontractors will be responsible for attending a mandatory site orientation meeting, which will be organized by the Environmental Consultant's HSO. Subcontractor personnel will also be required to attend additional site orientation meetings, as well as Health and Safety meeting, as determined by the HSO. Attendees will document their attendance by signing the Site Orientation Meeting Attendance Acknowledgment Form. The following topics are generally covered during Site Orientation Meetings:

- Names and responsibilities of key personnel
- Safe work practices
- Personal protective equipment
- Chemical and physical hazards
- Site equipment
- 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. The HSO is responsible for verifying that all personnel's training certificates remain current throughout 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 (see also, Section 6.3 above).

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 potential hazards for each task are presented herein.

8.1 General SOPs

Workers shall adhere to the established SOP for their respective tasks. Work at the Site will be conducted in accordance with established procedures and guidelines in order to protect the health and safety of all involved. General SOPs at the Site include the following:

- All questions should be referred to the Environmental Consultant's HSO & Project Manager and Subcontractor's HSO.

- All on-site personnel shall be trained and briefed on anticipated hazards, PPE to be worn, safety practices to be followed, emergency procedures, and communications.
- Site inspections will be conducted to ensure compliance with the HASP, and if any change in operation occurs, the HASP will be modified accordingly.
- Be observant of not only one's immediate surroundings but also those of others performing work at the Site.
- On-site personnel performing work inside the work zone will act as safety backup for each other, and on-site personnel outside the work zone will provide emergency assistance (as necessary).
- Take extra precautions when working near heavy equipment.
- Always communicate verbally and use hand signals (as necessary). This communication should occur between on-site personnel, HSO, and Project Manager.
- Work breaks should occur (as necessary) in order to prevent heat, cold, stresses, accidents, and fatigue.
- Work areas for various operational activities should be well established.
- Strict pedestrian and vehicular traffic control will be maintained at all times at the Site.
- Entrance / exit locations and emergency escape routes will be designated and delineated.
- On-site personnel and equipment within each work area will be minimized in order to maintain effective Site operations.
- Required PPE ensembles must be worn by all on-site personnel entering designated PPE work areas. At a minimum, hard hat, safety glasses, and steel-toe boots shall always be worn at the project Site.
- Work areas and decontamination procedures will be established prior to the start of on-site work activities. Procedures will be established based on projected Site conditions.
- Establish work procedures and designated decontamination areas in order to minimize contamination exposure.
- Contaminated equipment shall not be placed on unprotected surfaces.
- Procedures for leaving work areas will be established 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.

Violation of these SOPs will result in immediate dismissal from the Site.

8.2 Site Control Measures

Site control measures will minimize potential contamination exposure to on-site personnel, protect the public from on-site hazards, and prevent theft / vandalism of equipment and materials. Site control measures also enhance the team's emergency response. For this project, the primary site control measure will be temporary fencing or similar barrier installed along the perimeter of the Site's boundary for the duration of the project.

Areas where intrusive work will occur will be routinely divided into three distinct areas: Exclusion Zone, Contamination Reduction Zone (CRZ) and Support Zone.

Exclusion Zone
The Exclusion Zone is designated as the area where the highest potential for dermal or inhalation exposure exists. The Exclusion Zone coincides with areas being excavated (test pits, soil borings, monitoring well installations, etc.). PPE is required and a daily log will be kept for all personnel entering this zone. The Exclusion Zone for work areas will be demarcated with temporary fencing, barrier tape, and / or road cones as appropriate.

Exclusion Zone entry requires compliance with OSHA training and medical surveillance requirements (29 CFR 1910.120). Subcontractor and vendor equipment will not be permitted into 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. Eating, drinking, and smoking are strictly prohibited within the Exclusion Zone.

Contamination Reduction Zone (CRZ)
The Contractor will establish the CRZ in the area located in between the Exclusion Zone and Support Zone. 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 personnel facilities and equipment decontamination areas. PPE worn in the Exclusion Zone may not be worn outside of the CRZ, except in an emergency. Eating, drinking, and smoking is strictly prohibited inside the CRZ.

Support Zone
The Support Zone includes all areas outside the CRZ and Exclusion Zone. The exposure potential inside 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 clean storage of equipment and materials. Protective clothing worn inside the Exclusion Zone is not permitted inside of the Support Zone, except in an emergency. It is the responsibility of the Project Manager to control access to the Site and to ensure proper security. Any evidence of unauthorized entry will be documented in the daily logbook.

Under no circumstances will the general public be permitted to access the Site. 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 Project Manager. All personal vehicles are restricted to the Support Zone.

8.3 Communication Procedures

Personnel in the Exclusion Zone will remain within eyesight of other project personnel. The following commonly used hand and arm signals shall be used (whenever 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 investigation / remediation tasks under Modified Level D PPE ensemble will perform the decontamination procedures:

- Discard used disposable equipment (single-use trowels, scoops, etc.)
- Remove and discard 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 workday and before any social activities.
- 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 to update personnel regarding new Site conditions. The meetings will also provide an opportunity for on-site personnel to discuss health and safety concerns. Generally, the following topics will be discussed at each meeting:

- 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 and plan responses accordingly. All emergency situations require concise and timely actions in order to minimize 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 and Supervisor have shared responsibility for directing emergency response activities. Each person is responsible for:

- Assessing the situation
- Determining required response measures

- Notifying appropriate response teams
- Directing on-site personnel during the emergency

The Contractor's HSO or Supervisor will coordinate response activities with on-site personnel and with public agencies (as necessary). Public agency information is found in the Emergency Contacts table. The HSO will notify emergency response agencies and establish emergency procedures prior to commencing remedial activities at the Site. For activities conducted without a full time onsite HSO, the team leader shall bear the responsibilities detailed in section 9.1.

9.2 Emergency Procedures

Due to the nature of tasks to be conducted at the Site, emergency situations 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 emergency.

9.3 Accident and Injuries

Every accident is a unique event that must be dealt with by trained personnel in a calm, controlled manner. In the event of an accident, the initial response is the most critical decision in assisting those in jeopardy and without placing additional personnel at risk. Several types of emergency situations are outlined below.

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 become necessary. 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 transportation to a medical facility becomes necessary, it will be provided by on-site personnel. If the person needs to 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 involves chemical exposure, the following first aid procedures will be initiated as soon as possible:

- *Eye Exposure* – If a 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 Subcontractor 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.

- *Skin Exposure* – If a 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 and 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 until EMTs arrive.
- *Ingestion* - If a solid or liquid is swallowed, medical attention must be obtained immediately, and the Poison Control Center should be consulted for guidance.

9.4 Fire

On-site personnel will be knowledgeable in fire-extinguishing techniques. They will be instructed on proper use and maintenance of the fire extinguishers supplied at each work area. Fire extinguishers should only be used for small fires. If 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 Subcontractor.

9.5 Emergency Evacuation

In extraordinary circumstances, emergency evacuation of the Site may become necessary. On-site personnel shall be notified of the need to evacuate verbally or by signaling with an air horn. 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 at the start of the project. A head count will 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.

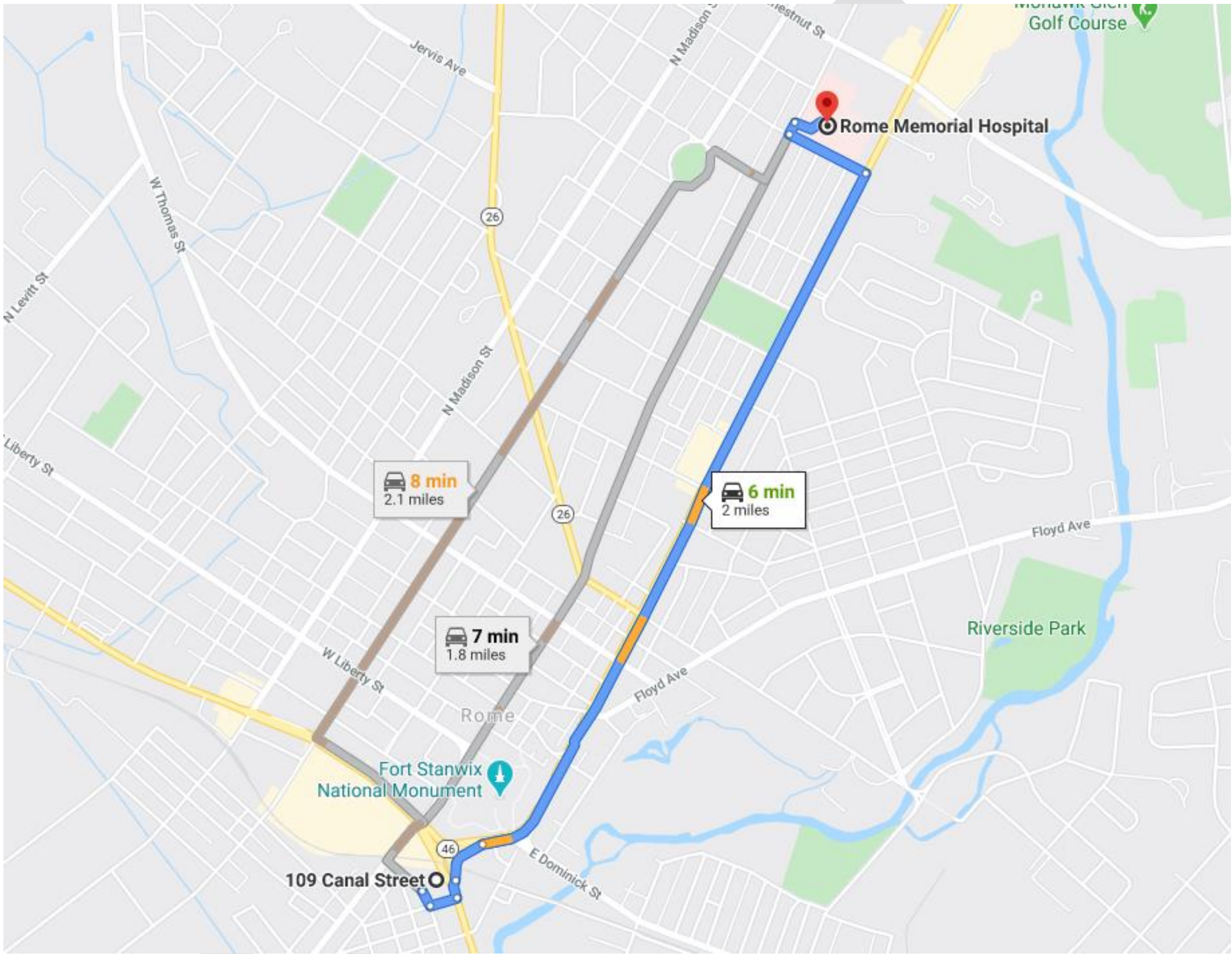
9.6 Emergency Response and Area Hospital

In case of emergency, call 911 or the appropriate individual authority:

EMERGENCY CONTACT NUMBERS	
Nearest Hospital	Rome Memorial Hospital 1500 N James Street Rome, New York 13440
Emergency Response Number	911
Poison Control Center	(800) 222-1222
Rome Police Department	(315) 339-7780

Directions to Nearest Hospital (Distance ~ 2.0 miles, Time ~ 6 minutes)

1. Travel south on Canal Street (<0.1 mile)
2. Left onto Jasper Street (<0.1 mile)
3. Left onto Erie Boulevard East (<0.1 mile)
4. Right onto Black River Boulevard North (follow Black River Boulevard for ~1.5 miles)
5. Left onto East Oak Street (~0.2 mile)
6. Right onto North James Street (<0.1 mile)
7. Rome Memorial Hospital is on the Right

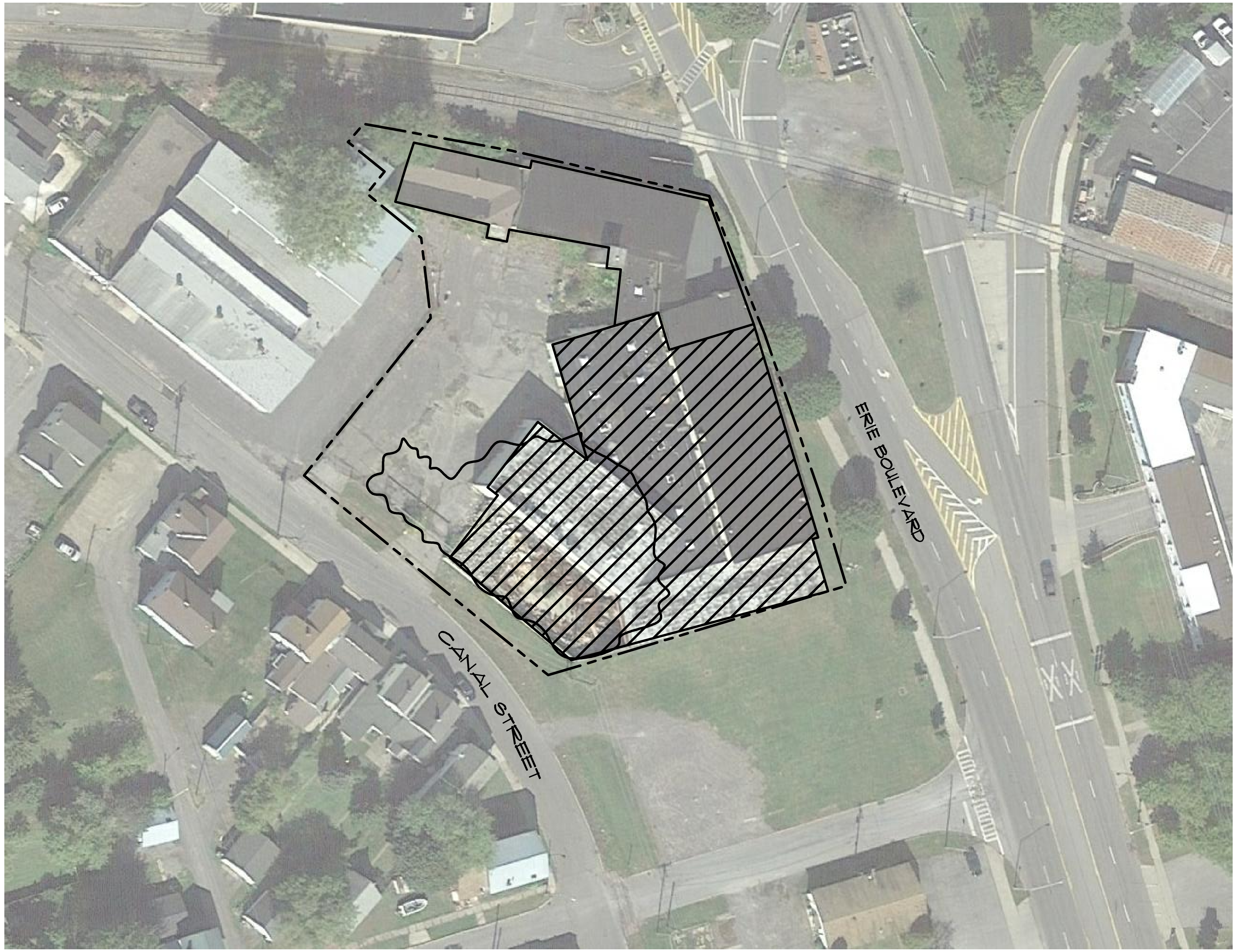


10.0 PERSONNEL ACKNOWLEDGEMENT

By signing below, the undersigned acknowledges that he/she has read and reviewed the AECC Health and Safety Plan for the Former Rome Turney Development Site Remedial Investigation Work Plan. The undersigned also acknowledges that he/she has been instructed in the contents of this document and understands the information pertaining to the specified work and will comply with the provisions contained therein.

PRINT NAME	SIGNATURE	ORGANIZATION	DATE

Figures



LEGEND:

— - — APPROXIMATE PROPERTY LINE (BROWNFIELD AREA EXTENT)

∿∿∿ AREA OF FOUNDATION DEBRIS PILES (CRUSHED CONCRETE)

▨ AREA OF REMOVED SLABS

— LIMITS OF EXISTING SLABS

NOTES:

1. IN DECEMBER 2020 SELECT AREAS OF FORMER BUILDINGS FOUNDATIONS WERE REMOVED, CRUSHED AND STAGED IN DEBRIS PILES ON THE SOUTHERN PORTION OF THE SITE

NOTES / DISCLAIMERS:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH WEBSITE(OCTOBER, 2017).
2. APPROXIMATE PROPERTY LINE BASED ON GISCLOUD WEBSITE.
3. ALL LOCATIONS ARE APPROXIMATE.

0 40' 80'
GRAPHIC SCALE

AECC
ENVIRONMENTAL CONSULTING
Asbestos & Environmental
Consulting Corporation

6308 Fly Road
East Syracuse, NY 13057

PROJECT NO. 20-037
DRAWN: JUNE 2021
DRAWN BY: NP
CHECKED BY: RM

SITE PLAN

FORMER ROME TURNEY DEVELOPMENT SITE
109 CANAL STREET
CITY OF ROME, NEW YORK 13440

FIGURE
HASP-1

Attachment A

Fact Sheets and Safety Data Reports

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

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.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, Public Health Service
Agency for Toxic Substances and Disease Registry

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.

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

2-Butanone - ToxFAQs™

What is 2-butanone?

2-Butanone is an industrial chemical. 2-Butanone is also called methyl ethyl ketone. It can also be present in the environment from natural sources. It is made by some trees and found naturally in some fruits and vegetables in small amounts.

2-Butanone is used in a number of industrial products such as paints and other coatings. It is also used in glues and as a cleaning agent.

How can I be exposed to 2-butanone?

You can be exposed to 2-butanone from food that naturally has a small amount of 2-butanone, or from contaminated drinking water. If you use paints, glues, coatings, or cleaning agents containing 2-butanone, you can be exposed from contaminated air or from skin contact with these products.

If you live near a facility where 2-butanone is produced or a facility that uses 2-butanone products, you can be exposed to low levels by breathing contaminated air.

How can 2-butanone affect my health?

Studies in humans breathing 2-butanone found nose, throat, and eye irritation. Other health effects seen in people breathing 2-butanone include headache, tiredness, and feeling of drunk.

Poor coordination has been found in lab animals exposed to high concentrations of 2-butanone. Kidney effects have been seen in lab animals that breathe 2-butanone or are orally exposed to it.

The levels of 2-butanone typically found in the environment are lower than levels known to cause harmful health effects.

Serious health effects in animals have been seen only at very high levels. When breathed, these effects included birth defects, loss of consciousness, and death.

Can 2-butanone cause cancer?

Three of four human studies did not find an increase in cancer; the fourth study did find an increase in childhood leukemia. In all of these studies, the individuals were exposed to a number of different chemicals. No animal studies were found that examined whether 2-butanone can cause cancer.

The Environmental Protection Agency (EPA) concluded that the data are inadequate for an assessment of human carcinogenic potential (cause cancer) of 2-butanone.

Can I get a medical test to check for 2-butanone?

Tests are available to measure levels of 2-butanone in blood, breath, and urine. Some of the chemicals that are formed when 2-butanone breaks down in the body can also be measured in the urine. These tests can show if you were exposed to 2-butanone and whether you were exposed to high levels, but these tests won't predict if you will have health problems. These tests are not usually done in the doctor's office as part of a routine medical exam. However, a sample taken in the doctor's office can be sent to a special laboratory. If you think you have had an exposure to 2-butanone, call your doctor, nurse, or poison control center.

How can I protect myself and my family from 2-butanone?

Workers involved in the production or use of 2-butanone should protect themselves to limit inhalation (breathing) and dermal (skin) exposure to it. Check for OSHA guidance about PPE (personal protective equipment) at http://www.osha.gov/SLTC/personalprotectiveequipment/.

People living near facilities that produce or use 2-butanone or areas where it is stored could be at greater risk of exposure than the general population.

For more information:

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 Toxicological Profile for 2-butanone: https://www.atsdr.cdc.gov/ToxProfiles/tp.asp?id=343&tid=60

Go to ATSDR's Toxic Substances Portal: http://www.atsdr.cdc.gov/substances/index.asp

Find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

Arsenic - ToxFAQs™

CAS # 7440-38-2

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. 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: Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 1,149 of the 1,684 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenate (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

What happens to arsenic when it enters the environment?

- Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
- Arsenic cannot be destroyed in the environment. It can only change its form.
- Rain and snow remove arsenic dust particles from the air.
- Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
- Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How might I be exposed to arsenic?

- Ingesting small amounts present in your food and water or breathing air containing arsenic.
- Breathing sawdust or burning smoke from wood treated with arsenic.
- Living in areas with unusually high natural levels of arsenic in rock.
- Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys.

How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans.

How can arsenic affect children?

There is some evidence that long-term exposure to arsenic in children may result in lower IQ scores. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant females, can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk.

How can families reduce the risks of exposure to arsenic?

- If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.
- If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.
- If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on your clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

Is there a medical test to determine whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict whether the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic (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 and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

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DDT, DDE, and DDD - ToxFAQs™

CAS # 50-29-3, 72-55-9, 72-54-8

This fact sheet answers the most frequently asked health questions (FAQs) about DDT, DDE, and DDD. 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: Exposure to DDT, DDE, and DDD occurs mostly from eating foods containing small amounts of these compounds, particularly meat, fish and poultry. High levels of DDT can affect the nervous system causing excitability, tremors and seizures. In women, DDE can cause a reduction in the duration of lactation and an increased chance of having a premature baby. DDT, DDE, and DDD have been found in at least 442 of the 1,613 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are DDT, DDE, and DDD?

DDT (dichlorodiphenyltrichloroethane) is a pesticide once widely used to control insects in agriculture and insects that carry diseases such as malaria. DDT is a white, crystalline solid with no odor or taste. Its use in the U.S. was banned in 1972 because of damage to wildlife, but is still used in some countries.

DDE (dichlorodiphenyldichloroethylene) and DDD (dichlorodiphenyldichloroethane) are chemicals similar to DDT that contaminate commercial DDT preparations. DDE has no commercial use. DDD was also used to kill pests, but its use has also been banned. One form of DDD has been used medically to treat cancer of the adrenal gland.

What happens to DDT, DDE, and DDD when they enter the environment?

- DDT entered the environment when it was used as a pesticide; it still enters the environment due to current use in other countries.
- DDE enters the environment as contaminant or breakdown product of DDT; DDD also enters the environment as a breakdown product of DDT.
- DDT, DDE, and DDD in air are rapidly broken down by sunlight. Half of what's in air breaks down within 2 days.
- They stick strongly to soil; most DDT in soil is broken down slowly to DDE and DDD by microorganisms; half the DDT in soil will break down in 2–15 years, depending on the type of soil.
- Only a small amount will go through the soil into groundwater; they do not dissolve easily in water.
- DDT, and especially DDE, build up in plants and in fatty tissues of fish, birds, and other animals.

How might I be exposed to DDT, DDE, and DDD?

- Eating contaminated foods, such as root and leafy vegetables, fatty meat, fish, and poultry, but levels are very low.
- Eating contaminated imported foods from countries that still allow the use of DDT to control pests.
- Breathing contaminated air or drinking contaminated water near waste sites and landfills that may contain higher levels of these chemicals.
- Infants fed on breast milk from mothers who have been exposed.
- Breathing or swallowing soil particles near waste sites or landfills that contain these chemicals.

How can DDT, DDE, and DDD affect my health?

DDT affects the nervous system. People who accidentally swallowed large amounts of DDT became excitable and had tremors and seizures. These effects went away after the exposure stopped. No effects were seen in people who took small daily doses of DDT by capsule for 18 months. A study in humans showed that women who had high amounts of a form of DDE in their breast milk were unable to breast feed their babies for as long as women who had little DDE in the breast milk. Another study in humans showed that women who had high amounts of DDE in the blood had an increased chance of having premature babies. In animals, short-term exposure to large amounts of DDT in food affected the nervous system, while long-term exposure to smaller amounts affected the liver. Also in animals, short-term oral exposure to small amounts of DDT or its breakdown products may also have harmful effects on reproduction.

DDT, DDE, and DDD - ToxFAQs™

CAS # 50-29-3, 72-55-9, 72-54-8

How likely are DDT, DDE, and DDD to cause cancer?

Studies in DDT-exposed workers did not show increases in cancer. Studies in animals given DDT with the food have shown that DDT can cause liver cancer.

The Department of Health and Human Services (DHHS) determined that DDT may reasonable be anticipated to be a human carcinogen.

The International Agency for Research on Cancer (IARC) determined that DDT may possibly cause cancer in humans. The EPA determined that DDT, DDE, and DDD are probable human carcinogens.

How can DDT, DDE, and DDD affect children?

There are no studies on the health effects of children exposed to DDT, DDE, or DDD. We can assume that children exposed to large amounts of DDT will have health effects similar to the effects seen in adults. However, we do not know whether children differ from adults in their susceptibility to these substances.

There is no evidence that DDT, DDE, or DDD cause birth defects in people. A study showed that teenage boys whose mothers had higher DDE amounts in the blood when they were pregnant were taller than those whose mothers had lower DDE levels. However, a different study found the opposite in preteen girls. The reason for the discrepancy between these studies is unknown.

Studies in rats have shown that DDT and DDE can mimic the action of natural hormones and in this way affect the development of the reproductive and nervous systems. Puberty was delayed in male rats given high amounts of DDE as juveniles. This could possibly happen in humans.

A study in mice showed that exposure to DDT during the first weeks of life may cause neurobehavioral problems later in life.

How can families reduce the risk of exposure to DDT,DDE, and DDE?

- Most families will be exposed to DDT by eating food or drinking liquids contaminated with small amounts of DDT.
- Cooking will reduce the amount of DDT in fish.
- Washing fruit and vegetables will remove most DDT from their surface.
- Follow health advisories that tell you about consumption of fish and wildlife caught in contaminated areas.

Is there a medical test to show whether I've been exposed to DDT, DDE, and DDD?

Laboratory tests can detect DDT, DDE, and DDD in fat, blood, urine, semen, and breast milk. These tests may show low, moderate, or excessive exposure to these compounds, but cannot tell the exact amount you were exposed to, or whether you will experience adverse effects. These tests are not routinely available at the doctor's office because they require special equipment.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) sets a limit of 1 milligram of DDT per cubic meter of air (1 mg/m^3) in the workplace for an 8-hour shift, 40-hour workweek.

The Food and Drug Administration (FDA) has set limits for DDT, DDE, and DDD in foodstuff at or above which the agency will take legal action to remove the products from the market.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for DDT/DDE/DDD (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 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.

Mercury - ToxFAQs™

CAS # 7439-97-6

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. 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 mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is mercury?

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, some dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

What happens to mercury when it enters the environment?

- Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.
- It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.
- Methylmercury may be formed in water and soil by small organisms called bacteria.
- Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

How might I be exposed to mercury?

- Eating fish or shellfish contaminated with methylmercury.
- Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fossil fuels.
- Release of mercury from dental work and medical treatments.
- Breathing contaminated workplace air or skin contact during use in the workplace.
- Practicing rituals that include mercury.

How can mercury affect my health?

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

Mercury

CAS # 7439-97-6

How likely is mercury to cause cancer?

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

How can mercury affect children?

Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there, possibly causing damage to the developing nervous system. It can also pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury's harmful effects that may affect the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

How can families reduce the risk of exposure to mercury?

Carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, because it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Teach children not to play with shiny, silver liquids.

Properly dispose of older medicines that contain mercury. Keep all mercury-containing medicines away from children.

Pregnant women and children should keep away from rooms where liquid mercury has been used.

Learn about wildlife and fish advisories in your area from your public health or natural resources department.

Is there a medical test to determine whether I've been exposed to mercury?

Tests are available to measure mercury levels in the body. Blood or urine samples are used to test for exposure to metallic mercury and to inorganic forms of mercury. Mercury in whole blood or in scalp hair is measured to determine exposure to methylmercury. Your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb).

The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m^3) and 0.05 mg/m^3 of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for mercury. 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.

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Cadmium- ToxFAQs™

CAS # 7440-43-9

This fact sheet answers the most frequently asked health questions (FAQs) about cadmium. 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: Exposure to cadmium happens mostly in the workplace where cadmium products are made. The general population is exposed from breathing cigarette smoke or eating cadmium contaminated foods. Cadmium damages the kidneys, lungs, and bones. Cadmium has been found in at least 1,014 of the 1,669 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is cadmium?

Cadmium is a natural element in the earth's crust. It is usually found as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide).

All soils and rocks, including coal and mineral fertilizers, contain some cadmium. Most cadmium used in the United States is extracted during the production of other metals like zinc, lead, and copper. Cadmium does not corrode easily and has many uses, including batteries, pigments, metal coatings, and plastics.

What happens to cadmium when it enters the environment?

- Cadmium enters soil, water, and air from mining, industry, and burning coal and household wastes.
- Cadmium does not break down in the environment, but can change forms.
- Cadmium particles in air can travel long distances before falling to the ground or water.
- Some forms of cadmium dissolve in water.
- Cadmium binds strongly to soil particles.
- Fish, plants, and animals take up cadmium from the environment.

How might I be exposed to cadmium?

- Eating foods containing cadmium; low levels are found in all foods (highest levels are found in leafy vegetables, grains, legumes, and kidney meat).
- Smoking cigarettes or breathing cigarette smoke.
- Breathing contaminated workplace air.
- Drinking contaminated water.
- Living near industrial facilities which release cadmium into the air.

How can cadmium affect my health?

Breathing high levels of cadmium can severely damage the lungs. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea.

Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects are lung damage and fragile bones.

How likely is cadmium to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have determined that cadmium and cadmium compounds are human carcinogens. The EPA determined that cadmium is a probable human carcinogen (group B1).

Cadmium

CAS # 7440-43-9

How can cadmium affect children?

The health effects in children are expected to be similar to the effects seen in adults (kidney and lung damage depending on the route of exposure).

A few studies in animals indicate that younger animals absorb more cadmium than adults. Animal studies also indicate that the young are more susceptible than adults to a loss of bone and decreased bone strength from exposure to cadmium.

We don't know if cadmium causes birth defects in people. Studies in animals exposed to high levels of cadmium during pregnancy have resulted in harmful effects to the young. Young animals exposed to cadmium before birth have shown effects on behavior and learning. There is also some information from animal studies that high enough exposures to cadmium before birth can reduce body weights and affect the skeleton in the developing young.

How can families reduce the risk of exposure to cadmium?

- Do not allow children to play with batteries. Dispose of nickel-cadmium batteries properly.
- Cadmium is a component of tobacco smoke. Avoid smoking and smoking in enclosed spaces like inside the home or car in order to limit exposure to children and other family members.
- If you work with cadmium, use all safety precautions to avoid carrying cadmium-containing dust home from work on your clothing, skin, hair, or tools.
- A balanced diet can reduce the amount of cadmium taken into the body from food and drink.

Is there a medical test to determine whether I've been exposed to cadmium?

Cadmium can be measured in blood, urine, hair, or nails. Urinary cadmium has been shown to accurately reflect the amount of cadmium in the body.

The amount of cadmium in your blood shows your recent exposure to cadmium. The amount of cadmium in your urine shows both your recent and your past exposure.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to cadmium in drinking water at concentrations of 0.04 milligrams per liter (0.04 mg/L) for up to 10 days is not expected to cause any adverse effects in a child.

The EPA has determined that lifetime exposure to 0.005 mg/L cadmium is not expected to cause any adverse effects.

The Food and Drug Administration (FDA) has determined that the cadmium concentration in bottled drinking water should not exceed 0.005 mg/L.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 5 $\mu g/m^3$ for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological Profile for Cadmium. 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.

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ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

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.

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.

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.

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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™ 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.

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XYLENE

CAS # 1330-20-7

Division of Toxicology and Environmental Medicine ToxFAQs™ August 2007

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. 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: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. Xylene has been found in at least 840 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

There are three forms of xylene in which the methyl groups vary on the benzene ring: *meta*-xylene, *ortho*-xylene, and *para*-xylene (*m*-, *o*-, and *p*-xylene). These different forms are referred to as isomers.

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar. Chemical industries produce xylene from petroleum. It is one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

❑ Xylene evaporates quickly from the soil and surface water into the air.
❑ In the air, it is broken down by sunlight into other less harmful chemicals in a couple of days.
❑ It is broken down by microorganisms in soil and water.
❑ Only a small amount of it builds up in fish, shellfish, plants, and other animals living in xylene-contaminated water.

How might I be exposed to xylene?

❑ Using a variety of consumer products including gasoline, paint varnish, shellac, rust preventatives, and cigarette smoke. Xylene can be absorbed through the respiratory tract and through the skin.
❑ Ingesting xylene-contaminated food or water, although these levels are likely to be very low.
❑ Working in a job that involves the use of xylene such as painters, paint industry workers, biomedical laboratory workers, automobile garage workers, metal workers, and furniture refinishers.

How can xylene affect my health?

No health effects have been noted at the background levels that people are exposed to on a daily basis.

High levels of exposure for short or long periods can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, Public Health Service
Agency for Toxic Substances and Disease Registry

How likely is xylene to cause cancer?

Both the International Agency for Research on Cancer (IARC) and the EPA have found that there is insufficient information to determine whether or not xylene is carcinogenic.

How can xylene affect children?

The effects of xylene have not been studied in children, but it is likely that they would be similar to those seen in exposed adults. Although there is no direct evidence, children may be more sensitive to acute inhalation exposure than adults because their narrower airways would be more sensitive to swelling effects.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy

How can families reduce the risks of exposure to xylene?

❏ Exposure to xylene as solvents (in paints or gasoline) can be reduced if the products are used with adequate ventilation and if they are stored in tightly closed containers out of the reach of small children.
❏ Sometimes older children sniff household chemicals in attempt to get high. Talk with your children about the dangers of sniffing xylene.
❏ If products containing xylene are spilled on the skin, then the excess should be wiped off and the area cleaned with soap and water.

Is there a medical test to determine whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office because they require special equipment.

Has the federal government made recommendations to protect human health?

The EPA set a limit of 10 parts xylene per million parts drinking water (10 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 100 parts xylene per million parts of workplace air (100 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Xylene (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 Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, 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.

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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.

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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.

Chromium - ToxFAQs™

CAS # 7440-47-3

This fact sheet answers the most frequently asked health questions (FAQs) about chromium. 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: Exposure to chromium occurs from ingesting contaminated food or drinking water or breathing contaminated workplace air. Chromium(VI) at high levels can damage the nose and cause cancer. Ingesting high levels of chromium(VI) may result in anemia or damage to the stomach or intestines. Chromium(III) is an essential nutrient. Chromium has been found in at least 1,127 of the 1,669 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is chromium?

Chromium is a naturally occurring element found in rocks, animals, plants, and soil. It can exist in several different forms. Depending on the form it takes, it can be a liquid, solid, or gas. The most common forms are chromium(0), chromium(III), and chromium(VI). No taste or odor is associated with chromium compounds.

The metal chromium, which is the chromium(0) form, is used for making steel. Chromium(VI) and chromium(III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.

What happens to chromium when it enters the environment?

- Chromium can be found in air, soil, and water after release from the manufacture, use, and disposal of chromium-based products, and during the manufacturing process.
- Chromium does not usually remain in the atmosphere, but is deposited into the soil and water.
- Chromium can easily change from one form to another in water and soil, depending on the conditions present.
- Fish do not accumulate much chromium in their bodies from water.

How might I be exposed to chromium?

- Eating food containing chromium(III).
- Breathing contaminated workplace air or skin contact during use in the workplace.
- Drinking contaminated well water.
- Living near uncontrolled hazardous waste sites containing chromium or industries that use chromium.

How can chromium affect my health?

Chromium(III) is an essential nutrient that helps the body use sugar, protein, and fat.

Breathing high levels of chromium(VI) can cause irritation to the lining of the nose, nose ulcers, runny nose, and breathing problems, such as asthma, cough, shortness of breath, or wheezing. The concentrations of chromium in air that can cause these effects may be different for different types of chromium compounds, with effects occurring at much lower concentrations for chromium(VI) compared to chromium(III).

The main health problems seen in animals following ingestion of chromium(VI) compounds are irritation and ulcers in the stomach and small intestine and anemia. Chromium(III) compounds are much less toxic and do not appear to cause these problems.

Sperm damage and damage to the male reproductive system have also been seen in laboratory animals exposed to chromium(VI).

Skin contact with certain chromium(VI) compounds can cause skin ulcers. Some people are extremely sensitive tochromium(VI) or chromium(III). Allergic reactions consisting of severe redness and swelling of the skin have been noted.

CAS # 7440-47-3

How likely is chromium to cause cancer?

The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have determined that chromium(VI) compounds are known human carcinogens.

In workers, inhalation of chromium(VI) has been shown to cause lung cancer. Chromium(VI) also causes lung cancer in animals. An increase in stomach tumors was observed in humans and animals exposed to chromium(VI) in drinking water.

How can chromium affect children?

It is likely that health effects seen in children exposed to high amounts of chromium will be similar to the effects seen in adults.

We do not know if exposure to chromium will result in birth defects or other developmental effects in people. Some developmental effects have been observed in animals exposed to chromium(VI).

How can families reduce the risk of exposure to chromium?

- Children should avoid playing in soils near uncontrolled hazardous waste sites where chromium may have been discarded.
- Chromium is a component of tobacco smoke. Avoid smoking in enclosed spaces like inside the home or car in order to limit exposure to children and other family members.
- Although chromium(III) is an essential nutrient, you should avoid excessive use of dietary supplements containing chromium.

Is there a medical test to determine whether I've been exposed to chromium?

Since chromium(III) is an essential element and naturally occurs in food, there will always be some level of chromium in your body. Chromium can be measured in hair, urine, and blood.

Higher than normal levels of chromium in blood or urine may indicate that a person has been exposed to chromium. However, increases in blood and urine chromium levels cannot be used to predict the kind of health effects that might develop from that exposure.

Has the federal government made recommendations to protect human health?

The EPA has established a maximum contaminant level of 0.1 mg/L for total chromium in drinking water.

The FDA has determined that the chromium concentration in bottled drinking water should not exceed 0.1 mg/L.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 0.005 mg/m^3 chromium(VI), 0.5 mg/m^3 chromium(III), and 1.0 mg/m^3 chromium(0) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological Profile for Chromium. 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.

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SELENIUM

CAS # 7782-49-2

Division of Toxicology ToxFAQs™ September 2003

This fact sheet answers the most frequently asked health questions (FAQs) about selenium. 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 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: People may be exposed to low levels of selenium daily through food and water. Selenium is a trace mineral needed in small amounts for good health, but exposure to much higher levels can result in neurological effects and brittle hair and deformed nails. Occupational inhalation exposure to selenium vapors may cause dizziness, fatigue, irritation of mucous membranes, and respiratory effects. This substance has been found in at least 508 of the 1,636 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is selenium?

Selenium is a naturally occurring mineral element that is distributed widely in nature in most rocks and soils. In its pure form, it exists as metallic gray to black hexagonal crystals, but in nature it is usually combined with sulfide or with silver, copper, lead, and nickel minerals. Most processed selenium is used in the electronics industry, but it is also used: as a nutritional supplement; in the glass industry; as a component of pigments in plastics, paints, enamels, inks, and rubber; in the preparation of pharmaceuticals; as a nutritional feed additive for poultry and livestock; in pesticide formulations; in rubber production; as an ingredient in antidandruff shampoos; and as a constituent of fungicides. Radioactive selenium is used in diagnostic medicine.

What happens to selenium when it enters the environment?

❑ Selenium occurs naturally in the environment and can be released by both natural and manufacturing processes.
❑ Selenium dust can enter the air from burning coal and oil. This selenium dust will eventually settle over the land and water.
❑ It also enters water from rocks and soil, and from agricultural and industrial waste. Some selenium compounds will dissolve in water, and some will settle to the bottom as particles.
❑ Insoluble forms of selenium will remain in soil, but soluble forms are very mobile and may enter surface water from soils.
❑ Selenium may accumulate up the food chain.

How might I be exposed to selenium?

❑ The general population is exposed to very low levels of selenium in air, food, and water. The majority of the daily intake comes from food.
❑ People working in or living near industries where selenium is produced, processed, or converted into commercial products may be exposed to higher levels of selenium in the air.
❑ People living in the vicinity of hazardous waste sites or coal burning plants may also be exposed to higher levels of selenium.

How can selenium affect my health?

Selenium has both beneficial and harmful effects. Low doses of selenium are needed to maintain good health. However, exposure to high levels can cause adverse health effects. Short-term oral exposure to high concentrations of selenium may cause nausea, vomiting, and diarrhea. Chronic oral exposure to high concentrations of selenium compounds can produce a disease called selenosis. The major signs of selenosis are hair loss, nail brittleness, and neurological abnormalities (such as numbness and other odd sensations in the extremities).

Brief exposures to high levels of elemental selenium or selenium dioxide in air can result in respiratory tract irritation, bronchitis, difficulty breathing, and stomach pains. Longer-term exposure to either of these air-borne forms can cause respiratory irritation, bronchial spasms, and coughing. Levels of these forms of selenium that would be necessary to produce such effects are normally not seen outside of the workplace.

Animal studies have shown that very high amounts of selenium can affect sperm production and the female reproductive cycle. We do not know if similar effects would occur in humans.

How likely is selenium to cause cancer?

Studies of laboratory animals and people show that most selenium compounds probably do not cause cancer. In fact, studies in humans suggest that lower-than-normal selenium levels in the diet might increase the risk of cancer.

The International Agency for Research on Cancer (IARC) has determined that selenium and selenium compounds are not classifiable as to their carcinogenicity to humans.

The EPA has determined that one specific form of selenium, selenium sulfide, is a probable human carcinogen. Selenium sulfide is not present in foods and is a very different chemical from the organic and inorganic selenium compounds found in foods and in the environment.

How can selenium affect children?

It is likely that the health effects seen in children exposed to selenium will be similar to the effects seen in adults. However, one study found that children may be less susceptible to the health effects of selenium than adults.

Selenium compounds have not been shown to cause birth defects in humans or in other mammals.

How can families reduce the risk of exposure to selenium?

- ❑ Certain dietary supplements and shampoos contain selenium; these should be used according to the manufacturer's directions.
- ❑ Children living near waste sites that contain selenium or coal burning plants should be encouraged to wash their hands before eating and to avoid putting their unwashed hands in their mouths.

Is there a medical test to show whether I've been exposed to selenium?

Low levels of selenium are normally found in body tissues and urine. Blood and urine tests for selenium are most useful for people who have recently been exposed to high levels. Toenail clippings can be used to determine longer-term exposure. These tests are not usually available at your doctor's office, but your doctor can send the samples to a laboratory that can perform the tests. None of these tests, however, can predict whether you will experience any health effects.

Has the federal government made recommendations to protect human health?

The EPA restricts the amount of selenium allowed in public water supplies to 50 parts total selenium per billion parts of water (50 ppb).

The Occupational Safety and Health Administration (OSHA) sets a limit of 0.2 mg selenium/m^3 of workroom air for an 8-hour work shift.

ATSDR and the EPA have determined that 5 micrograms of selenium per kilogram of body weight taken daily would not be expected to cause any adverse health effects over a lifetime of such intake.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2003. Toxicological Profile for Selenium (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.

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: 10/19/20

Technician: Joe Goodfellow **Other Technicians on site**:

Customer: Asbestos & Environmental Consulting Corp.

Site Address: Rome Turney site 109 Canal St. Rome, NY

Contact Person: Rico McKenna **Phone**: 315-345-1649

Scope of Work: Location Services - Clear the entire site as per map and direction Rich McKenna

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* _________

Site Access/Safety Training: **Expiration Date**:

Ground Cover/Weather Conditions: Gravel, concrete, some grass. Rain, 50s.

Instructions from Onsite Contact: Clear designated areas per Rico.

Field Report – Utility Location

Information Transfer:

In addition to this field report,
mark all that apply:

☒ *Information relayed on site to:*

Rico McKenna

☐ *Hand drawn sketch*

☐ *Maps updated onsite*

☒ *Photographs*

☐ *Surveyed by others*

☐ *Surveyed and AutoCAD Mapping by NYLD*

Notes/Testing Results:

A visual inspection was performed in the area of concern to assess for utility structures. Utilizing the MetroTech vLocPro2 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 with a 250 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.

- Building has been torn down
- Some pipe work was removed.
- Scanned concrete floor and located several drains

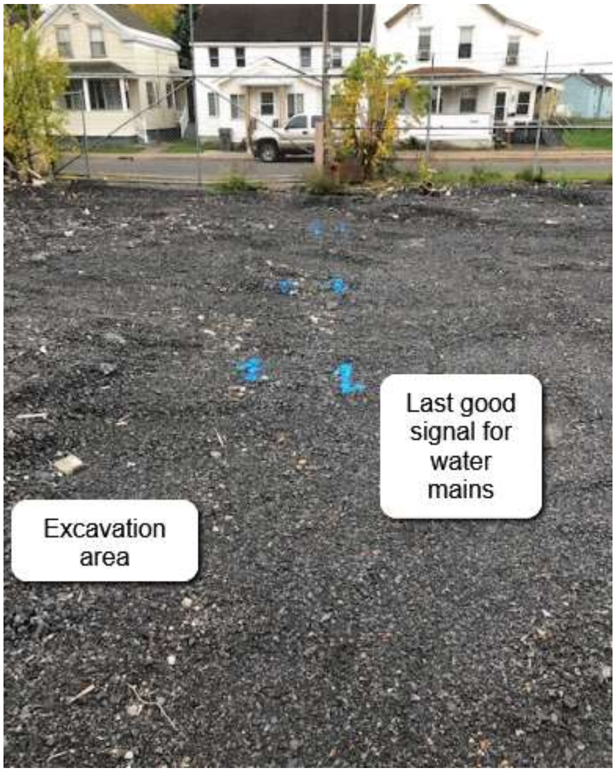
Utilities were painted in appropriate color, marked with flags and depths provided where possible.

This report is back up to information relayed and marked on site at time of service. It is for informational purposes only.

Key

Blue	Water
Red	Power
Orange	Communications
Yellow	Gas/Flammable Fuel
White	Unknown
Green	Storm/Sanitary

Field Report – Utility Location




Gas
service

Field Report – Utility Location


Gas service
Storm line


Unknowns, One is possible water main

Field Report – Utility Location


Floor drain ?


Erie Blvd. E.
Unknown


Steel pipework lines

Field Report – Utility Location

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
Former Rome Turney Development Site
109 Canal Street
City of Rome, Oneida County, New York

Parameter	Action Level	Stop Work Level
VOC Monitoring	5 ppm	25 ppm
Particulate Monitoring (PM-10)	100 µg/m^3	150 µg/m^3

June 2021

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ATTACHMENTS

1.0 INTRODUCTION

The New York State Department of Health (NYSDOH) Community Air Monitoring Plan (NYSDEC, 2010) requires real-time monitoring for vapors of volatile organic compounds (VOCs) and respirable particulate matter (PM-10) at the downwind perimeter of the site when certain activities are in progress at contaminated sites.

This Community Air Monitoring Plan (CAMP) was prepared for work associated with the former Rome Turney Development Site located at 109 Canal Street in the City of Rome, Oneida County, New York and supplements the *Remedial Investigation Work Plan* (AECC, 2021).

1.1 Purpose

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 herein require increased monitoring, corrective actions to prevent emissions, and / or work shutdown.

1.2 Objectives

The community air-monitoring will include real time air quality data, which will be collected throughout the duration of all ground-intrusive activities and will include, at a minimum, upwind and downwind measurements at the site perimeter. The CAMP was established to address the following objectives:

- To ensure concentrations of VOCs and PM-10 (particulates having a diameter of less than 10 micrometers) associated with ground-intrusive activities are minimized to protect human health and the environment.
- To provide an early warning system so engineering controls can be enacted to prevent unnecessary exposure of emissions resulting from project activities.
- To measure and document the concentrations of VOCs and PM-10 for determining compliance with the air-monitoring limits established by the NYSDOH.

1.3 Applicability

Continuous monitoring will be required for activities that aggressively disturb contaminated or potentially-contaminated soils in a sufficient quantity as to pose a potential for dispersion of dust or volatile vapors to downwind receptors. Such activities would include, but are not limited to, excavation of test pits, test trenches, or larger holes; site clearing/scraping/grading; and construction site traffic. Continuous monitoring will not be required for activities that disturb “clean” soils or insignificant amounts of contaminated or potentially-contaminated soils, such as use of hand tools, advancement of soil borings, etc. (see Section 5.0).

The CAMP is not intended for use in establishing action levels for worker respiratory protection. This CAMP is a companion document to the site-specific Health and Safety Plan (HASP), which is the document that is directed primarily toward the protection of workers within the designated work zones.

CAMP monitoring will not be required if engineering controls prevent exposure to or disturbance of the contaminated or potentially-contaminated soils. Examples of such controls would include placement of a demarcation fabric over soils prior to backfilling, polyethylene sheeting over a pile of contaminated soil, or clean gravel over a high-trafficked area.

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 direction to provide an upwind and at least one downwind monitoring station. Wind direction may be determined using a weather station or equivalent device, or lightweight flagging affixed at each station. The attached Figure CAMP-1 illustrates the likely location of monitoring stations associated with various work areas at the site.

The primary chemicals of concern associated with the site include the following:

- Metals
- Petroleum: VOCs, semi-VOCs, Polycyclic Aromatic Hydrocarbons (PAH)
- Pesticides

Continuous monitoring of VOCs will serve as the primary method of screening for potential volatile vapors (VOCs and SVOCs). Since metals, PAH, and pesticides are not volatile (gaseous) compounds, continuous monitoring of particulates will serve as the primary method of (indirectly) screening for these compounds.

As the investigation progresses and additional data is collected for other classes of chemicals (Herbicides, PFAS, etc.), the CAMP may be updated to reflect this information.

3.0 MONITORING, RESPONSE LEVELS, AND ACTIONS

3.1 Volatile Organic Compound Monitoring

VOCs will be monitored continuously at the upwind and downwind perimeters of the work area or exclusion zone at temporary VOC monitoring stations. 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 until the source of the emissions is identified and controlled.

All 15-minute readings will be recorded and available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

3.2 Particulates Monitoring

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, for comparison to 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 if 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 by a qualified environmental professional.

3.3 Recording of Data

All readings will be recorded and available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

4.0 MONITORING DURING NON-INTRUSIVE AND MINIMALLY-INTRUSIVE ACTIVITIES

4.1 Volatile Organic Compounds

CAMP monitoring for VOCs will not be required for this project during non-intrusive and minimally-intrusive activities that do not have the potential to release volatile vapors. Typical non-intrusive and minimally-intrusive activities related to site investigation that have the potential to release volatile vapors include:

- Advancing of borings
- Installation of monitoring wells
- Development of monitoring wells
- Collecting groundwater samples from monitoring wells
- Opening of vaults/manholes
- Opening of chemical or petroleum tanks, etc.

If these activities occur, then periodic monitoring of VOCs will be performed during the non-intrusive activity. Each of the periodic measurements will occur directly at the location (i.e. – no upwind or downwind sampling). If the action level at the location is exceeded, then upwind and downwind concentrations will measured (with the same device) to verify that the exceedance is a discrete/local condition.

Boring Advancement

Periodic monitoring during boring advancement will consist of taking a reading upon arrival at the boring location, and monitoring periodically during advancement of the boring.

Groundwater Well Installation / Development

Periodic monitoring during groundwater well installation and/or development will consist of taking a reading upon arrival at a sample location, monitoring periodically during the installation of the well, and monitoring periodically during the well development process.

Groundwater Well Sampling

Periodic monitoring during groundwater sample collection will consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap, and monitoring periodically during well baling/purging/sampling.

Vaults/Manholes

Periodic monitoring during opening of vaults/manholes will consist of taking a reading upon opening of the vault/manhole cover, and monitoring periodically while the vault/manhole remains open. *Note that these measurements are not intended to be used in conjunction with confined space entry procedures.*

Chemical/Petroleum Tanks

Periodic monitoring during opening of chemical or petroleum tanks will consist of taking a reading upon opening of the vault/manhole cover, and monitoring periodically while the vault/manhole remains open.

4.2 Particulates

Due to the limited risk of dust generation, CAMP monitoring for particulates will not be required for non-intrusive activities, and the following minimally-intrusive activities (provided that such activities do not occur during extremely dry or windy conditions):

- Use of hand tools for shallow soil sampling
- Installation of soil borings
- Installation of monitoring wells

Furthermore, CAMP monitoring for particulates will not be required during handling of the existing on-site crushed wall/slab material, as sampling has deemed this material inert.

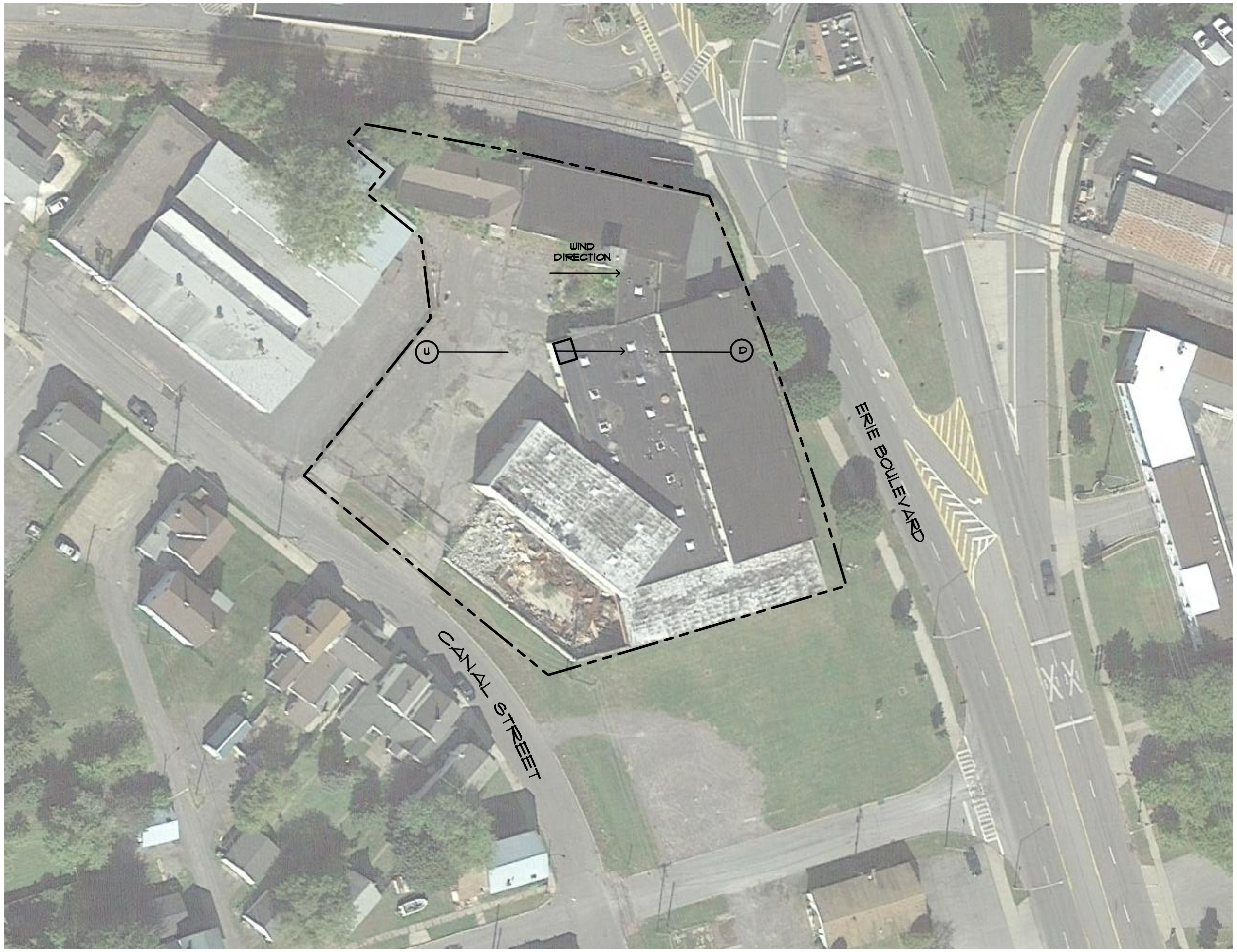
If localized visible dust is observed during operations, then dust suppression techniques will be employed. Examples of dust suppression techniques would include wetting the surface at boring locations, and wetting of crushed wall/slab material. If visible dust is still observed after implementation of dust suppression techniques, then continuous CAMP monitoring for particulates will be implemented.

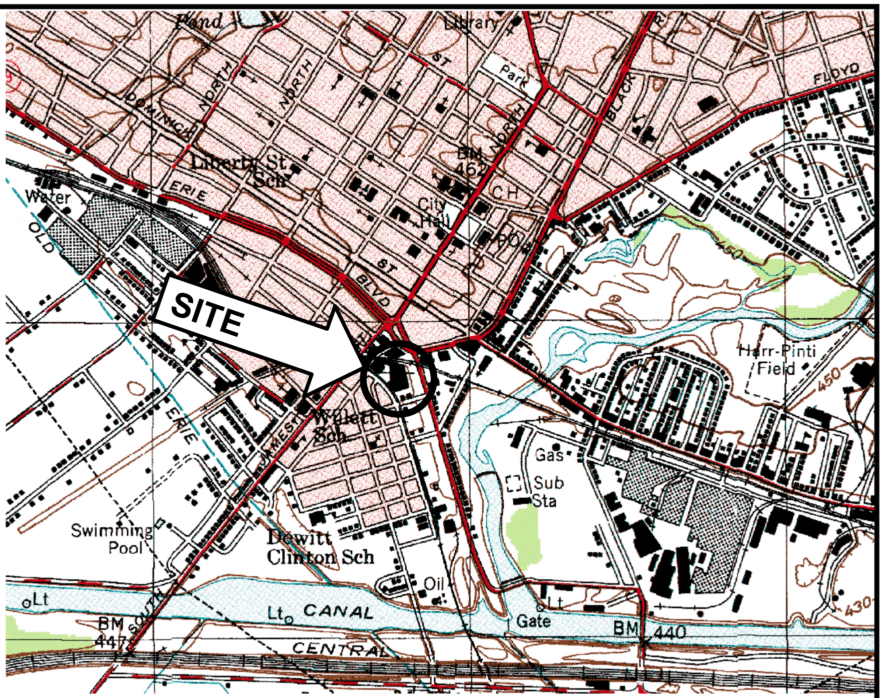
5.0 REPORTING

CAMP data summary tables (see figure 2) will be provided electronically to the NYSDEC and NYSDOH on a weekly basis (at a minimum), and any exceedances of CAMP action levels and corrective measure taken will be reported to the Departments immediately (within 24 hours).

CAMP data will be provided as an attachment within the Remedial Investigation report.

Figures





SITE LOCATION

LEGEND:

— — — APPROXIMATE PROPERTY LINE (BROWNFIELD AREA EXTENT)

▭ APPROXIMATE / EXAMPLE WORK AREA BOUNDARY

Ⓤ EXAMPLE UPWIND MONITORING LOCATION

Ⓓ EXAMPLE DOWNWIND MONITORING LOCATION

NOTES:

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH WEBSITE(OCTOBER, 2017).
2. APPROXIMATE PROPERTY LINE BASED ON GISCLOUD WEBSITE.
3. ALL LOCATIONS ARE APPROXIMATE.

0 40' 80'

GRAPHIC SCALE

AECC
ENVIRONMENTAL CONSULTING
Asbestos & Environmental
Consulting Corporation

6308 Fly Road
East Syracuse, NY 13057

PROJECT NO. 20-037
DRAWN: JULY 2020
DRAWN BY: NP
CHECKED BY: DB

Example Air Monitoring Locations

FORMER ROME TURNEY DEVELOPMENT SITE
109 CANAL STREET
ROME, NEW YORK 13440

FIGURE
CAMP-1

Attachments

Attachment A	Example CAMP Data Summary Sheet

CAMP DATA SUMMARY FORM

Rome Turney Development Site (#C633090)
109 Canal Street
Rome, New York

Table 1: Particulates Data

Date	**Action Level (µg/m^3)**	**Stop Work Level (µg/m^3)**	**Peak Particulates Reading (µg/m^3)**		**Comments/Response Action**
			Unit 1 (Upwind)	**Unit 2 (Downwind)**	
XX/XX/2021	100	150	XX	XX	No response action necessary or detailed response action

All particulates data is presented as 15-minute peak averages
Italics indicates recording in excess of alert level
Bold and italics indicates recording in excess of stop work level

Table 2: VOC Data

Date	**Action Level (ppm)**	**Stop Work Level (ppm)**	**Peak VOC Reading (ppm)**		**Comments/Response Action**
			Unit 1 (Upwind)	**Unit 2 (Downwind)**	
XX/XX/2021	5	25	XX	XX	No response action necessary or detailed response action

VOC data is presented as 15-minute peak averages
Italics indicates recording in excess of alert level
Bold and italics indicates recording in excess of stop work level

Appendix E

Property Access Agreement

ROME NY
the copper city

OFFICE OF THE MAYOR
Jacqueline M. Izzo

March 31, 2020

Brownfield Requestor and Applicant
c/o Mr. Bryan Bowers
Rome Turney, LLC
6308 Fly Road
East Syracuse, NY 13057

RE: Property Access & Authorization to perform Obligations under the NYSDEC BCP

Dear Sir or Madam:

The City of Rome, New York. ("Owner") owns the property located at 109 Canal Street (Tax Map No.: 242.066-0001-001), Rome, New York ("Property"). Owner hereby authorizes Rome Turney, LLC (the "Authorized Applicant/Requestor"), to access the Property and to apply to participate in and perform any obligations under the New York State Department of Environmental Conservation's ("NYSDEC") Brownfield Cleanup Program ("BCP").

Owner further understands that the Authorized Applicant will also need to provide access to the NYSDEC and environmental professionals that the Authorized Applicant has hired to perform any investigation and remedial activities under the BCP.

Sincerely,

Jacqueline M. Izzo
Mayor

Rome City Hall, 198 N. Washington Street
Rome, New York 13440-5815
Phone: 315-339-7676 Fax: 315-339-7667
mayor@romecitygov.com