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Remedial Investigation Work Plan
29 Clay Street
Brooklyn, New York
NYSDEC BCP No. C224408

July 2024
File No. 41.0163305.00

PREPARED FOR
NYSDEC – Division of Environmental Remediation
625 Broadway | Albany, NY 12233

PREPARED BY:
GZA GeoEnvironmental of New York
104 West 29th Street, 10th Floor | New York, NY 10001

32 Offices Nationwide
www.gza.com

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104 West 29th Street
10th Floor
New York, NY 10001
T: 212.594.8140
F: 212.279.8180
www.gza.com

July 29, 2024
File No. 41.0163305.00

Ms. Jennifer Gonzalez
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany NY, 12233

Re: Remedial Investigation Work Plan Report
29 Clay Street
Brooklyn, New York
NYSDEC BCP No. C224408

Dear Ms. Gonzalez:

GZA GeoEnvironmental of New York (GZA) is pleased to provide the Revised Remedial Investigation Work Plan (RIWP) for the above-referenced property (Site). The RIWP was revised to address the comments received from the NYSDEC and NYSDOH on July 29, 2024.

Should you have any questions, please contact Victoria Whelan at (631) 793-8821 or Victoria.Whelan@gza.com or Mark Hutson at (646) 929-8955 or Mark.Hutson@gza.com.

Very truly yours,

GZA GEOENVIRONMENTAL OF NEW YORK

Mark Hutson, P.G.
Senior Project Manager

Stephen M. Kline, P.E.
Consultant Reviewer

Victoria Whelan, P.G.
Associate Principal

Enclosure: Remedial Investigation Work Plan

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CERTIFICATION

I, Victoria D. Whelan, certify that I am currently a Qualified Environmental Professional as defined in 6 New York Codes, Rules, and Regulations (NYCRR) Part 375 and that this Remedial Investigation Work Plan (RIWP) was prepared in accordance with all applicable statutes and regulations and substantial conformance with New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER)-10 Technical Guidance for Site Investigation and Remediation.

Victoria D. Whelan, QEP, NYSPG

1.0 INTRODUCTION

The following Remedial Investigation Work Plan (RIWP) was prepared by GZA Geoenvironmetnal Of New York (GZA) on behalf of Clay Properties, LLC, the Brownfield Cleanup Program (BCP) volunteer, relative to the necessary remediation of the real property located at 29 Clay Street, Brooklyn, New York, BCP Site No. C224408(herein referred to as the 'Site' or 'Property'). This RIWP is based upon the guidelines set forth in Section 3 of the New York State Department of Environmental Conservations (NYSDEC) Draft Brownfield Cleanup Program Guide dated May 2004 and NYSDEC's DER-10 Technical Guidance for Site Investigations and Remediations. The proposed scope of work discussed in this RIWP will be conducted in accordance with the Quality Assurance Project Plan (Appendix A), the Health & Safety Plan (Appendix B) and the Community Air Monitoring Plan (Appendix C).

The Site is currently enrolled in the NYSDEC BCP as BCP Site No. C224408. Prior investigations indicate that the subsurface, including the soil, groundwater and soil vapor have been impacted by past usage of the Site. Based on the previous investigations for the purposes of developing this RIWP and the HASP, the contaminants of concern are Volatile Organic Compounds (VOCs). One previous study was completed:

1. Remedial Investigation Report (RIR), Clay Properties, Preferred Environmental March 2023.

The results of the March 2023 RIR will be included in the RIR for this scope of work. The information collected from the previous investigations document that there is contamination of VOCs, at the Site. Due to the limited nature of the previous investigations GZA has prepared this RIWP to fully identify the nature and extent of the impacted media beneath the Site. The purpose of this RIWP is to outline the scope and protocol to be followed during the investigation of soil, groundwater, and soil vapor to:

1. Define the nature and extent of all contamination;
2. Identify contaminant source areas; and
3. Produce data of sufficient quantity and quality to support the development of a NYSDEC acceptable Remedial Action Work Plan.

2.0 PHYSICAL SITE CHARACTERISTICS

2.1 SITE DESCRIPTION

The site is located at 29 Clay Street, Brooklyn, NY 11222. The site is one New York City Tax Lot (County: Brooklyn; Block 2482; Lots 53. The total area of the site is 9,415 square feet (sq ft). The Site has frontage along Clay Street. The site is partially developed.

The site is a large vacant parcel with the old foundation slab in place. The site is gated to avoid any trespassers entering the premises. The Site is currently unoccupied. The use of the site will not interfere with the investigation or when the remediation commences.

The site is currently vacant, and the current zoning designation is M1-2-R6. The Site is level and has no natural or artificial surface water bodies or impoundments. The depth to groundwater is between 6-8 feet below surface grade. A Topographic Map and a Property Location Map are included as Figures 1 and 2, respectively.

2.2 SITE HISTORY

The site was utilized for various industrial and manufacturing operations including iron works, tin can storage facility, cotton batting company, paper storage warehouse, and "non-specific manufacturing use."

Sanborn History:

1887-1905: The Subject Property is developed with multiple structures identified as the Logan Iron Works, including a blacksmith shop, a flange shop and a boiler shop. Commercial Street and additional portions of the iron works are to the north, followed by a sugar refinery.

1916: The Subject Property is developed consistent with the 1905 map depictions; however, the buildings are now identified as a tin can storage facility.

1942-1951: The Subject Property has been redeveloped with a commercial/industrial building along Clay Street. These include a 2-story structure (west) occupied by a cotton batting manufacturer. The structure layout appears to be consistent with the recently demolished building.

1965: The building is identified as occupied by non-specific manufacturing use

Previous Investigations:

The following investigations were previously performed at the Site:

1. Remedial Investigation by Preferred Environmental Services, March 2023

Remedial Investigation (RI) by Preferred Environmental Services (Preferred), March 2023

Preferred conducted an RIR under the oversight of the New York City Office of Environmental Remediation (NYCOER). The RI was completed for three NYC Tax Lots (9, 10 and 53) identified at 19-27 Clay Street, 53 Clay Street and 60-62 Commercial Street. The investigation included the installation of ten (10) soil borings, five (5) permanent groundwater monitoring wells, nine (9) soil vapor probes. Of the samples collected for the RI, this section summarizes the samples collected specifically associated with the BCP Site. At 29 Clay Street, a total of Fourteen (14) soil samples, three (3) groundwater samples, and five (5) soil vapor samples were collected and sent for a laboratory analysis.

Soil samples were analyzed for the following:

- Target Compound List (TCL) volatile organic compounds (VOCs) by United States Environmental Protection Agency (EPA) Method 8260
- TCL semi-volatile organic compounds (SVOC) by EPA Method 8270
- Target Analyte List (TAL) metals by EPA Method 6000/7000 series
- Pesticides/polychlorinated biphenyls (PCB) by EPA Method 8081/8082
- 1,4-Dioxane and Poly-Fluoro-Aalkyl Substances (PFAS)

Groundwater samples were analyzed for the following:

- TCL VOCs by United States EPA Method 8260
- TCL SVOCs by EPA Method 8270
- TAL metals EPA Method 6000/7000 series (filtered and unfiltered)
- Pesticides/polychlorinated biphenyls (PCB) by EPA Method 8081/8082

Soil vapor samples were analyzed for the following:

- TCL VOCs analysis via EPA Method TO-15

Summary of Historical Environmental Findings:

1. Depth to groundwater is shallow and between 6-8 feet below ground surface grade.

2. On-site groundwater flow is generally northwest.

3. Bedrock was not encountered during the investigation.

4. Soils encountered throughout the site consisted generally of brown fine grained sandy fill mixed with wood, gravel and/or brick fragments (consistent with historic fill material) from grade surface to a depth of approximately 4 feet (ft) below ground surface (bgs), Soil below 4 feet did have silty clay to the terminal drilling depth (10-15 ft bgs).

5. The known contaminants of concern include the following in the soil:

   VOCs

   Trichloroethylene (TCE) was reported above both the Protection of Groundwater Soil Cleanup Objective (PGSCO) and Unrestricted Use Soil Cleanup Objective (UUSCO) in SB-6 (0-2 ft) and SB-4 (0-2 ft).

   SVOCs

   Seven (7) semi-volatile organic compounds (SVOCs), Benzo(a)anthracene (maximum 15 mg/kg), Benzo(a)pyrene (maximum 13.1 mg/kg), Benzo(b)fluoranthene (maximum 12 mg/kg), Dibenzo (a,h)anthracene (maximum 4 mg/kg) Benzo(k)fluoranthene (maximum 10.9 mg/kg) Chrysene (maximum 13.9 mg/kg), Ideno(1, 2, 3-cd)pyrene(maximum 1.66 mg/kg) were detected above RRSCOs. SB-5 (0-2 ft) and SB-7 (0-2 ft) reported all seven (7) of these compounds at concentrations above their applicable RRSCO.

   Total Metals

   Five metals, Barium (maximum 513 mg/kg in SB-5 (0-2'), Cadmium maximum 6.14 mg/kg in SB-5 (0-2'), Copper (maximum 331 mg/kg in SB-5 (0-2'), Lead (maximum 6,870 mg/kg in SB-7 (0-2') and Manganese (maximum 3,260 mg/kg in SB-7 (0-2') were detected at or above their applicable Restricted Residential Use Soil Cleanup Objective (RRSCO) and/or the Protection of Groundwater SCO. The elevated detections of inorganic constituents were not detected at the deeper sample locations within the same boring.

6. Groundwater samples were collected, and results showed exceedances above groundwater standards for eight (8) compounds; 1,1,2-Trichloroethane 1.38 ug/L (AGWQS 1 ug/L), 1,1-Dichloroethylene 11.2 ug/L (AGWQS 5 ug/L), chloroform 12 ug/L (AGWQS 7 ug/L), cis-1,2-Dichloroethylene 1,340 ug/L, (AGWQS 5 ug/L), Tetrachloroethylene 6.28 ug/L, (AGWQS 5 ug/L), trans-1,2-Dichloroethylene 42.6 ug/L (AGWQS 5 ug/L), Trichloroethylene 6,370 ug/L (AGWQS 5 ug/L), and Vinyl Chloride 60.4 ug/L(AGWQS 2 ug/L).

7. Nine (9) soil vapor samples were collected and analyzed across the site. All of the soil vapor samples had elevated detections of chlorinated solvents as are summarized below by contaminant:

Carbon Tetrachloride - the NYSDOH has established that 6 ug/m3 as an immediate action level. SV-3 located on the Clay Street side of the property reported the maximum concentration of Carbon tetrachloride of 9.2 ug/m3.

cis-1,2-dichloroethene - the NYSDOH has established that 6 ug/m3 as an immediate action level. SV-3 on the Clay has the maximum site detection of 120 ug/m3. SV-1, SV-2, SV-3 and SV-4 all had results over the immediate action level.

Methylene chloride – the NYSDOH has established that 600 ug/m3 as an immediate action level. Methylene chloride was detected in any of the Soil Vapor Samples at concentrations above laboratory detection limits and therefore below applicable the immediate action level.

Tetrachloroethylene (PCE) - the NYSDOH has established that 300 ug/m3 as an immediate action level. PCE was detected in soil vapor samples collected across the Subject Property ranging in concentration from 3.7 ug/m3 to 4,500 ug/m3 in the SV-2 sample collected form the Clay Street side of the Subject Property.

Trichloroethene (TCE) - the NYSDOH has established that 20 ug/m3 is an immediate action level. TCE was detected across the property at ranges from 11 ug/m3 to 740,000 ug/m3 in the SV-2 sample.

2.3 AREAS OF CONCERN

Based on the site history and the findings of the previous studies, the Areas of Concern (AOCs) to be further investigated during the RI are as described below:

AOC-1 Historical Site Use

Information obtained from multiple historic sources revealed that the site was utilized as for various industrial/manufacturing operations from at least 1887. In addition, the site was identified on several regulatory agency databases related to hazardous waste generation with multiple RCRA and other agency violations. Given the length of time this facility operated, the lack of information regarding its operations and chemical/waste handling practices, there is a potential for historic operations to have impacted the subsurface.

Historic information also revealed that a number of the adjacent/surrounding properties were also historically utilized for various industrial/manufacturing uses, machine shops, iron works/foundries, service stations, garages/repair shops, and railroad/bus maintenance facilities. Further the southern and eastern adjacent properties are listed on multiple regulatory agency databases, including the NY SHWS and NY Brownfields, with documented impacts to the subsurface. As such, there is a potential for historic operations at these properties to have impacted the subsurface (soil vapor and/or groundwater quality).

AOC-2 – RI Findings

Information obtained from multiple historic sources revealed that the Subject Property was utilized as for various industrial/manufacturing operations from at least 1887. In addition, the Subject Property was identified on several regulatory agency databases.

2.4 SURROUNDING LAND USE

The site is located within a densely developed mixed-use area. The following surrounding land uses were observed during the Phase I ESA site inspection:

North: Commercial Street and a 4-story residential building (74 Commercial Street), followed by a NYC Transit facility (65 Commercial Street), an undeveloped lot (33-35 Commercial Street) and a high-rise building under construction (1-3 Bell Slip).

South: Clay Street, followed by three 1-story industrial buildings (26-32 Clay Street), four 1- and 2-familiy residences (38-46 Clay Street) and a mixed-use (residential (48 Clay Street).

East: A 7-story mixed-use (retail residential) building (1133 Manhattan Avenue, followed by two mixed-use buildings and Manhattan Avenue.

West: A warehouse at 19-27 Clay Street and a building supply warehouse (15 Clay Street), followed by three undeveloped parcels used as a storage yard, with the intersection of Clay and Commercial Streets beyond.

2.5 HYDROGEOLOGIC SETTING

The Site is relatively flat and has no natural or artificial surface water bodies or impoundments. According to the most recent subsurface investigation conducted by Preferred, the depth to groundwater is approximately 6-feet below surface grade. It is anticipated that shallow groundwater flows to the northwest.

2.6 PROPOSED REDEVELOPMENT/PROJECT DESCRIPTION

This project is to investigate and remediate the site through the NYSDEC BCP. The project development will include a residential development that will cover the entire footprint of the property.

3.0 REMEDIAL INVESTIGATION

3.1 OBJECTVIES

The objectives of the investigation phase of this project are to:

1. Determine the nature and extent of soil, groundwater and soil vapor at the Site; and,
2. Obtain the necessary information needed to design and implement a Remedial Action Work Plan (RAWP) for the Site.

Based on the soil vapor results from the previous remedial investigation, vapor intrusion evaluation is needed to understand the extent of the vapor intrusion at the site. The values of chlorinated VOC's were above the limits prescribed in Matrix 1 of the NYSDOH Soil Vapor intrusion Guidance, which suggests a vapor encroachment condition exists at the site. A soil vapor survey, including the collection of soil vapor samples throughout the interior and exterior of the property, identifying soil vapor quality impacted by chlorinated VOCs will be part of the scope of work along with soil and groundwater quality.

The names, contact information and roles of personnel who will participate in the investigation are included in the QAPP – Appendix A.

3.2 UTILITY CLEARANCE

GZA will retain a contractor to conduct a geophysical survey across the entire Site to scan the shallow subsurface for the presence of anomalies (e.g., underground storage tanks and associated piping, utilities, and foundation slabs). The geophysical survey will include one or more of the following techniques to assist in detecting subsurface anomalies: Ground Penetrating Radar (GPR), electromagnetic surveys and/or subsurface utility surveys. Anomalies detected by the geophysical survey will be marked with spray paint and/or flags. GZA personnel will be onsite to observe and document the survey. A written geophysical survey report and figure will be appended to the Remedial Investigation Report

Additionally, a mark-out of underground utility lines will be performed prior to the start of fieldwork by calling the New York City One-Call Center. A utility mark-out verification reference number for the Site will be obtained and a record of the utilities will be kept (e.g., Con Ed, Cablevision, etc.).

3.3 GROUNDWATER MONITORING WELLS

3.3.1 Groundwater Monitoring Well Installation

A total of four (4) permanent groundwater monitoring well clusters will be installed through the Site. Each of the clusters will consist of two (2) monitoring wells. One 2-inch diameter monitoring well will be installed into the shallow groundwater and will be constructed with a 10-foot long 0.010-inch slotted well screen followed by a 10-foot riser. The second monitoring well will be screened from 30-40 feet bgs with a 0.010-inch slotted well screen followed by a 30-foot riser. The monitoring wells will be furnished with a flush-mount cap and a locking j-plug.

The following characteristics of each newly installed well will be recorded in the field logbook:

- Date/time of construction
- Drilling method used
- Approximate well location
- Borehole diameter and well casing diameter
- Well depth
- Drilling and lithologic logs
- Casing materials
- Screen materials and design
- Casing and screen joint type
- Screen slot size/length
- Filter pack material/size

- Filter pack placement method
- Sealant materials

A minimum of 24 hours after installation, the monitoring wells will be developed by surging/bailing, using a centrifugal pump and dedicated polyethylene tubing, or by Waterra positive displacement pumps and dedicated polyethylene tubing, or other methods at the discretion of the Field Manager/Site Supervisor. The development water will be contained in a tank on site or in drums to be provided by Aarco Environmental Services Corp. (AARCO), the drilling subcontractor. Wells will be developed until turbidity is less than 50 Nephelometric Turbidity Units (NTUs) for three (3) successive reading and until water quality indicators stabilized within 10% for pH, temperature, and specific conductivity for three successive readings, or until at least three well volumes are purged. All monitoring well development will be overseen by a field geologist and the duration, method of development, and approximate volume of water removed will be recorded in the field book.

3.3.2 Well Survey

The monitoring wells will be surveyed. The elevations of the top of the well casings will be surveyed by a licensed surveyor to the nearest 0.01 of a foot. The depth to water will be measured and a water table elevation contour map will be prepared. The water table contour map will also include the horizontal and gradient direction of groundwater flow.

3.3.3 Groundwater Monitoring Well Sampling

Groundwater samples will be collected from the eight (8) newly installed groundwater monitoring wells. All monitoring wells will be sampling in accordance with EPA's Low-Flow (minimal drawdown) Groundwater Sampling procedures.

Two (2) weeks after well development, the ten (10) groundwater monitoring wells will be sampled. The following materials, as required, shall be available during groundwater sampling:

- Sample pump (peristaltic)
- Sample tubing
- Power source (i.e., generator, battery)
- Appropriate health and safety equipment as specified in the HASP
- Dedicated or disposable bailers
- New disposable polypropylene rope
- Buckets to measure purge water
- Water-level interface probe
- Conductivity/temperature meter

- pH meter
- Turbidity meter
- Appropriate water sample containers
- Appropriate blanks (trip blank supplied by the laboratory)
- Appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials
- Groundwater sampling logs
- COC forms
- Indelible ink pens
- Site map with well locations

Prior to sampling, groundwater elevations will be measured at each monitoring well and the presence of light non-aqueous phase liquid (LNAPL) or DNAPL (if any) within the well will be evaluated. Depth to water and depth to bottom measurements of each well will be collected using a sonic interface probe and recorded on the sampling log sheet.

After groundwater elevations are measured and NAPLs are determined not to be present, groundwater will be purged from the wells. If NAPLs are determined present, then a groundwater sample will not be collected, rather a representative NAPL sample may be collected (if required) using a peristaltic pump or other method determined by the Field Manager/Site Supervisor.

Tubing (for peristaltic pumps) will be lowered slowly into the well to a depth corresponding to the center of the saturated screen section of the well. Purging rates will not exceed 500 milliliters per minute. During well purging, monitor the field indicator parameters (turbidity, temperature, specific conductance, pH, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) every three to five minutes (or as appropriate). The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized (readings with 10% of prior reading for pH, conductivity, turbidity and DO and 10 +/- mV for ORP) for three consecutive readings. Readings will be recorded utilizing a Horiba multimeter with flow through cell or equivalent.

Groundwater samples will be collected directly from the decontaminated tubing into laboratory-issued bottle ware. The vials will be filled completely and checked to ensure that no air bubbles are present. Samples will be packaged in laboratory-issued sample contained by GZA personnel and stored on ice pending same day or overnight shipment to a New York State ELAP and Contract Laboratory Protocol (CLP)-Accredited laboratory subcontracted by GZA. All samples will be uniquely identified, and all information associated with the samples will be recorded utilizing standard Chain-of-Custody (COC) sampling protocols. Sample containers will then be placed on ice until delivered to the laboratory.

Groundwater samples from each well will be analyzed for NYSDEC Full TCL/TAL List Volatile Organic Compounds (VOCs) by EPA Method 8260, Semi-Volatile Organic Compounds (SVOCs) by EPA Method 8270, Organochlorine Pesticides by USEPA Method 8081, Polychlorinated Byphenols (PCBs) by USEPA Method 8082, Chlorinated Herbicides by USEPA Method 8151 and Target Analyte list (TAL) Metals via EPA 6010/7471 Series, Per- and Polyfluoroalkyl Substances (PFAS) and 1,4-Dioxane. Sample analyses for Per- and Polyfluoroalkyl Substances (PFAS) and 1,4-dioxane will be conducted in accordance with the NYSDEC April 2023 Guidance for Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS). All analysis will be reported using NYSDEC ASP Category B deliverables.

During this round of sampling, the following samples will be collected for QA/QC purposes in accordance with the attached Quality Assurance Project Plan (QAPP) (Appendix A):

- 1 trip blank
- 1 field blank
- 1 duplicate sample
- 1 matrix spike and 1 matrix spike duplicate

The groundwater laboratory data will be reviewed by a qualified Data Validator and a Data Usability Summary Report (DUSR) will be prepared. The laboratory analytical results of the samples will be compared to NYSDEC TOGS groundwater standards and guidance values. Monitoring well installation logs will be generated and will be included as an Appendix in the Remedial Investigation Report. The logs will contain any local condition(s) that occurred during the sampling that may influence interpretation of the results (i.e., weather). Additionally, logs will include parameters recorded during low flow sampling, depth to water, depth to bottom, monitoring well screen information, and construction details. All purge water will be drummed and sampled for proper off-site disposal.

3.4 SOIL SAMPLING

Ten (10) soil borings will be advanced to a maximum depth of approximately 40-ft bgs at pre-specified locations to further characterize the soil to the groundwater interface. Utilizing the Geoprobe drilling system, continuous soil samples will be collected and screened from each boring at two-foot depth intervals.

As requested by the Department, to further delineate the extent of shallow TCE impacts identified around GW-1, two soil borings will be installed 1) 10 feet east and 2) 10 feet north of the former GW-1.

A GZA representative will oversee all soil boring activities; log (characterize) the shallow fill lithology and screen the subsurface earth materials (fill) samples with a PID. Organoleptic conditions will be noted for all samples.

A shallow soil sample will be collected from each boring at approximately 0-2- feet bgs and a second sample will be collected from the soil exhibiting the highest degree of impact based upon both a visual inspection and PID readings and/or the deepest sample above the groundwater interface for laboratory analysis. Soil borings will be advanced to a maximum depth of approximately 40-ft bgs.

Soil Samples will be submitted for laboratory analysis for NYSDEC Full TCL/TAL List Volatile Organic Compounds (VOCs) by EPA Method 8260, Semi-Volatile Organic Compounds (SVOCs) by EPA Method 8270, Organochlorine Pesticides by USEPA Method 8081, Polychlorinated Byphenols (PCBs) by USEPA Method 8082, Chlorinated Herbicides by USEPA Method 8151 and Target Analyte list (TAL) Metals via EPA 6010/7471 Series, Per- and Polyfluoroalkyl Substances (PFAS) and 1,4-Dioxane. Sample analyses for Per- and Polyfluoroalkyl Substances (PFAS) and 1,4-dioxane will be conducted in accordance with the NYSDEC April 2023 Guidance for Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS). All analysis will be reported using NYSDEC ASP Category B deliverables from an ELAP-certified laboratory.

All on-site sampling equipment will be decontaminated between each use in the following manner: laboratory grade detergent and freshwater wash using scrub brush, followed by two freshwater rinses and a final air dry. Gloves worn for sample handling will be discarded between sample collections. Each sample will be placed in sterilized laboratory supplied containers. The sampled earth material will be settled and capped to ensure that little or no headspace is present within the sample. Sample containers will then be placed on ice until delivered to the laboratory. All samples will be uniquely identified, and all information associated with the samples will be recorded utilizing standard chain-of-custody sampling protocols.

Following the completion of each boring, the boreholes will be backfilled with drill cuttings and then sealed with cement grout if no evidence of free product, NAPL, or grossly contaminated soil were identified during the advancement of the boring. If free product, NAPL, or grossly contaminated soi is identified, soil cuttings will be disposed of off-site in accordance with DER-10, see Section 3.6 for additional details. Boring logs will be generated for each borehole.

During this round of sampling, the following samples will be collected for QA/QC purposes in accordance with the attached Quality Assurance Project Plan (QAPP) (Appendix A):

- 1 trip blank – per day
- 1 field blank/20 samples
- 1 duplicate sample/20 samples
- 1 matrix spike and 1 matrix spike duplicate/20 samples

The soil laboratory data will be reviewed by a qualified Data Validator and a Data Usability Summary Report (DUSR) will be prepared. The laboratory analytical results of the samples will be compared to NYSDEC Part 375 standards and guidance values. Soil boring installation logs will be generated and will be included as an Appendix in the Remedial Investigation Report. The logs will contain any local condition(s) that occurred during the sampling that may influence interpretation of the results (i.e., weather).

3.5 SOIL VAPOR POINT INSTALLATION AND SAMPLIING

Five (5) soil vapor samples will be installed via a Geoprobe™ direct push technology throughout the Site in accordance with the NYSDOH “Guidance for Evaluating Soil Vapor Intrusion in the State of New York” dated October 2006.

As requested by the Department, to further delineate the extent of shallow TCE impacts identified around GW-1 mg/kg), two soil vapor samples will be installed 1) 10 feet east and 2) 10 feet north of the former GW-1.

A stainless-steel screen connected to ¼-inch poly-tubing tubing will be advanced to two-feet above the groundwater interface, approximately 4 feet below surface grade and capped with a sample fitting to allow for the collection of soil gas. The annual space around the stainless-steel screen will be packed with coarse sand to one foot above the screen, creating a sampling zone of one foot six inches. A three (3) foot bentonite seal will then be emplaced above the sampling zone. The remainder of the borehole will be backfilled with clean fill.

One (1) soil gas sample will be collected from each soil vapor point at least 24-hours after installation in accordance with NYSDOH's "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" dated October 2006. Concurrently one outdoor air sample will be collected.

Prior to sampling, one-to-three volumes of soil gas will be purged from the soil vapor point using a calibrated air sampling pump. A bucket will be placed over the sample assembly and helium gas will be used to enrich the atmosphere around the sample location in combination with real-time air monitoring (for helium) to verify that ambient air was not infiltrating the sampling assembly during purging and sampling.

Once confirmed that ambient air is not being drawn into the assembly, the soil vapor will be screened for the presence of VOCs using a photoionization detector (PID). After field screening is completed, the tubing will be connected to the SUMMA canister and a soil vapor sample will be collected. The SUMMA canister regulators for the soil vapor, indoor air and outdoor air samples will be set to restrict the sample collection to not exceed 0.2 liters per minute over an eight-hour time period. The canister will be submitted to a NYSDOH-certified laboratory for analysis of VOCs via EPA method TO-15 under chain-of-custody documentation.

During this round of sampling, the following samples will be collected for QA/QC purposes in accordance with the attached Quality Assurance Project Plan (QAPP) (Appendix A):

- 1 duplicate sample

Sampling activities a sample log sheet will be complete for each sample summarizing the following:

- sample identification;
- date and time of sample collection;
- sampling depth/height;
- identity of samplers;
- sampling methods and devices;
- purge volumes;
- volume of soil vapor extracted;
- if canisters used, the vacuum before and after samples collected;
- apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, and
- chain of custody protocols and records used to track samples from sampling point to analysis.

Soil vapor point installation logs will be generated and will be included as an Appendix in the Remedial Investigation Report. The logs will contain any local condition(s) that occurred during the sampling that may influence interpretation of the results (i.e., weather).

The soil vapor laboratory data will be reviewed by a qualified data validator and a Data Usability Summary Report (DUSR) will be prepared in accordance with the QAPP.

3.6 DISPOSAL

Waste generated from remedial investigation activities including soil boring installation, soil vapor point installation, monitoring well installation, and subsequent sampling will be handled in accordance with DER-10 Section 3.3(e). Drill cuttings may be disposed at the site within the borehole that generated them within 24 inches of the surface unless:

- Free product, NAPL or grossly contaminated soil, are present in the cuttings;
- The borehole has penetrated an aquitard, aquiclude or other confining layer; or extends significantly into bedrock;
- Backfilling the borehole with cuttings will create a significant path for vertical movement of contaminants. Soil additives (bentonite) may be added to the cuttings to reduce permeability;
- The soil cannot fit into the borehole.

Those soil cuttings needing to be managed on-site will be containerized in properly labeled DOT approved 55-gallon drums for future off-site disposal at a permitted facility. All boreholes which require drill cuttings disposal would ultimately be backfilled with drill cuttings and cement grout. Disposable sampling equipment including spoons, gloves, bags, paper towels, etc. that came in contact with environmental media will be double bagged and disposed as municipal trash dumpster as non-hazardous trash.

3.7 EQUIPMENT DECONTAMINATION

An equipment decontamination area will be set up in a location close to, but segregated from, the work area. This decontamination area will be set up on top of a minimum 6-mil polyethylene liner (or equivalent quality plastic sheeting) and will include the following equipment: decontaminating cleaners and solutions, deionized water, sprayers, washing tubs, brushes and clean disposable latex and neoprene gloves. Gloves worn for sample handling will be discarded between sample collections.

All down-hole drilling equipment will be decontaminated upon arrival at the Site and between each use, e.g., augers, samplers, rods and plugs, etc. All re-usable sampling equipment, including bowls, trowels, and split-spoon samplers, etc. will be decontaminated with a three-step washing process that consists of a tap water rinse, an Alconox® and tap water wash, followed by a distilled water rinse. After each rinsing process the equipment will be allowed to air dry. The submersible pump used for groundwater sample collection will be decontaminated between sample collection by passing the detergent and water mixture through the pump, followed by two freshwater rinses.

3.8 SAMPLING QA/QC PROTOCOL

Field notes including observations of soil conditions, pertinent observations, diagrams (if appropriate) will be maintained, and appropriate photographs will be taken. A record of each sample, including any pertinent observations about the sample will be kept in a field notebook and/or appropriate logs and copies will be included in the Remedial Investigation Report.

3.9 AIR MONITORING

Air monitoring will be conducted for site workers and the community (Community Air Monitoring Program). Air monitoring results will be recorded in the field book during the investigation activities. Fugitive particulate (dust) generation that could affect site workers of the community is not expected for the following reasons:

- Most of the work area and the boring locations are paved with asphalt, gravel, or concrete; therefore, vehicle movement will not generate dust.
- Intrusive work is limited to boring. Sub-slab vapor point and well installation, which does not generate large volumes of soil cuttings or dust.

3.9.1 Worker Air Monitoring

Air monitoring of the breathing zone will be performed periodically during drilling and sampling activities to document health and safety protection for the work team. VOCs will be monitored with a PID in accordance with the HASP (Appendix B). If air monitoring during intrusive operations identifies the presence of VOCs, the field engineer will follow the guidelines outlined in the HASP regarding action levels, permissible exposure, engineering controls, and personal protective equipment. If the VOC action level is exceeded, work will cease and the work location will be evacuated. Monitoring will continue until the levels drops to permissible limits, at which point, work will resume with continued monitoring. If high levels persist, field activities will be halted, and the work relocated to another area. If dust emissions are observed, work will stop and dust suppression measures (i.e., water spray) will be implemented.

3.9.2 Community Air Monitoring Plan

In addition to air monitoring in the worker breathing zone, community air monitoring will be performed in compliance with the NYSDOH Generic Community Air Monitoring Plan (CAMP) during all intrusive work for the duration of the investigation. The CAMP is included in Appendix C. The CAMP will consist of continuous monitoring for VOCs and dust emissions during ground intrusive activities (i.e., soil boring and monitoring well installation). Concentrations of VOCs and dust emissions will be measured at both the upwind (one) and downwind (one) CAMP stations before the start of the RI to establish background concentrations. During the RI, VOCs and dust emissions will be measured at the start of each workday, and at one-minute intervals throughout the day at the downwind perimeter of the work zone, which will be established at points on the site where the general public or site employees may be present. VOC Monitoring will be conducted with a PID equipped with a 10.6 eV lamp. VOC community air monitoring requirements will be conducted until it is determined that the site is not a source of organic vapors. Dust emissions will be monitored using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM10) and capable of averaging a period of 15 minutes (or less) for comparison to the airborne particulate action level (e.g., DustTrak). If dust emissions are observed, work will stop and dust suppression measures will be used. The results will be presented in the daily reports (see DER-10 for details).

3.10 HEALTY & SAFETY

A site-specific Health and Safety Plan (HASP) has been prepared for the field portion of the Remedial Investigation. The HASP will cover all activities in the investigation area as well as, emergency procedures and available emergency services in proximity to the Site. All proposed work discussed in the RIWP will be conducted in accordance with the HASP. The HASP is included as Appendix B.

3.11 QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

A Qualitative Human Health Exposure Assessment will be conducted in accordance with Appendix 3B of the NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation. The assessment will be submitted in the RIR.

3.12 FISH AND WILDLIFE RESOURCE IMPACT ANALYSIS

A Fish and Wildlife Resource Impact Study is not required for this site according to DER-10 Section 3.10.

3.13 GREEN AND SUSTAINABLE REMEDIATION (GSR) PRACTICES

According to NYSDEC DER-31 Green Remediation guidance document, green Remediation approaches should be considered during site remediation. GZA and its subcontractors will incorporate sustainability practices to reduce the environmental footprint of the investigation and cleanup. In accordance with ASTM E2893-16e1 the project GSR goals include the following:

- To minimize total energy use and maximize use of renewable energy,
- To minimize air pollutants and greenhouse gas emissions,
- To minimize water, use and impact to water resources,
- To reduce, reuse and recycle materials and waste; and
- To protect land and ecosystems

GZA will incorporate best management practices to lower our environmental footprint during the investigation and remediation phase of the project. GZA will incorporate the following practicable measures during the planned scope of work:

1. Limit the use of generators, excavation equipment, and vehicles to reduce emissions.
2. Minimize truck travel for disposal of waste generated during the IRM implementation by selecting local disposal facilities.
3. Minimize waste disposal by reusing soil/fill that does not exhibit visual, olfactory, or PID evidence of contamination to backfill excavated areas.
4. Manage onsite resources and materials efficiently.
5. Use local subcontractors during IRM implementation to minimize vehicle emissions during commute.
6. Request IRM implementation subcontractors to use clean diesel equipment to reduce emissions.
7. Request project staff and subcontractors to use public transportation during IRM implementation to the extent practicable.
8. Reducing waste, increasing recycling and increasing reuse of materials that otherwise be considered waste.

As required a Climate screen checklist and an environmental footprint analysis has been completed for the project and are attached in Appendix E.

4.0 REPORTING

4.1 REMEDIAL INVESTIGATION REPORTING

Following completion of the RI and receipt of analytical data, an RIR will be prepared. The report will include:

- A summary of the site history and previous investigations
- A description of site conditions
- Sampling methodology and field observations
- An evaluation of the results and findings
- Conclusions and recommendations for any further assessment (if warranted), and remedial action objectives

The report will summarize the nature and extent of contamination at each area of concern and identify unacceptable exposure pathways (as determined through a Qualitative Human Health Exposure Assessment).

The report will include soil boring and well construction logs, sampling logs, tabulated analytical results, figures, and laboratory data packages. The tabulated analytical results will be organized in table format and include sample location, media sampled, sample depth, field/laboratory identification numbers, analytical results and the applicable Standards, Criteria, and Guidance (SCGs) pertaining to the site and contaminants of concern for comparison. The report will include scaled figures showing the locations of soil borings, monitoring wells, and sub-slab vapor points, sample concentrations above SCGs for each media, groundwater elevation contours and flow direction, and, if appropriate, groundwater contaminant concentration contours.

4.2 DAILY REPORTS

Daily reports will be submitted to NYSDEC and NYSDOH Project Managers by the end of each day following the reporting period and will include:

- An update of progress made during the reporting day
- Locations of work and quantities of material imported and exported from the site
- References to alpha-numeric map for site activities
- A summary of any and all complaints with relevant details (names, phone numbers)
- A summary of CAMP findings, including exceedances
- An explanation of notable site conditions.

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the RIWP or other sensitive or time critical information. However, such conditions must also be included in the daily reports. Emergency conditions and changes to the RIWP will be addressed directly to NYSDEC Project Manager via personal communication.

Daily Reports will include a description of daily activities keyed to an alpha-numeric map for the site that identifies work areas. These reports will include a summary of CAMP results, odor and dust problems and corrective actions, and all complaints received from the public. The NYSDEC-assigned project number will appear on all reports.

4.3 MONTHLY REPORTS

Monthly reports will be submitted to NYSDEC and NYSDOH Project Managers by the 10th of each month and will include:

- Activities relative to the site during the previous reporting period and those anticipated for the next reporting period, including a quantitative presentation of work performed (i.e., tons of material exported and imported, etc.)
- Description of approved activity modifications, including changes of work scope and/or
- Schedule Sampling results received following internal data review and validation, as applicable
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays

5.0 COMMUNITY RELATIONS

A detailed mailing list of contact list of near residents, businesses, public officials and citizens groups in included in the BCP Application. We will update this list as needed to include any other interested parties.

6.0 SCHEDULE

The following Schedule is provided for the BCP Project:

Event	Schedule
Remedial Investigation Work Plan and HASP (with BCP Application)	June-July 2024
Site Investigation Field Work	August 2024
Remedial Investigation Report	September – October 2024

TABLES

Table 1

Sample Summary
29-37 Clay Street, Brooklyn NY
NYSDEC BCP Site No. C224408

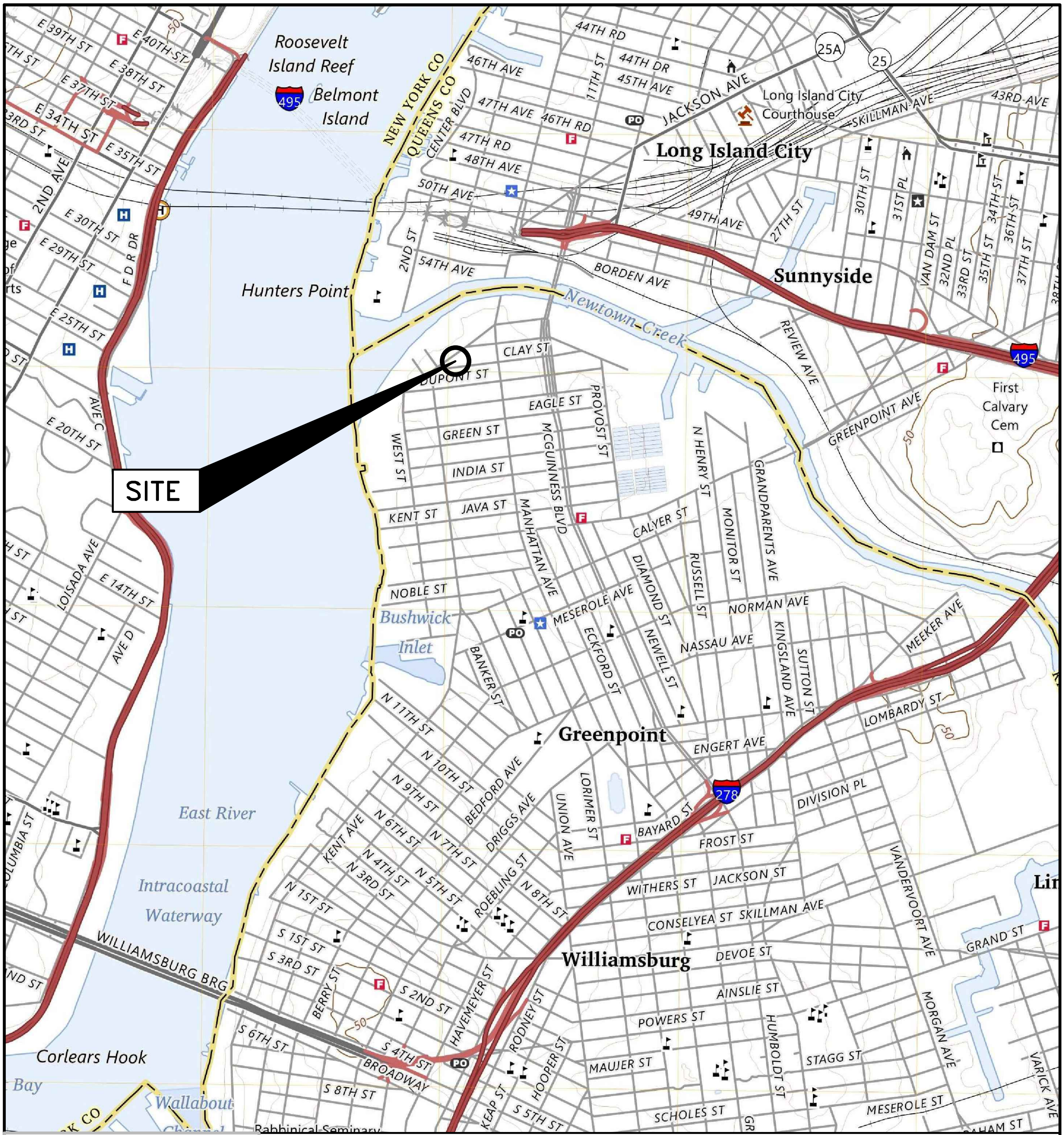
Sample Matrix	Sample ID	Sample Location	Depth	Sample Analyses
Soil	29-SB-8-S 29-SB-8-D	10 feet north of GW-1	0-2 feet bgs and highest impact or 1-foot interval above groundwater	TCL VOCs) by United State EPA Method 8260 TCL SVOC by EPA Method 8270 TAL metals by EPA Method 6000/7000 series Pesticides/PCBs by EPA Method 8081/8082 1,4-Dioxane and PFAS
Soil	29-SB-9-S 29-SB-9-D	10 feet east or GW-1	0-2 feet bgs and highest impact or 1-foot interval above groundwater	TCL VOCs) by United State EPA Method 8260 TCL SVOC by EPA Method 8270 TAL metals by EPA Method 6000/7000 series Pesticides/PCBs by EPA Method 8081/8082 1,4-Dioxane and PFAS
Soil	29-SB-10-S 29-SB-10-D	20 feet east of SB-4	0-2 feet bgs and highest impact or 1-foot interval above groundwater	TCL VOCs) by United State EPA Method 8260 TCL SVOC by EPA Method 8270 TAL metals by EPA Method 6000/7000 series Pesticides/PCBs by EPA Method 8081/8082 1,4-Dioxane and PFAS
Soil	29-SB-11-S 29-SB-11-D	10 feet west of SB-6	0-2 feet bgs and highest impact or 1-foot interval above groundwater	TCL VOCs) by United State EPA Method 8260 TCL SVOC by EPA Method 8270 TAL metals by EPA Method 6000/7000 series Pesticides/PCBs by EPA Method 8081/8082 1,4-Dioxane and PFAS
Soil	29-SB-12-S 29-SB-12-D	10 feet south of SB-6	0-2 feet bgs and highest impact or 1-foot interval above groundwater	TCL VOCs) by United State EPA Method 8260 TCL SVOC by EPA Method 8270 TAL metals by EPA Method 6000/7000 series Pesticides/PCBs by EPA Method 8081/8082 1,4-Dioxane and PFAS
Soil	29-SB-13-S 29-SB-13-D	10 feet east of SB-6	0-2 feet bgs and highest impact or 1-foot interval above groundwater	TCL VOCs) by United State EPA Method 8260 TCL SVOC by EPA Method 8270 TAL metals by EPA Method 6000/7000 series Pesticides/PCBs by EPA Method 8081/8082 1,4-Dioxane and PFAS
GW	29-GW-6S	NW corner of Site	10-20 ft bgs	TCL VOCs by United States EPA Method 8260 TCL SVOCs by EPA Method 8270 TAL metals EPA Method 6010/7471 series Pesticides/PCBs/Chlorinated Herbicides by EPA Method 8081/8082 and 8151 1,4-Dioxane and PFAS

Table 1

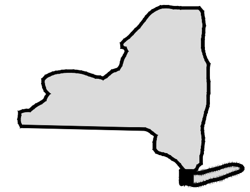
Sample Summary
29-37 Clay Street, Brooklyn NY
NYSDEC BCP Site No. C224408

Sample Matrix	Sample ID	Sample Location	Depth	Sample Analyses
				TCL VOCs) by United State EPA Method 8260
GW	29-GW-6D	NW corner of Site	30-40 ft bgs	TCL VOCs by United States EPA Method 8260
				TCL SVOCs by EPA Method 8270
				TAL metals EPA Method 6010/7471 series
				Pesticides/PCBs/Chlorinated Herbicides by EPA Method 8081/8082 and 8151
				1,4-Dioxane and PFAS
GW	29-GW-7S	5 feet NE of SB-6	8-18 ft bgs	TCL VOCs by United States EPA Method 8260
				TCL SVOCs by EPA Method 8270
				TAL metals EPA Method 6010/7471 series
				Pesticides/PCBs/Chlorinated Herbicides by EPA Method 8081/8082 and 8151
				1,4-Dioxane and PFAS
GW	29-GW-7D	5 feet NE of SB-6	30-40 ft bgs	TCL VOCs by United States EPA Method 8260
				TCL SVOCs by EPA Method 8270
				TAL metals EPA Method 6010/7471 series
				Pesticides/PCBs/Chlorinated Herbicides by EPA Method 8081/8082 and 8151
				1,4-Dioxane and PFAS
GW	29-GW-8S	SW corner of Site	8-18 ft bgs	TCL VOCs by United States EPA Method 8260
				TCL SVOCs by EPA Method 8270
				TAL metals EPA Method 6010/7471 series
				Pesticides/PCBs/Chlorinated Herbicides by EPA Method 8081/8082 and 8151
				1,4-Dioxane and PFAS
GW	29-GW-8D	SW corner of Site	30-40 ft bgs	TCL VOCs by United States EPA Method 8260
				TCL SVOCs by EPA Method 8270
				TAL metals EPA Method 6010/7471 series
				Pesticides/PCBs/Chlorinated Herbicides by EPA Method 8081/8082 and 8151
				1,4-Dioxane and PFAS
GW	29-GW-9S	SE corner of Site	8-18 ft bgs	TCL VOCs by United States EPA Method 8260
				TCL SVOCs by EPA Method 8270
				TAL metals EPA Method 6010/7471 series
				Pesticides/PCBs/Chlorinated Herbicides by EPA Method 8081/8082 and 8151
				1,4-Dioxane and PFAS
GW	29-GW-9D	SE corner of Site	30-40 ft bgs	TCL VOCs by United States EPA Method 8260
				TCL SVOCs by EPA Method 8270
				TAL metals EPA Method 6010/7471 series
				Pesticides/PCBs/Chlorinated Herbicides by EPA Method 8081/8082 and 8151
				1,4-Dioxane and PFAS
Air	29-SV-8	SW corner of Site	4-6 ft bgs	TCL VOCs EPA Method TO-15
Air	29-SV-9	SW corner of Site	4-6 ft bgs	TCL VOCs EPA Method TO-15
Air	29-SV-10	10 feet east of SV-3	4-6 ft bgs	TCL VOCs EPA Method TO-15
Air	29-SV-11	5 feet NW of SV-5	4-6 ft bgs	TCL VOCs EPA Method TO-15
Air	29-SV-12	10 feet N of SB-5	4-6 ft bgs	TCL VOCs EPA Method TO-15

FIGURES



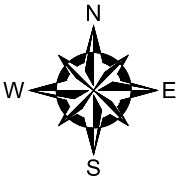
NEW YORK



QUADRANGLE LOCATION

SOURCE:

USGS TOPOGRAPHIC MAPS: BROOKLYN, NY, NJ (2023). CONTOUR INTERVAL 10FT., NAVD-1988, ORIGINAL SCALE 1:24,000 (1IN.=2,000FT.).



29 CLAY STREET
BROOKLYN, NY 11222

PREPARED BY:
GZA GeoEnvironmental of NY
Engineers and Scientists
www.gza.com

PREPARED FOR:
CLAY PROPERTIES, LLC

SITE LOCATION MAP

PROJ MGR: JB	REVIEWED BY: VW	CHECKED BY: SK	FIGURE
DESIGNED BY: VW	DRAWN BY: DT	SCALE: 1"=2000'	1
DATE: JULY 2024	PROJECT NO. 41.0163305.00	REVISION NO. -	SHEET NO. 1 OF 1

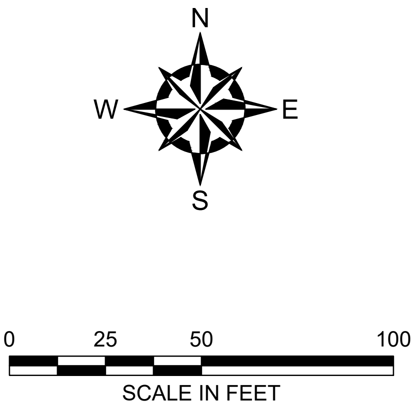
GZA–J:\Active 163300 to 163399\163305.00 – 29 Clay Street Remedial Investigation\Reports\RIWP\Figures\Drawings\41.0163279.00 Figures 1,2,3,6 – 19 Clay.dwg [FIG 2 – AERIAL] July 22, 2024 – 11:12am daniel.tess

GENERAL NOTES

1. AERIAL IMAGERY DEVELOPED FROM (C) MICROSOFT CORPORATION (C) 2023 MAXAR (C) CNES (2023) DISTRIBUTION AIRBUS DS.
2. BASE MAP ADAPTED FROM DRAWING TITLED "FIGURE 2 – AERIAL PHOTOGRAPH", PREPARED BY "PREFERRED ENVIRONMENTAL SERVICES", ORIGINAL SCALE 1" = 50', DATED FEBRUARY 2024.

LEGEND

🟥 APPROXIMATE SITE BOUNDARY



NO.	ISSUE/DESCRIPTION	BY	DATE

29 CLAY STREET
BROOKLYN, NY 11222

AERIAL MAP

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Engineers and Scientists
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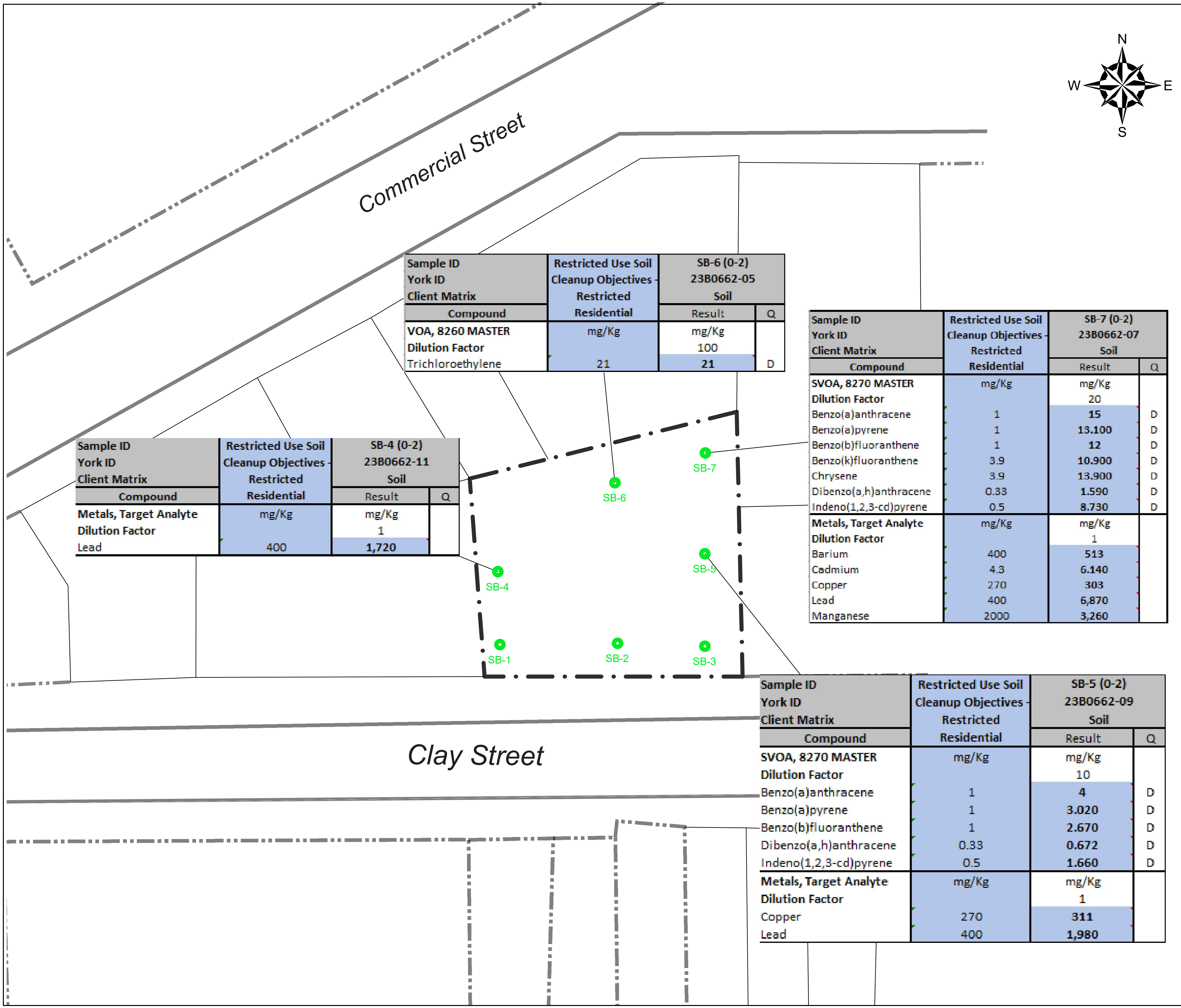
PREPARED FOR:
CLAY PROPERTIES, LLC

PROJ MGR: JB	REVIEWED BY: SK	CHECKED BY: SK	FIGURE 2
DESIGNED BY: VW	DRAWN BY: DT	SCALE: 1" = 50'	
DATE: JULY 2024	PROJECT NO. 41.0163305.00	REVISION NO. -	SHEET NO. 1 OF 1



Sample ID York ID Client Matrix	Restricted Use Soil Cleanup Objectives - Restricted Residential	SB-6 (0-2) 23B0662-05 Soil	
Compound		Result	Q
VOA, 8260 MASTER	mg/Kg	mg/Kg	
Dilution Factor		100	
Trichloroethylene	21	21	D

Sample ID York ID Client Matrix	Restricted Use Soil Cleanup Objectives - Restricted Residential	SB-4 (0-2) 23B0662-11 Soil	
Compound		Result	Q
Metals, Target Analyte	mg/Kg	mg/Kg	
Dilution Factor		1	
Lead	400	1,720	

Sample ID York ID Client Matrix	Restricted Use Soil Cleanup Objectives - Restricted Residential	SB-7 (0-2) 23B0662-07 Soil	
Compound		Result	Q
SVOA, 8270 MASTER	mg/Kg	mg/Kg	
Dilution Factor		20	
Benzo(a)anthracene	1	15	D
Benzo(a)pyrene	1	13.100	D
Benzo(b)fluoranthene	1	12	D
Benzo(k)fluoranthene	3.9	10.900	D
Chrysene	3.9	13.900	D
Dibenzo(a,h)anthracene	0.33	1.590	D
Indeno(1,2,3-cd)pyrene	0.5	8.730	D
Metals, Target Analyte	mg/Kg	mg/Kg	
Dilution Factor		1	
Barium	400	513	
Cadmium	4.3	6.140	
Copper	270	303	
Lead	400	6,870	
Manganese	2000	3,260	

Sample ID York ID Client Matrix	Restricted Use Soil Cleanup Objectives - Restricted Residential	SB-5 (0-2) 23B0662-09 Soil	
Compound		Result	Q
SVOA, 8270 MASTER	mg/Kg	mg/Kg	
Dilution Factor		10	
Benzo(a)anthracene	1	4	D
Benzo(a)pyrene	1	3.020	D
Benzo(b)fluoranthene	1	2.670	D
Dibenzo(a,h)anthracene	0.33	0.672	D
Indeno(1,2,3-cd)pyrene	0.5	1.660	D
Metals, Target Analyte	mg/Kg	mg/Kg	
Dilution Factor		1	
Copper	270	311	
Lead	400	1,980	

GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "FIGURE 6 – PROPOSED SAMPLING LOCATIONS", PREPARED BY "PREFERRED ENVIRONMENTAL SERVICES", ORIGINAL SCALE 1" = 25', DATED FEBRUARY 2024.
2. FORMER EXPLORATION LOCATIONS SHOWN ARE APPROXIMATED BASED ON THE SITE PLAN REFERENCED IN NOTE 1.
3. PROPOSED EXPLORATION LOCATIONS MAY BE ADJUSTED IN THE FIELD DUE TO THE PRESENCE OF UNDERGROUND UTILITIES OR OBSTRUCTIONS.

LEGEND

▭	APPROXIMATE SITE BOUNDARY
●	APPROXIMATE SOIL SAMPLING LOCATION
●	APPROXIMATE MONITORING WELL CLUSTER AND SOIL BORING LOCATION

0 20 40 80
SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

29 CLAY STREET
BROOKLYN, NY 11222

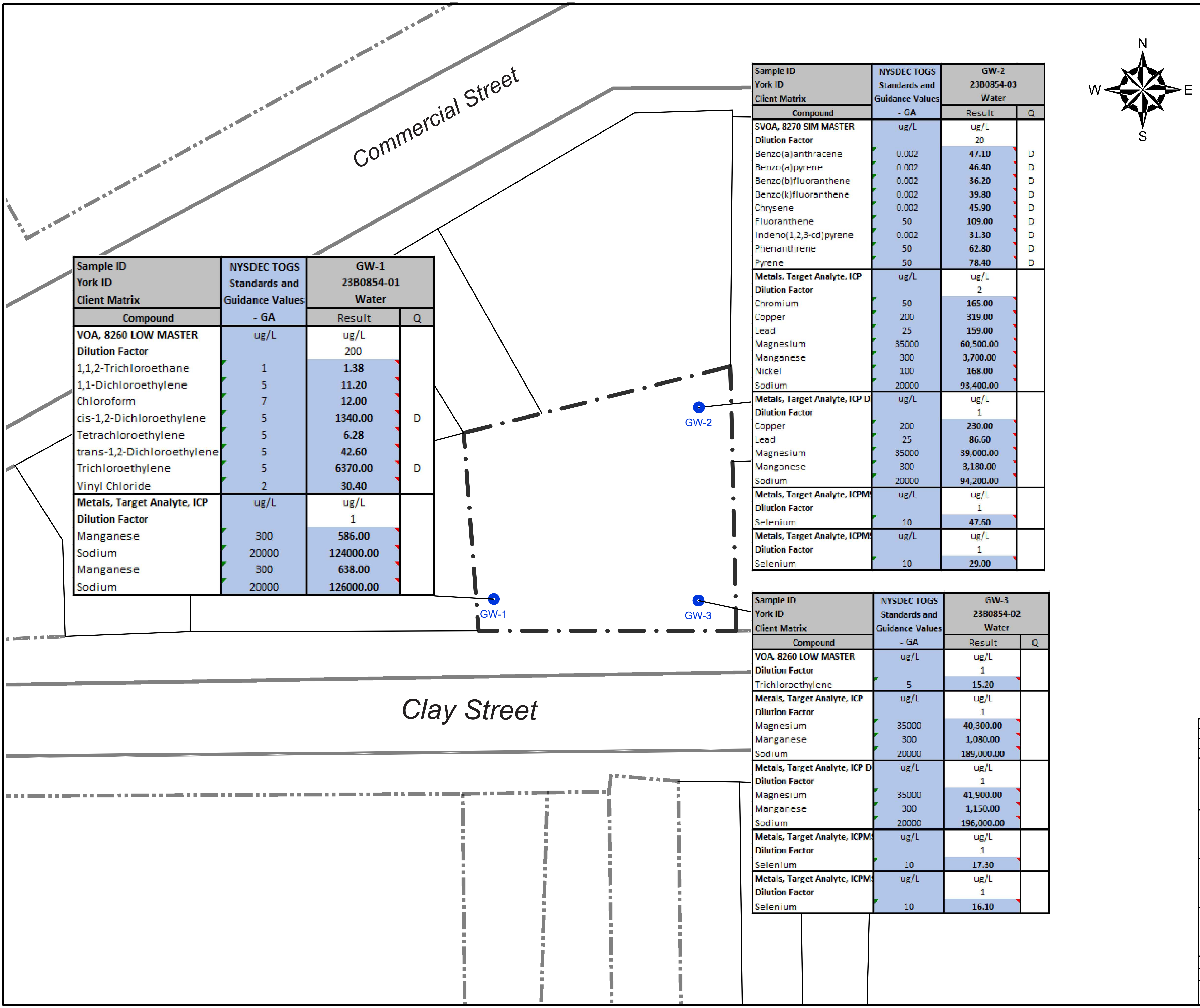
SOIL SAMPLING RESULTS

PREPARED BY:
GZA GeoEnvironmental of NY
Engineers and Scientists
www.gza.com

PREPARED FOR:
CLAY PROPERTIES, LLC

PROJ MGR: JB	REVIEWED BY: VW	CHECKED BY: VW	FIGURE 3
DESIGNED BY: VW	DRAWN BY: DT	SCALE: 1" = 40'	
DATE: JULY 2024	PROJECT NO. 41.0163305.00	REVISION NO. -	SHEET NO. 1 OF 1

GZA-J:\Active 163300 to 163399\163305.00 – 29 Clay Street Remedial Investigation\Reports\RIWP\Figures\Drawings\41.0163279.00 Figures – 29 Clay Street.dwg [FIG 3 – SOIL SAMPLING RESULTS] July 23, 2024 – 10:0



Sample ID York ID Client Matrix	NYSDEC TOGS Standards and Guidance Values - GA	GW-1 23B0854-01 Water	
Compound		Result	Q
VOA, 8260 LOW MASTER	ug/L	ug/L	
Dilution Factor		200	
1,1,2-Trichloroethane	1	**1.38**	
1,1-Dichloroethylene	5	**11.20**	
Chloroform	7	**12.00**	
cis-1,2-Dichloroethylene	5	**1340.00**	D
Tetrachloroethylene	5	**6.28**	
trans-1,2-Dichloroethylene	5	**42.60**	
Trichloroethylene	5	**6370.00**	D
Vinyl Chloride	2	**30.40**	
Metals, Target Analyte, ICP	ug/L	ug/L	
Dilution Factor		1	
Manganese	300	**586.00**	
Sodium	20000	**124000.00**	
Manganese	300	**638.00**	
Sodium	20000	**126000.00**	

Sample ID York ID Client Matrix	NYSDEC TOGS Standards and Guidance Values - GA	GW-2 23B0854-03 Water	
Compound		Result	Q
SVOA, 8270 SIM MASTER	ug/L	ug/L	
Dilution Factor		20	
Benzo(a)anthracene	0.002	**47.10**	D
Benzo(a)pyrene	0.002	**46.40**	D
Benzo(b)fluoranthene	0.002	**36.20**	D
Benzo(k)fluoranthene	0.002	**39.80**	D
Chrysene	0.002	**45.90**	D
Fluoranthene	50	**109.00**	D
Indeno(1,2,3-cd)pyrene	0.002	**31.30**	D
Phenanthrene	50	**62.80**	D
Pyrene	50	**78.40**	D
Metals, Target Analyte, ICP	ug/L	ug/L	
Dilution Factor		2	
Chromium	50	**165.00**	
Copper	200	**319.00**	
Lead	25	**159.00**	
Magnesium	35000	**60,500.00**	
Manganese	300	**3,700.00**	
Nickel	100	**168.00**	
Sodium	20000	**93,400.00**	
Metals, Target Analyte, ICP D	ug/L	ug/L	
Dilution Factor		1	
Copper	200	**230.00**	
Lead	25	**86.60**	
Magnesium	35000	**39,000.00**	
Manganese	300	**3,180.00**	
Sodium	20000	**94,200.00**	
Metals, Target Analyte, ICPM	ug/L	ug/L	
Dilution Factor		1	
Selenium	10	**47.60**	
Metals, Target Analyte, ICPM	ug/L	ug/L	
Dilution Factor		1	
Selenium	10	**29.00**	

Sample ID York ID Client Matrix	NYSDEC TOGS Standards and Guidance Values - GA	GW-3 23B0854-02 Water	
Compound		Result	Q
VOA, 8260 LOW MASTER	ug/L	ug/L	
Dilution Factor		1	
Trichloroethylene	5	**15.20**	
Metals, Target Analyte, ICP	ug/L	ug/L	
Dilution Factor		1	
Magnesium	35000	**40,300.00**	
Manganese	300	**1,080.00**	
Sodium	20000	**189,000.00**	
Metals, Target Analyte, ICP D	ug/L	ug/L	
Dilution Factor		1	
Magnesium	35000	**41,900.00**	
Manganese	300	**1,150.00**	
Sodium	20000	**196,000.00**	
Metals, Target Analyte, ICPM	ug/L	ug/L	
Dilution Factor		1	
Selenium	10	**17.30**	
Metals, Target Analyte, ICPM	ug/L	ug/L	
Dilution Factor		1	
Selenium	10	**16.10**	

GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "FIGURE 6 – PROPOSED SAMPLING LOCATIONS", PREPARED BY "PREFERRED ENVIRONMENTAL SERVICES", ORIGINAL SCALE 1" = 25', DATED FEBRUARY 2024.
2. FORMER EXPLORATION LOCATIONS SHOWN ARE APPROXIMATED BASED ON THE SITE PLAN REFERENCED IN NOTE 1.
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LEGEND

⬚	APPROXIMATE SITE BOUNDARY
🟢	APPROXIMATE SOIL SAMPLING LOCATION
🔵	APPROXIMATE MONITORING WELL CLUSTER AND SOIL BORING LOCATION

NO.	ISSUE/DESCRIPTION	BY	DATE

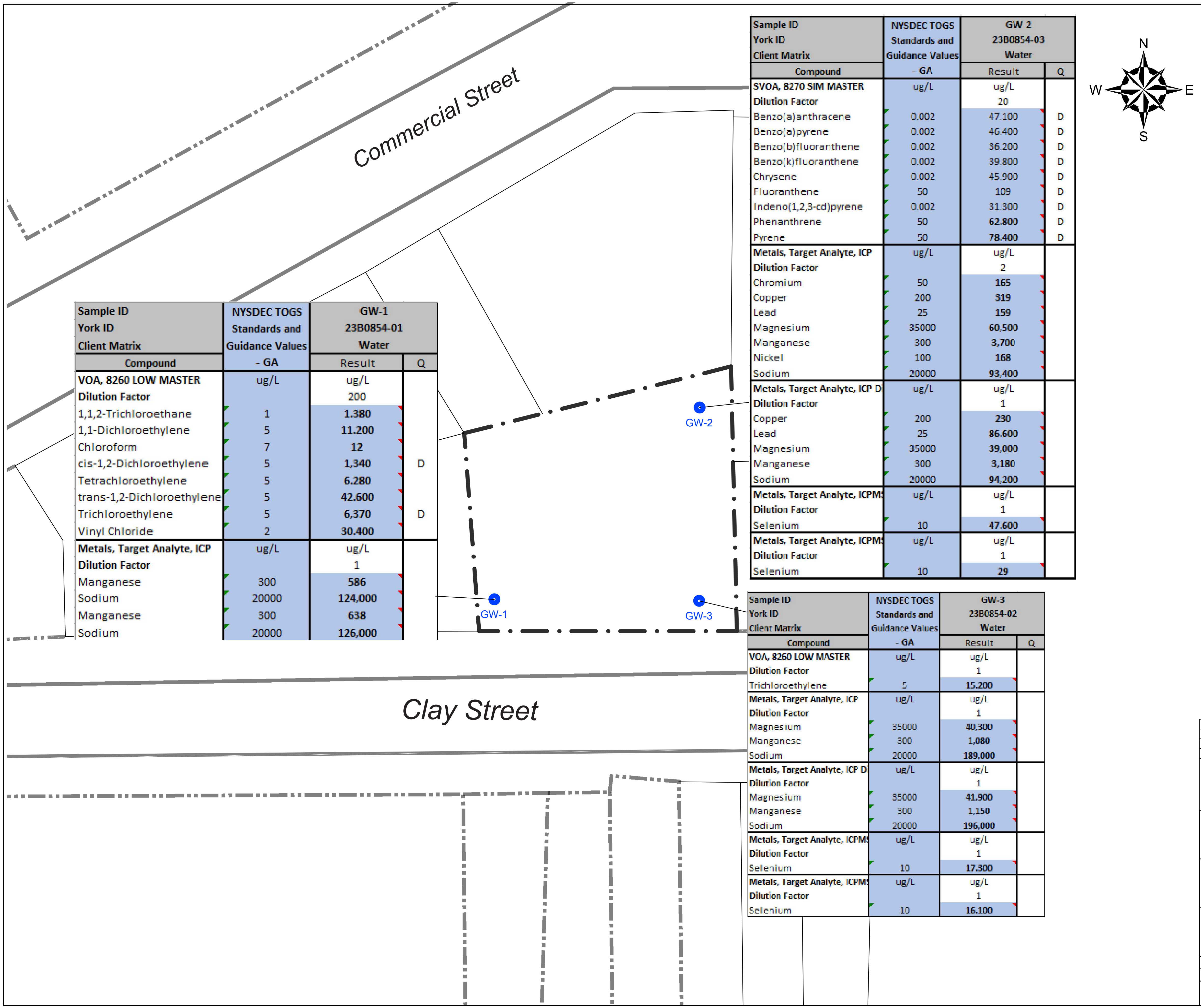
29 CLAY STREET
BROOKLYN, NY 11222

GROUNDWATER SAMPLING RESULTS

PREPARED BY:
GZA GeoEnvironmental of NY
Engineers and Scientists
www.gza.com

PREPARED FOR:
CLAY PROPERTIES, LLC

PROJ MGR: JB	REVIEWED BY: VW	CHECKED BY: VW	FIGURE 4
DESIGNED BY: VW	DRAWN BY: DT	SCALE: 1" = 40'	
DATE: JULY 2024	PROJECT NO. 41.0163305.00	REVISION NO. -	SHEET NO. 1 OF 1



Sample ID York ID Client Matrix	NYSDEC TOGS Standards and Guidance Values - GA	GW-1 23B0854-01 Water	
Compound		Result	Q
VOA, 8260 LOW MASTER	ug/L	ug/L	
Dilution Factor		200	
1,1,2-Trichloroethane	1	**1.380**	
1,1-Dichloroethylene	5	**11.200**	
Chloroform	7	**12**	
cis-1,2-Dichloroethylene	5	**1,340**	D
Tetrachloroethylene	5	**6.280**	
trans-1,2-Dichloroethylene	5	**42.600**	
Trichloroethylene	5	**6,370**	D
Vinyl Chloride	2	**30.400**	
Metals, Target Analyte, ICP	ug/L	ug/L	
Dilution Factor		1	
Manganese	300	**586**	
Sodium	20000	**124,000**	
Manganese	300	**638**	
Sodium	20000	**126,000**	

Sample ID York ID Client Matrix	NYSDEC TOGS Standards and Guidance Values - GA	GW-2 23B0854-03 Water	
Compound		Result	Q
SVOA, 8270 SIM MASTER	ug/L	ug/L	
Dilution Factor		20	
Benzo(a)anthracene	0.002	47.100	D
Benzo(a)pyrene	0.002	46.400	D
Benzo(b)fluoranthene	0.002	36.200	D
Benzo(k)fluoranthene	0.002	39.800	D
Chrysene	0.002	45.900	D
Fluoranthene	50	109	D
Indeno(1,2,3-cd)pyrene	0.002	31.300	D
Phenanthrene	50	**62.800**	D
Pyrene	50	**78.400**	D
Metals, Target Analyte, ICP	ug/L	ug/L	
Dilution Factor		2	
Chromium	50	**165**	
Copper	200	**319**	
Lead	25	**159**	
Magnesium	35000	**60,500**	
Manganese	300	**3,700**	
Nickel	100	**168**	
Sodium	20000	**93,400**	
Metals, Target Analyte, ICP D	ug/L	ug/L	
Dilution Factor		1	
Copper	200	**230**	
Lead	25	**86.600**	
Magnesium	35000	**39,000**	
Manganese	300	**3,180**	
Sodium	20000	**94,200**	
Metals, Target Analyte, ICPMS	ug/L	ug/L	
Dilution Factor		1	
Selenium	10	**47.600**	
Metals, Target Analyte, ICPMS	ug/L	ug/L	
Dilution Factor		1	
Selenium	10	**29**	

Sample ID York ID Client Matrix	NYSDEC TOGS Standards and Guidance Values - GA	GW-3 23B0854-02 Water	
Compound		Result	Q
VOA, 8260 LOW MASTER	ug/L	ug/L	
Dilution Factor		1	
Trichloroethylene	5	**15.200**	
Metals, Target Analyte, ICP	ug/L	ug/L	
Dilution Factor		1	
Magnesium	35000	**40,300**	
Manganese	300	**1,080**	
Sodium	20000	**189,000**	
Metals, Target Analyte, ICP D	ug/L	ug/L	
Dilution Factor		1	
Magnesium	35000	**41,900**	
Manganese	300	**1,150**	
Sodium	20000	**196,000**	
Metals, Target Analyte, ICPMS	ug/L	ug/L	
Dilution Factor		1	
Selenium	10	**17.300**	
Metals, Target Analyte, ICPMS	ug/L	ug/L	
Dilution Factor		1	
Selenium	10	**16.100**	

GENERAL NOTES

1. BASE MAP DEVELOPED FROM DRAWING TITLED "FIGURE 6 – PROPOSED SAMPLING LOCATIONS", PREPARED BY "PREFERRED ENVIRONMENTAL SERVICES", ORIGINAL SCALE 1" = 25', DATED FEBRUARY 2024.
2. FORMER EXPLORATION LOCATIONS SHOWN ARE APPROXIMATED BASED ON THE SITE PLAN REFERENCED IN NOTE 1.
3. PROPOSED EXPLORATION LOCATIONS MAY BE ADJUSTED IN THE FIELD DUE TO THE PRESENCE OF UNDERGROUND UTILITIES OR OBSTRUCTIONS.

LEGEND

⬚	APPROXIMATE SITE BOUNDARY
🟢	APPROXIMATE SOIL SAMPLING LOCATION
🔵	APPROXIMATE MONITORING WELL CLUSTER AND SOIL BORING LOCATION

0 20 40 80
SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

29 CLAY STREET
BROOKLYN, NY 11222

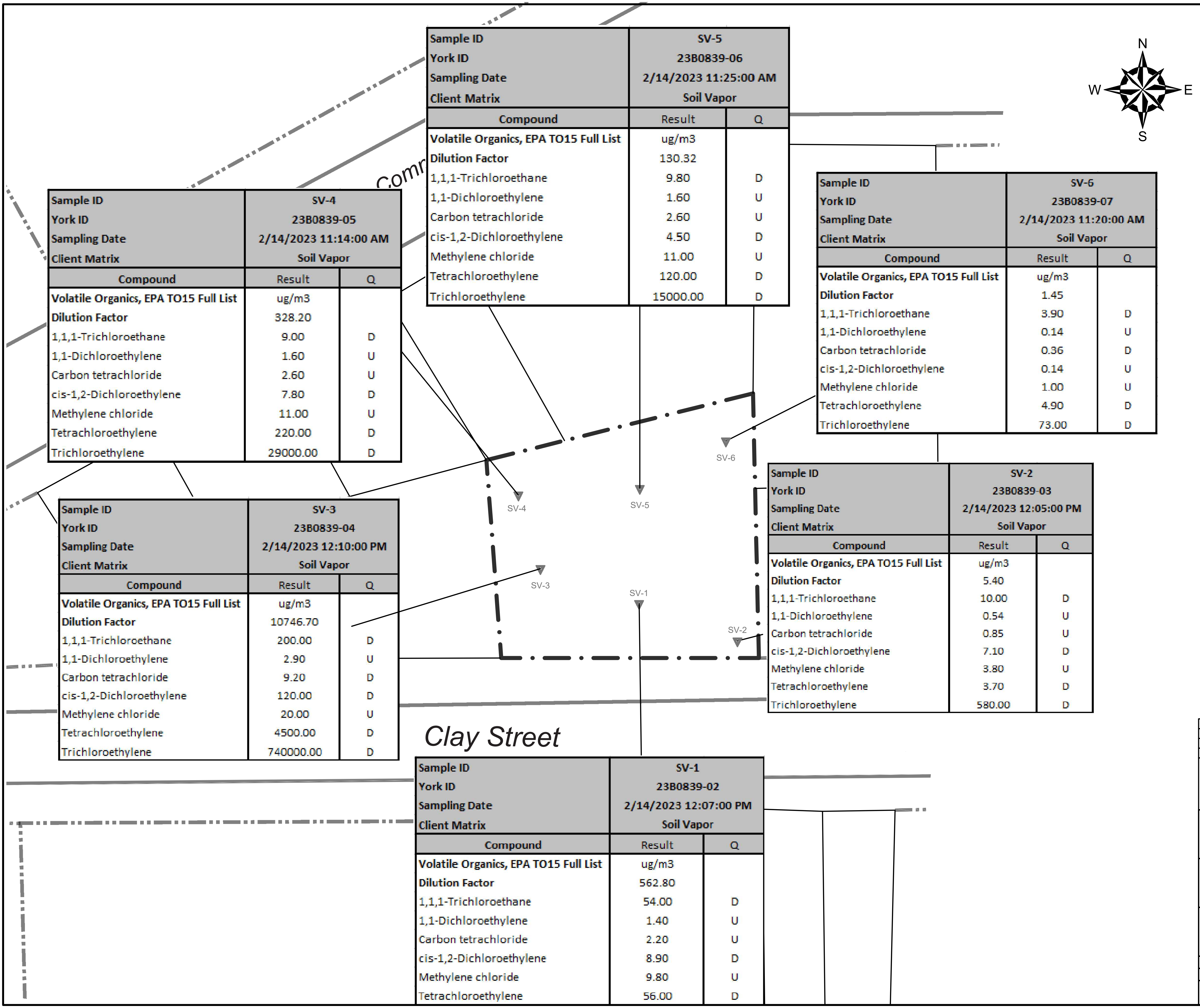
GROUNDWATER SAMPLING RESULTS

PREPARED BY:
GZA GeoEnvironmental of NY
Engineers and Scientists
www.gza.com

PREPARED FOR:
CLAY PROPERTIES, LLC

PROJ MGR: JB	REVIEWED BY: VW	CHECKED BY: VW	FIGURE 4
DESIGNED BY: VW	DRAWN BY: DT	SCALE: 1" = 40'	
DATE: JULY 2024	PROJECT NO. 41.0163305.00	REVISION NO. -	SHEET NO. 1 OF 1

GZA–J:\Active 163300 to 163399\163305.00 – 29 Clay Street Remedial Investigation\Reports\RIWP\Figures\Drawings\41.0163279.00 Figures – 29 Clay Street.dwg [FIG 4 – GW SAMPLING RESULTS] July 23, 2024 – 10:06



Sample ID	**SV-5**	
York ID	**23B0839-06**	
Sampling Date	**2/14/2023 11:25:00 AM**	
Client Matrix	**Soil Vapor**	
Compound	**Result**	**Q**
Volatile Organics, EPA TO15 Full List	ug/m3	
Dilution Factor	130.32	
1,1,1-Trichloroethane	9.80	D
1,1-Dichloroethylene	1.60	U
Carbon tetrachloride	2.60	U
cis-1,2-Dichloroethylene	4.50	D
Methylene chloride	11.00	U
Tetrachloroethylene	120.00	D
Trichloroethylene	15000.00	D

Sample ID	**SV-4**	
York ID	**23B0839-05**	
Sampling Date	**2/14/2023 11:14:00 AM**	
Client Matrix	**Soil Vapor**	
Compound	**Result**	**Q**
Volatile Organics, EPA TO15 Full List	ug/m3	
Dilution Factor	328.20	
1,1,1-Trichloroethane	9.00	D
1,1-Dichloroethylene	1.60	U
Carbon tetrachloride	2.60	U
cis-1,2-Dichloroethylene	7.80	D
Methylene chloride	11.00	U
Tetrachloroethylene	220.00	D
Trichloroethylene	29000.00	D

Sample ID	**SV-6**	
York ID	**23B0839-07**	
Sampling Date	**2/14/2023 11:20:00 AM**	
Client Matrix	**Soil Vapor**	
Compound	**Result**	**Q**
Volatile Organics, EPA TO15 Full List	ug/m3	
Dilution Factor	1.45	
1,1,1-Trichloroethane	3.90	D
1,1-Dichloroethylene	0.14	U
Carbon tetrachloride	0.36	D
cis-1,2-Dichloroethylene	0.14	U
Methylene chloride	1.00	U
Tetrachloroethylene	4.90	D
Trichloroethylene	73.00	D

Sample ID	**SV-3**	
York ID	**23B0839-04**	
Sampling Date	**2/14/2023 12:10:00 PM**	
Client Matrix	**Soil Vapor**	
Compound	**Result**	**Q**
Volatile Organics, EPA TO15 Full List	ug/m3	
Dilution Factor	10746.70	
1,1,1-Trichloroethane	200.00	D
1,1-Dichloroethylene	2.90	U
Carbon tetrachloride	9.20	D
cis-1,2-Dichloroethylene	120.00	D
Methylene chloride	20.00	U
Tetrachloroethylene	4500.00	D
Trichloroethylene	740000.00	D

Sample ID	**SV-2**	
York ID	**23B0839-03**	
Sampling Date	**2/14/2023 12:05:00 PM**	
Client Matrix	**Soil Vapor**	
Compound	**Result**	**Q**
Volatile Organics, EPA TO15 Full List	ug/m3	
Dilution Factor	5.40	
1,1,1-Trichloroethane	10.00	D
1,1-Dichloroethylene	0.54	U
Carbon tetrachloride	0.85	U
cis-1,2-Dichloroethylene	7.10	D
Methylene chloride	3.80	U
Tetrachloroethylene	3.70	D
Trichloroethylene	580.00	D

Sample ID	**SV-1**	
York ID	**23B0839-02**	
Sampling Date	**2/14/2023 12:07:00 PM**	
Client Matrix	**Soil Vapor**	
Compound	**Result**	**Q**
Volatile Organics, EPA TO15 Full List	ug/m3	
Dilution Factor	562.80	
1,1,1-Trichloroethane	54.00	D
1,1-Dichloroethylene	1.40	U
Carbon tetrachloride	2.20	U
cis-1,2-Dichloroethylene	8.90	D
Methylene chloride	9.80	U
Tetrachloroethylene	56.00	D

GENERAL NOTES

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LEGEND

⬚	APPROXIMATE SITE BOUNDARY
🟢	APPROXIMATE SOIL SAMPLING LOCATION
🔵	APPROXIMATE MONITORING WELL CLUSTER AND SOIL BORING LOCATION

0 20 40 80
SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

29 CLAY STREET
BROOKLYN, NY 11222

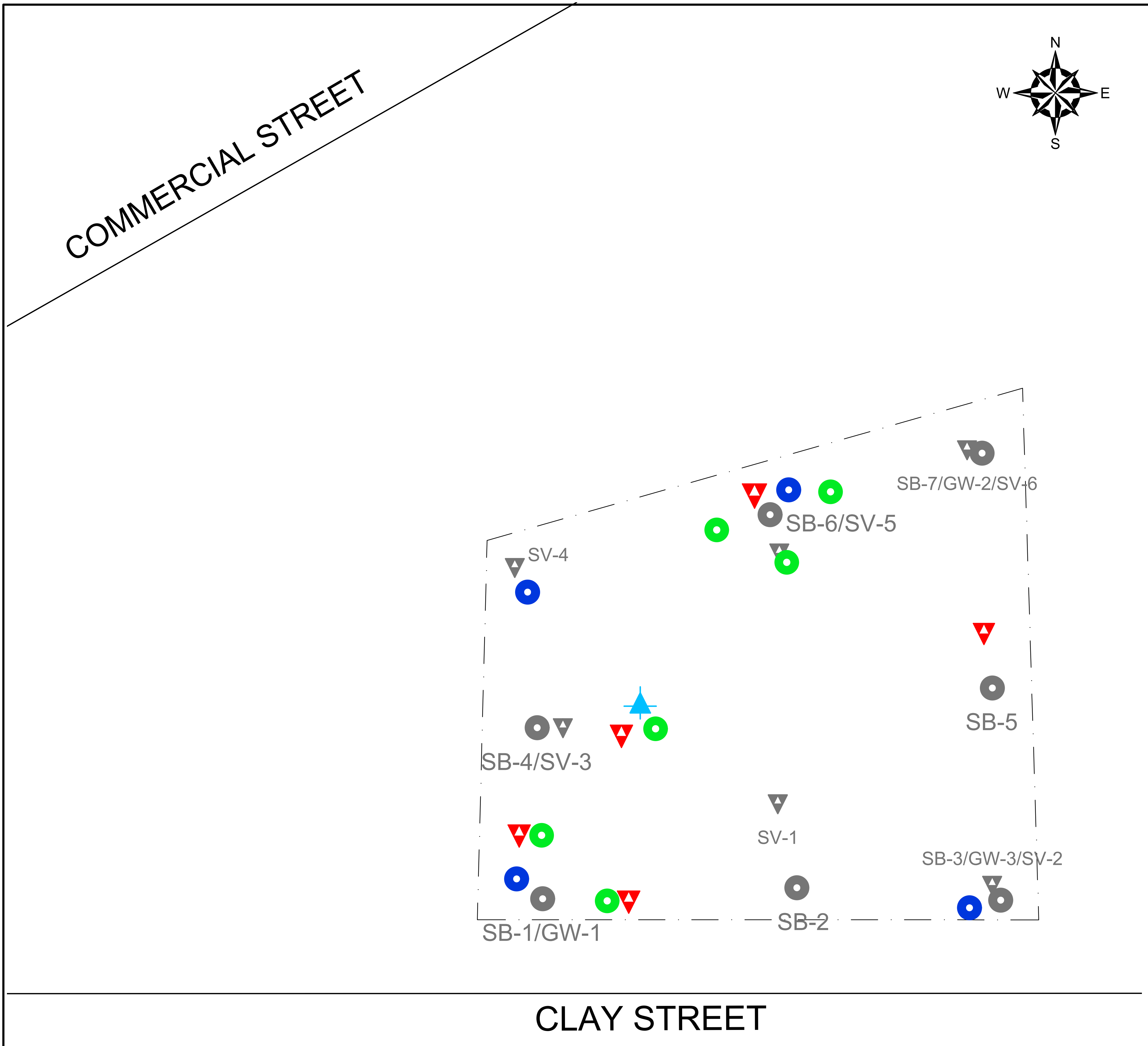
SOIL VAPOR SAMPLING RESULTS

PREPARED BY:
GZAGeoEnvironmental of NY
Engineers and Scientists
www.gza.com

PREPARED FOR:
CLAY PROPERTIES, LLC

PROJ MGR: JB	REVIEWED BY: VW	CHECKED BY: VW	FIGURE 5
DESIGNED BY: VW	DRAWN BY: DT	SCALE: 1" = 40'	
DATE: JULY 2024	PROJECT NO. 41.0163305.00	REVISION NO. -	SHEET NO. 1 OF 1

©2022 – GZA GeoEnvironmental of NY.
GZA-J:\Active 163300 to 163399\163305.00 – 29 Clay Street Remedial Investigation\Drawings\GZA CAD\41.0163279.00 Figures – 29 Clay Street.dwg [FIG 6 – SAMPLING LOCATIONS] July 29, 2024 – 1:37pm jackson.bog



GENERAL NOTES

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LEGEND

- ▭ APPROXIMATE SITE BOUNDARY
- 🔻 PROPOSED SOIL VAPOR SAMPLING LOCATION
- 🟢 PROPOSED SOIL SAMPLING LOCATION
- 🔵 PROPOSED MONITORING WELL CLUSTER AND SOIL BORING LOCATION
- ▲ OUTDOOR AIR SAMPLING LOCATION
- ▲ INDOOR AIR SAMPLING LOCATION
- ▼ APPROXIMATE 2023 REMEDIAL INVESTIGATION SOIL VAPOR SAMPLING LOCATION
- ● APPROXIMATE 2023 REMEDIAL INVESTIGATION SOIL SAMPLING LOCATION
- ● APPROXIMATE 2023 REMEDIAL INVESTIGATION MONITORING WELL CLUSTER AND SOIL BORING LOCATION
- ▲ OUTDOOR AIR SAMPLING LOCATION
- ▲ INDOOR AIR SAMPLING LOCATION

0 10 20 40
SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

29 CLAY STREET
BROOKLYN, NY 11222

PROPOSED SAMPLING LOCATIONS

PREPARED BY:
GZAGeoEnvironmental of NY
Engineers and Scientists
www.gza.com

PREPARED FOR:
CLAY PROPERTIES, LLC

PROJ MGR: JB	REVIEWED BY: VW	CHECKED BY: SK	FIGURE 6
DESIGNED BY: VW	DRAWN BY: DT	SCALE: 1" = 20'	
DATE: JULY 2024	PROJECT NO. 41.0163305.00	REVISION NO. -	SHEET NO. 1 OF 1

APPENDIX A – QUALITY ASSURANCE PROJECT PLAN (QAPP)

Known for excellence.
Built on trust.

QUALITY ASSURANCE PROJECT PLAN/FIELD SAMPLING PLAN

29 Clay Street
Block 2482, Lot 53
Brooklyn, New York
NYSDEC BCP Site No. C224408

June 2024
File No. 41.0163305.00

PREPARED FOR:
Clay Properties, LLC
134 North 4th Street
Brooklyn, NY, 11249

PREPARED BY:
Goldberg Zoino Associates of New York, P.C.
d/b/a GZA GeoEnvironmental of New York
104 West 29th Street, 10th Floor
New York, NY 10001

TABLE OF CONTENTS

FIGURES

TABLE

ATTACHMENTS

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP) presents the organization, objectives, planned activities, and specific quality assurance/quality control (QA/QC) procedures associated with the Remedial Investigation Work Plan (RIWP) at 29 Clay Street, Brooklyn, New York ((Site). **Figure 1** presents a Site location map.

This QAPP/FSP describes specific protocols for field sampling, sample handling and storage, chain-of-custody, laboratory analysis, and data handling and management. Preparation of the Plan was based on EPA Quality Assurance Project Plan guidance documents, including:

EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5, March 2001); and

Guidance for Quality Assurance Project Plans (EPA QA/G-5, December 2002).

The data generated from the analysis of samples will be used to determine the extent of contamination, identify impacted targets, and to compare the results of the remedial actions to site-specific cleanup goals. Potential parameters to be analyzed, including their respective quantitation limits (QLs), and data quality levels (DQLs), are provided in **Tables 1A through 1C**.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

A qualified person will coordinate and manage the Site sampling and analysis program, data reduction, QA/QC, data validation, analysis, and reporting. A Stephen M. Kline, P.E. is a qualified environmental professional (QEP), as defined by the New York State Department of Environmental Conservation (NYSDEC) and will direct the sampling activities and coordinate laboratory and drilling activities. The intent of this QAPP/FSP is to be performed the RI in accordance with the technical guidance applicable to Technical Guidance for Site Investigation and Remediation (DER-10), and Sampling, Analysis and Assessment of Per- and Polyfluoroalykly Substances (PFAS) under NYSDEC's Part 375 Remedial Programs dated April 2023.

A qualified person will ensure that the QA/QC plan is implemented and will oversee data validation. GZA's Senior Technical Specialist, Dr. Chunhua Liu will provide oversight and technical support for the sampling and analytical procedures followed acting as the project QA Officer. This individual has the broad authority to approve or disapprove project plans, specific analyses, and final reports. The QEP is independent from the data generation activities. In general, the QA officer will be responsible for reviewing and advising on all QA/QC aspects of this program.

Laboratories used will be New York State Department of Health Environmental (NYSDOH) Laboratory Approval Program (ELAP) certified laboratories. The laboratories will communicate directly with the sampler regarding the analytical results and reporting and will be responsible for providing all labels, sample containers, field blank water, trip blanks, shipping coolers, and laboratory documentation. Qualifications of the QA officer are provided in **Attachment A.**

3.0 QA OBJECTIVES FOR DATA MANAGEMENT

The analytical data will be provided by the laboratory using the NYSDEC Category B deliverable format. Analytical data collected for disposal characteristics that may be requested by off-site soil or wastewater disposal facilities will be provided in the format that the facility requests.

All analytical measurements will be made so that the results are representative of the media sampled and the conditions measured. Data will be reported in consistent dry weight units for solid samples [i.e., micrograms per kilogram (µg/kg) and/or milligram per kilogram (mg/kg), micrograms per liter (µg/L) or milligrams per liter (mg/L) for aqueous samples and in micrograms per cubic meter (µg/m^3) for soil vapor and air samples. **Table 2** presents the proposed samples, sampling and analytical parameters, analytical methods, sample preservation requirements and containers.

Quantitation Limits (QLs) are laboratory-specific and reflect those values achievable by the laboratory performing the analyses. Data Quality Levels (DQLs) are those reporting limits required to meet the objectives of the program (i.e., program action levels, cleanup standards, etc.). Data Quality Objectives (DQOs) define the quality of data and documentation required to support decisions made in the various phases of the data collection activities. The DQOs are dependent on the end uses of the data to be collected and are also expressed in terms of objectives for precision, accuracy, representativeness, completeness, and comparability.

The analytical methods to be used at this Site provide the highest level of data quality and can be used for purposes of risk assessment, evaluation of remedial alternatives and verification that cleanup standards have been met. However, in order to ensure that the analytical methodologies are capable of achieving the DQOs, measurement performance criteria have been set for the analytical measurements in terms of accuracy, precision, and completeness.

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are sufficient to meet DQOs. Specific procedures for sampling, chain of custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, and corrective action are described in other sections of this QAPP/FSP.

Tables 3, **4**, and **5** present the precision and accuracy requirements for each parameter to be analyzed. For quantitation limits for parameters associated with soil, sediment, and solid waste samples, the laboratory will be required to attempt to meet or surpass the parameter-specific limits listed in 6 NYCRR Part 375.

For quantitation limits for parameters associated with groundwater samples, the laboratory will be required to attempt to meet or surpass the parameter-specific limits for groundwater from the Division of Water Technical and Operational Guidance Series (TOGS 1.1.1) Ambient Water Quality Standards and Guidance Values. In certain instances, if the TOGS criteria are not achievable due to analytical limitations, the laboratory will report the lowest possible quantitation limit.

For quantitation limits for parameters associated with soil gas samples, the laboratory will be required to meet the parameter-specific limits from EPA's Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), Table 3c-SG:

Question 5 Soil Gas Screening Levels for Scenario-Specific Vapor Attenuation Factors (**α=**2H10^{-3}), November 2002. In certain instances, if these criteria are not achievable due to analytical limitations, the laboratory will report the lowest possible quantitation limits (see **Tables 1A through 1C** for affected analytes).

The QA objectives are defined as follows:

> ***Accuracy*** is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error.
>
> Accuracy in the field is assessed through the adherence to all field instrument calibration procedures, sample handling, preservation, and holding time requirements, and through the collection of equipment blanks prior to the collection of samples for each type of equipment being used (e.g., split spoons, groundwater sampling pumps).
>
> The laboratory will assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix effects) through the measurement of "standards," materials of accepted reference value. Accuracy will vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy will be measured in terms of blank results, the percent recovery (%R) of surrogate compounds in organic analyses, or %R of spiked compounds in matrix spikes (MSs), matrix spike duplicates (MSDs) and/or laboratory control samples (LCSs). This gives an indication of expected recovery for analytes tending to behave chemically like the spiked or surrogate compounds. **Tables 3**, **4**, and **5** summarize the laboratory accuracy requirements.
>
> ***Precision*** is the agreement among a set of replicate measurements without consideration of the "true" or accurate value: i.e., variability between measurements of the same material for the same analyte. Precision is measured in a variety of ways including statistically, such as calculating variance or standard deviation.
>
> Precision in the field is assessed through the collection and measurement of field duplicates (one extra sample in addition to the original field sample). Field duplicates will be collected at a frequency of one per twenty investigative samples per matrix per analytical parameter, with the exception of the Toxicity Characteristic Leaching Procedure (TCLP) parameters and parameters associated with wastewater samples. Precision will be measured through the calculation of relative percent differences (RPDs). The resulting information will be used to assess sampling and analytical variability. Field duplicate RPDs must be $\leq$ 50 for soil samples and $\leq$ 30 for aqueous samples. These criteria apply only if the sample and/or duplicate results are >5x the quantitation limit; if both results are $\leq$ 5x the quantitation limit, the criterion will be doubled. Due to the uncertainty of available representative soil gas volume, field duplicates will not be collected for this matrix.
>
> Precision in the laboratory is assessed through the calculation of RPD for duplicate samples. For organic soil, sediment and water analyses, laboratory precision will be assessed through the analysis of MS/MSD samples and field duplicates. For the inorganic analyses, laboratory precision will be assessed through the analysis of matrix duplicates and field duplicates. For soil gas analyses, laboratory precision will be assessed through the analysis of matrix duplicates. MS/MSD samples

or matrix duplicates will be performed at a frequency of one per twenty investigative samples per matrix per parameter. **Tables 3**, **4**, and **5** summarize the laboratory precision requirements.

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan was implemented as planned.

Field completeness is a measure of the amount of (1) valid measurements obtained from all the measurements taken in the project and (2) valid samples collected. The field completeness objective is greater than 90 percent.

Laboratory completeness is a measure of the amount of valid measurements obtained from all valid samples submitted to the laboratory. The laboratory completeness objective is greater than 95 percent.

Representativeness is a qualitative parameter that expresses the degree to which data accurately and precisely represent either a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. To ensure representativeness, the sampling locations have been selected to provide coverage over a wide area and to highlight potential trends in the data. In addition, field duplicate samples will provide an additional measure of representativeness at a given location.

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plans and QAPP are followed, and that proper sampling, sample handling, and sample preservation techniques are used.

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, and meeting sample holding times.

Comparability expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plans and QAPP are followed and that proper sampling techniques are used. Maximization of comparability with previous data sets is expected because the sampling design and field protocols are consistent with those previously used.

Comparability is dependent on the use of recognized EPA or equivalent analytical methods and the reporting of data in standardized units. Laboratory procedures are consistent with those used for previous sampling efforts.

4.0 SAMPLING PLAN

Environmental sampling may include soil, groundwater, soil vapor and sediment sampling. Additionally, wastes generated during remediation or development will be sampled and tested for characterization for disposal. Direct push drilling (GeoProbe®), sonic drilling, and/or test pit excavations will be the preferred methods for obtaining subsurface soil samples. However, other drilling methods including mud rotary and drive and wash may also be used if warranted by site conditions. Hand auger and/or hand-held sampling equipment will be the preferred method for collecting surficial and/or shallow soil samples. Groundwater samples will be collected using bailers or peristaltic, bladder or submersible pumps. Soil vapor samples will be collected in SUMMA® canisters. Performing grab or composite sampling using appropriate hand-held sampling equipment will be the preferred method for waste characterization sampling.

4.1. Utility Clearance

New York State law requires that New York 811 be notified at least three working days prior to subsurface work is conducted to initiate the utility locating activities. Companies with subsurface utilities present will locate and mark out subsurface utility lines. However, New York 811 contractors will only locate utilities on public property and rights-of-way.

During the recent, subsurface investigations, GZA contracted for underground utilities within the Site, including electric lines, gas lines, storm and sanitary sewers, and communication lines will need to be to be located by survey and geophysical survey. If additional subsurface utility locating is considered necessary, a private locating company will be contracted to locate on-site utilities that have not been identified by New York 811 contractors or the Owner.

4.2. Test Pit Soil Sampling

Test pitting and/or excavating may be conducted during the RI, if necessary. Test pits will allow for visual characterization of subsurface soil conditions and the collection of grab soil samples. Prior to soil sample collection, headspace screening will be conducted to evaluate whether analysis of soil samples is warranted, and if so, which soils should be collected.

Prior to completing a test pit or excavation, underground utilities should be identified as discussed in **Section 4.1**. Should active, underground utilities be located in the vicinity of the intended excavation, hand or vacuum excavation methods should be employed, as appropriate, to confirm the location and depth prior to initiating the excavation.

The size and type of excavator used to complete the test pits will be selected based on the anticipated depth and overall size of the excavation required to meet the project objectives. At no time will field personnel enter a test pit/excavation unless it has been deemed safe to enter by an Excavation Competent person based on training and experience required by 29CFR 1926.652.

Grab soil/solid samples will be collected from the material or interval in question by retrieving a volume for analysis using a clean stainless steel, aluminum, or mild steel/ disposable scoop, trowel, spoon, or bucket auger and placing the soil in a cleaned stainless steel pan for homogenization before inserting into the sample container. Samples collected for analysis for volatile organic compounds and total organic halides will not be homogenized. Samples for volatile organics analysis and total organic halides will be placed directly into the sample container.

Composite samples will be collected in the same manner described above, except that the discrete sample volumes will be placed in a clean stainless steel pan and mixed to form the composite. Composite sampling will be performed for the following objectives:

- Waste characterization;
- Determination of the suitability of the soil for on-site re-use; and
- Evaluation of health and safety requirements for workers that will disturb the soil during subsequent construction work.

4.3. Direct Push Drilling Soil Sampling

This drilling method is typically used to collect shallow overburden soils and create boreholes for temporary monitoring well installations, or soil vapor sampling points. Sampling will be performed using four or five-foot-long acetate sleeves that will be advanced continuously to the desired depth below the surface. Soil samples from each sleeve will be screened using a photoionization detector (PID) to detect possible organic vapors. Organic vapor screening will be performed by slicing open the acetate sleeve, making a small slice in the soil column with a clean knife or sampling tool, inserting the PID probe and pushing the slice closed, and monitoring the soil for approximately 5 to 10 seconds. This procedure will be repeated at intervals along the soil column at the field geologist's discretion.

The samples will be examined for staining, discoloration, odors, and debris indicative of contamination (ash, coal fragments, wood chips, cinders, petroleum staining, etc.). Samples for laboratory analysis will be collected from the six-inch interval most likely to be contaminated, based on PID readings, discoloration, staining, and the field geologist's judgment (field conditions may require a section longer than six inches to make sufficient sample; however, this decision will be field-based).

The samples will be collected by cutting the soil in two places with a decontaminated steel, stainless steel, or aluminum trowel, spoon, or knife and homogenized in a decontaminated stainless steel pan before being placed in the sample bottles. Samples collected for analysis for VOCs and total organic halides will be placed directly into the sample containers without homogenization (as per EPA sampling method 5035A). Samplers will wear phthalate-free gloves such as nitrile (no latex will be used) and will avoid contact of the gloves with the sample. Clean metal/disposable instruments will be used to transfer samples. If there is insufficient soil volume in the spoon, then this will be made up by attempting a second direct push sleeve at the same depth, or by using the next immediate sample interval above or below this depth, if appropriate. If there is no recovery, then the sample depth will be skipped, and drilling will progress to the next depth interval.

Soil samples will be collected in laboratory provided containers and transported to a NYSDOH ELAP certified laboratory, under proper chain of custody procedures for analysis. Once the sample containers are filled, they will be immediately placed in the cooler with ice (in Ziploc plastic bags to prevent leaking) or synthetic ice packs to maintain the samples at below 4°C.

4.4. Sonic Drill Rig Soil Sampling

The sonic drilling system employs simultaneous high frequency vibration and low speed rotational motion along with down pressure to advance the cutting shoes of the drill string. This technique provides a continuous soil core and generates minimal cuttings. Due to the continuous sampling of the system, accurate depictions of the stratigraphy and lithology of the overburden are obtained (minimal sloughing). Additionally, few cuttings are mobilized to the surface. Most of the formation material enters the core barrel, except small amounts, which are pushed into the borehole wall.

Drilling operations take place from the drill platform, which is about 4 feet above ground. Steel drill casing and core barrel are connected to the head from the work platform/support truck and are then hoisted to vertical in the derrick. Tool joints are connected and broken by a hydraulic vise/wrench that is in the base of the derrick. The sonic head is able to pivot 90 degrees to facilitate connection of the drilling rods.

The sonic drilling system uses an override core barrel system and can create a 4- or 6-inch diameter borehole. This is followed by the override casing drilled to the same depth as the core barrel cutting shoe. The core barrel is then removed, and cores are extruded into plastic sleeves. The outer casing prevents cross contamination and formation mixing and allows for a very controlled placement of wells.

GZA proposes to use a track-mounted sonic drill rig collecting soil continuously from either five-foot long or 10-foot long cores. Samples will be extruded from the core barrel into polyethylene sleeves. Once the plastic sleeve is cut open, soil will be screened using a PID to detect possible organic vapors. Organic vapor screening will be performed by making a small slice in the soil column with a clean knife or sampling tool, inserting the PID probe and pushing the slice closed, and monitoring the soil for approximately 5 to 10 seconds. This procedure will be repeated at intervals along the soil column at the field geologist’s discretion.

The samples will be examined for staining, discoloration, odors, and debris indicative of contamination (ash, coal fragments, wood chips, cinders, petroleum staining, etc.) Samples for laboratory analysis will be collected from the six-inch interval most likely to be contaminated, based on PID readings, discoloration, staining, and the field geologist’s judgment (field conditions may require a section longer than six inches to make sufficient sample; however, this decision will be field-based).

The samples will be collected by cutting the soil in two places with a decontaminated steel, stainless steel, or aluminum trowel, spoon, or knife and homogenized in a decontaminated stainless steel pan before being placed in the sample bottles. Samples collected for analysis for VOCs and total organic halides will be placed directly into the sample containers without homogenization (as per EPA sampling method 5035A). Samplers will wear phthalate-free gloves such as nitrile (no latex will be used) and will avoid contact of the gloves with the sample. Clean metal/disposable instruments will be used to transfer samples. If there is insufficient soil volume in the spoon, then this will be made up by attempting a second direct push sleeve at the same depth, or by using the next immediate sample interval above or below this depth, if appropriate. If there is no recovery, then the sample depth will be skipped, and drilling will progress to the next depth interval.

Soil samples will be collected in laboratory provided containers and transported to a NYSDOH ELAP certified laboratory, under proper chain of custody procedures for analysis. Once the sample containers are filled, they will be immediately placed in the cooler with ice (in Ziploc plastic bags to prevent leaking) or synthetic ice packs to maintain the samples at below 4°C.

4.5. Temporary Well Point Installation and Sampling

If proposed for site characterization, temporary well points will be immediately installed in drilled soil direct-push soil borings by placing a one-inch diameter PVC screen and riser pipe directly into the borehole. No additional materials will be placed around the annual space. The screen will be set so as to straddle the water table. Temporary wells will not be purged prior to sample collection. Depth to water will be measured in each well point to provide data to approximate groundwater flow direction.

Groundwater samples will be collected from the temporary well point using a dedicated microbailer. The samples will be collected in sample bottles (pre-preserved, if appropriate), placed in iced coolers and removed from light immediately after collection. In addition, all sample bottles must be filled to the top so that no aeration of the samples occurs during transport. All bottles will be filled to avoid cascading and aeration of the samples, the goal being to minimize any precipitation of colloidal matter. Samples for dissolved metals will be collected in unpreserved containers and will be filtered and preserved at the laboratory within 24 hours of sampling. Samples will be transported to a NYSDOH ELAP certified laboratory under proper chain of custody procedures for analysis.

Screen and riser pipes will be removed from the borehole and the borehole will be backfilled.

4.6. Permanent Well Installation and Sampling

Groundwater sampling of permanent monitoring wells is described according to the following distinct phases of this work: well installation/construction, well development, well purging, and well sampling.

4.6.1. *Well Installation/Construction*

To collect representative groundwater samples, soil borings drilled with the sonic drilling method will be converted into permanent two-inch diameter monitoring wells. Groundwater monitoring wells will be constructed of threaded two-inch diameter PVC well casing and 20-slot well screen (to investigate the potential of floating product). The 10-foot screen will be set seven feet below the measured water table. Clean silica sand, Morie No. 1 or equivalent, will be placed in the annular space around the well to a minimum of one foot above the top of the well screen, two feet being optimal. Solid PVC riser, attached to the well screen, will extend to grade or above if the well is a stick-up. For a two-inch diameter well, the annular space for the filter pack should be 4 inches thick. A two-foot thick bentonite seal will then be placed above the sand pack and moistened with potable water for a minimum of 15 minutes before backfilling the remaining space with a cement-bentonite grout. If warranted by depth, filling will be completed using a tremie pipe placed below the surface of the grout. A stick-up or flush-mount protective casing with a locking well cap will then be installed, and a measuring point marked on each PVC well riser. Well construction diagrams will be prepared for each well.

4.6.2. Well Development

Following installation, the groundwater monitoring wells will be developed using a two-inch diameter submersible pump(s) (or equivalent) until the water is reasonably free of turbidity and field readings (pH, conductivity, temperature, and dissolved oxygen) sufficiently stabilize. Fifty nephelometric turbidity units (NTUs) or less will be the turbidity goal but not an absolute value. The wells will be developed aggressively to remove fines from the formation and sand pack. The wells will be allowed to equilibrate for seven days prior to sampling. The volume of water removed, the well development time, and field instrument readings will be recorded in the logbook.

4.6.3. Well Purging

The objective is to purge monitoring wells until turbidity stabilizes to a level as low as possible and this parameter will be given the greatest weight in determining when groundwater sampling may begin. With this objective in mind, a low-flow pump will be used to avoid entrainment of particulates within the well or from the formation. Groundwater from each well will be purged until parameters have stabilized. A turbidity level of fifty NTUs or less is the well purging goal, but not an absolute value before sampling. Other field parameters including temperature, conductivity, pH, and dissolved oxygen (DO) will also be monitored. As practical, all field measurements will be taken from the flow cell and will be recorded during and after purging, and before sampling. Field parameters should generally be within ±10 percent for three consecutive readings, one minute apart, prior to sampling.

Upon opening each monitoring well and point, the concentration of VOCs in the headspace will be measured using a PID and water level measurements will be recorded using an electronic interface probe. The depth to product (if present), depth to water, and the total depth will be measured from the top of the marked PVC casings. Water level and free product measurements will first be made and the volume of water in the well determined. The volume of water in the well will be calculated so that the number of well volumes purged and an estimate of the time required to purge the well can be made. Before sampling, the wells will be purged utilizing a low-flow submersible stainless steel pump using dedicated Teflon® or Teflon®-lined polyethylene tubing connected to a flow cell. Very low purging rates are proposed, on the order of 100 ml/minute to 500 ml/minute, to minimize suspension of particulate matter in the well.

Purging will be done with the pump intake placed at the midpoint of the well screen or the midpoint of the water column (to be determined based on the depth and length of the screen interval) to ensure that all stagnant water in the well is removed, while not stirring up sediment that may have accumulated on the bottom of the well. Equipment will be lowered into the well very carefully to prevent suspension of bottom sediment and subsequent entrainment onto sampling equipment. Surging will be avoided. Tubing will be replaced between each well. Pumps must be carefully cleaned between wells according to the procedures specified in **Section 4.15,** below. It is anticipated that no more than three well volumes will be purged in order for turbidity to reach a minimum and the other parameters to stabilize. Ideally, pumping rates will be at a rate so that no drawdown of the groundwater level occurs (i.e., pumping rate is less than recharge rate). During purging, the sampler will actively monitor and track the volume of water purged and the field parameter readings. Data will be recorded in the field logbook. For example, the sampler will record the running total volume purged from each well and note the readings for the corresponding field parameters.

4.6.4. Well Sampling

Once groundwater conditions have stabilized and groundwater levels have recovered, samples will be collected from the flow cell outlet (connected to the low-flow submersible pump). All non-disposable/non-dedicated (re-usable) sampling equipment will be cleaned according to the procedures specified in **Section 4.15**.

Sampling will be performed with the pump intake at the same location used for purging. Pumping rates for withdrawing the samples will be similar to those followed for well purging.

The samples will be collected in sample bottles (pre-preserved, if appropriate), placed in iced coolers and removed from light immediately after collection. In addition, all sample bottles must be filled to the top so that no aeration of the samples occurs during transport. All bottles will be filled to avoid cascading and aeration of the samples, the goal being to minimize any precipitation of colloidal matter. Samples will be transported to a NYSDOH ELAP certified laboratory under proper chain of custody procedures for analysis. Samples for dissolved metals will be collected in unpreserved containers and will be filtered and preserved at the laboratory within 24 hours of sampling.

4.7. Borehole Abandonment

Soils extracted during the advancement of the borings will be used to backfill the borings, provided that the borings are not to be used for installation of permanent monitoring wells. However, soils that exhibit “gross” contamination, as evidenced by staining or free-phase product, or any visual, olfactory, or PID readings greater than 100 ppm above background, will be managed in accordance with **Section 9**. In this event, bentonite chips or pellets to within 0.5 feet below ground surface. The ground surface will be restored to a similar condition as the surrounding grade (e.g., topsoil, asphalt, or concrete).

4.8. Monitoring Well Abandonment

There may be occasions when monitoring wells will require abandonment. For temporary monitoring wells, the approach will be to pull the PVC well materials from the borehole and backfill the remaining open portion of the borehole with cement/bentonite grout to approximately 0.5 feet below the ground surface. The ground surface will be restored to a similar condition as the surrounding grade (e.g., topsoil, asphalt, or concrete). For permanent overburden and bedrock monitoring wells, depending on the site-specific subsurface geologic conditions and nature of contamination, the abandonment approach will be in accordance with NYSDEC Policy CP-43 – Groundwater Monitoring Well Decommissioning Policy.

4.9. Soil Reuse and Worker Health & Safety Sampling

Soil reuse sampling may be performed to determine whether the soil can be reused elsewhere on the Site, or to determine whether contaminant levels in the soil would warrant OSHA 40-hour HAZWOPER training for workers disturbing the soil during post-remediation construction activities. This sampling would consist of compositing discrete soil samples from borings advanced by direct push (see **Section 4.3**), or during test pits following the procedures outlined in **Section 4.2**.

4.10. Waste Characterization Sampling

Waste classification sampling may be conducted to characterize soil, liquids and/or groundwater for the purpose of proper off-site waste disposal. Specific methods for sampling liquid and solid wastes are briefly discussed below.

4.10.1. Solid Waste

Solid sampling methods include utilizing dedicated stainless steel or Teflon® scoops/shovels, triers, and thiefs. Scoops and shovels are the preferred method for sampling solids from piles or containers. Stainless steel triers are similar to a scoop and are used for the collection of a core sample of a solid material.

4.10.2. Liquid Waste

Liquid sampling methods include utilizing dedicated dippers, glass tube samplers, pump and tubing, kemmerer bottles, and Bacon Bomb samplers. Dippers are used to collect samples from the surface of the liquid and are appropriate for wastes that are homogeneous. Glass tube samplers consist of glass tubes of varying length and diameter used to collect a full-depth liquid sample from a drum or similar container. Pump and tubing (e.g., bladder pump or peristaltic pump) are used to collect liquid samples from a depth (up to approximately 20 feet below grade), and are typically relied upon for sampling subsurface structures, such as underground storage tanks. To minimize the loss of volatile organic components in the liquid, the lowest achievable flow rate is utilized for collecting the sample by this method. Kemmerer bottles and Bacon Bomb samplers are discrete-depth samplers. These samplers are lowered into the liquid and opened to collect a sample at a desired depth.

4.10.3. Grab versus Composite Sampling

Waste characterization of a liquid or a solid can involve grab or composite sampling depending upon the homogeneity and the volume of the waste. Grab sampling consists of collecting a discrete sample or samples of a material and submitting each sample for separate analysis. Grab sampling is appropriate for characterizing small quantities of waste as well as waste streams of varying content (e.g., drums of different contents). Composite sampling consists of taking discrete grab samples of a material and combining them into a smaller number of samples for analysis. Composite sampling generally is appropriate for large volumes of a homogenous waste material, such as a pile of soil or construction debris. The specific number of composite and grab samples largely will depend upon the size and nature of the waste pile (i.e., cubic yards) as well as the analysis required for characterization of the waste.

4.11. Soil Gas Sampling

A direct-push drill rig will be utilized to drive rods with a decontaminated stainless steel probe to the desired sample depth, which will be a minimum of 5 feet bgs or two feet above the water table if groundwater is present at 5 feet. The soil gas probe will then be purged at a flow rate not greater than 0.2 liters/minute to evacuate one to three volumes using a photoionization detector (PID) with an integrated vacuum pump (MiniRAE 3000 or appropriate alternate). Peak and stabilized PID readings will be recorded prior to sample collection. Following the stabilization period, each probe will be connected to an evacuated laboratory-supplied 6-liter SUMMA® canister. SUMMA® canisters are passivated stainless steel vessels that have been cleaned and certified contaminant-free by the contract laborer. After connecting the SUMMA® canister to the soil gas probe, a regulator valve on the canister will be opened and the vacuum will slowly draw the sample into the canister over a period of 20 minutes. The samples will not be drawn at greater than 0.2 liters per minute. Quantitation limits for all analytes range between 1.6 ppbV and 4.0 ppbV, depending on the compound. After collecting the soil gas sample, the valve will be closed and disconnected from the soil gas probe. The soil-gas samples will be transported to a NYSDOH ELAP certified laboratory for TO-15 analysis.

Prior to sample collection, helium will be used as a tracer gas to evaluate the potential for infiltration of outdoor air into the sample. Subsequent rounds of soil gas sampling would include the use of tracer gas only if the initial round of sampling indicates that outdoor air has the potential to influence soil gas sample results.

When soil vapor samples are collected, the following conditions that may influence the interpretation of results will be documented:

- Identification of any nearby commercial or industrial buildings that likely uses volatile organic compounds;
- A sketch of the Site, showing streets, neighboring commercial or industrial facilities (with estimated distances to the Site, and soil-gas sampling locations);

- Weather conditions (e.g., precipitation, outdoor temperature, barometric pressure, wind speed and direction); and
- Any pertinent observations, such as odors or readings from field instrumentation.

4.12. Ambient Air Sampling

Ambient air samples will be collected with an evacuated laboratory-supplied 6-liter SUMMA® canister. SUMMA® canisters are passivated stainless steel vessels that have been cleaned and certified contaminant-free by the contract laborer. The sample will be set at an elevation of approximately 4 to 5 feet above grade, to represent breathing zone air quality conditions. The samples will not be drawn at greater than 0.2 liters per minute. After collecting the ambient air sample, the valve will be closed, and the canister will be labeled with the necessary information. The soil-gas samples will be transported to a NYSDOH ELAP certified laboratory for TO-15 analysis.

When ambient air samples are collected, the following conditions that may influence the interpretation of results will be documented:

- Identification of any nearby commercial or industrial buildings that likely uses volatile organic compounds;
- A sketch of the Site, showing streets, neighboring commercial or industrial facilities (with estimated distances to the Site, and soil-gas sampling locations);
- Weather conditions (e.g., precipitation, outdoor temperature, barometric pressure, wind speed and direction); and
- Any pertinent observations, such as odors or readings from field instrumentation.

4.13. QC Sample Collection

QC samples will include equipment blanks, trip blanks, field duplicates and MS/MSDs.

Equipment blanks will consist of distilled water and will be used to check for potential contamination of the equipment that may cause sample contamination. Equipment blanks will be collected by routing the distilled water through the sampling equipment prior to sample collection. Equipment blanks will be submitted to the laboratory at a frequency of one per day per matrix per type of equipment being used per parameter. Equipment blanks will not be collected with samples for analysis for TCLP parameters, parameters associated with wastewater samples, samples collected for disposal purposes, soil gas samples, chip samples, wipe samples and samples collected for grain size analyses.

Trip blanks will consist of distilled water (supplied by the laboratory) and will be used to assess the potential for volatile organic compound contamination of groundwater samples due to contaminant migration during sample shipment and storage. Trip blanks will be transported to the site unopened, stored with the investigative samples, and kept closed until analyzed by the laboratory. Trip blanks will be submitted to the laboratory at a frequency of one per cooler that contains groundwater samples for analysis for VOCs.

Field duplicates are an additional aliquot of the same sample submitted for the same parameters as the original sample. Field duplicates will be used to assess the sampling and analytical reproducibility. Field duplicates will be collected by alternately filling sample bottles from the source being sampled. Field duplicates will be submitted at a frequency of one per 20 samples for all matrices and all parameters with the exception of TCLP parameters, parameters associated with wastewater samples, samples collected for waste characterization purposes, chip samples, wipe samples and samples collected for grain size analyses. Soil gas field duplicates will be obtained by using a tubing a T-splitter.

MSs and MSDs are two additional aliquots of the same sample submitted for the same parameters as the original sample. However, the additional aliquots are spiked with the compounds of concern. Matrix spikes provide information about the effect of the sample matrix on the measurement methodology. MS/MSDs will be submitted at a frequency of one per 20 investigative samples per matrix for organic parameters for soil, sediment, and groundwater. MSs will be submitted at a frequency of one per 20 investigative samples per matrix for inorganic parameters.

4.14. Sample Preservation and Containerization

The analytical laboratory will supply the sample containers for the chemical samples. These containers will be cleaned by the manufacturer to meet or exceed all analyte specifications established in the latest U.S. EPA's *Specifications and Guidance for Contaminant-Free Sample Containers*. Certificates of analysis are provided with each bottle lot and maintained on file to document conformance to EPA specifications. The containers will be pre-preserved, where appropriate (see **Table 2**).

Table 6 presents a summary of QC sample preservation and container requirements.

4.15. Equipment Decontamination

Re-usable Teflon®, stainless steel, and aluminum sampling equipment shall be cleaned between each use in the following manner:

- Wash/scrub with a biodegradable degreaser ("Simple Green") if there is oily residue on equipment surface
- Tap water rinse
- Wash and scrub with Alconox and water mixture
- Tap water rinse
- Distilled/deionized water rinse

- Air dry

Cleaned equipment shall be wrapped in aluminum foil if not used immediately after air-drying.

Groundwater sampling pumps will be cleaned by washing and scrubbing with an Alconox/water mixture, rinsing with tap water and irrigating with distilled/deionized water.

5.0 DOCUMENTATION AND CHAIN-OF-CUSTODY

5.1. Sample Collection Documentation

5.1.1. Field Notes

Field team members will keep a field logbook to document all field activities. Field logbooks will provide the means of recording the chronology of data collection activities performed during the remediation. As such, entries will be described in as much detail as possible so that a particular situation could be reconstructed without reliance on memory.

The logbook will be a bound notebook with water-resistant pages. Logbook entries will be dated, legible, and contain accurate and inclusive documentation of the activity. The title page of each logbook should contain the following:

- Person to whom the logbook is assigned
- The logbook number
- Project name and number
- Site name and location
- Project start date
- End date

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, and names of sampling team members present will be entered. Each page of the logbook will be signed and dated by the person making the entry. All entries will be made in permanent ink, signed, and dated and no erasures or obliterations will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark that is signed and dated by the sampler. The correction shall be written adjacent to the error.

Field activities will be fully documented. Information included in the logbook should include, but may not be limited to, the following:

- Chronology of activities, including entry and exit times
- Names of all people involved in sampling activities
- Level of personal protection used

- Any changes made to planned protocol
- Names of visitors to the site during sampling and reason for their visit
- Sample location and identification
- Changes in weather conditions
- Dates (month/day/year) and times (military) of sample collection
- Measurement equipment identification (model/manufacturer) and calibration information
- Sample collection methods and equipment
- Sample depths
- Whether grab or composite sample collected
- How sample composited, if applicable
- Sample description (color, odor, texture, etc.)
- Sample identification code
- Tests or analyses to be performed
- Sample preservation and storage conditions
- Equipment decontamination procedures
- QC sample collection
- Unusual observations
- Record of photographs
- Sketches or diagrams
- Signature of person recording the information

Field logbooks will be reviewed on a daily basis by the Field Team Leader. Logbooks will be supported by standardized forms.

5.1.2. Chain-of-Custody Records

On a regular basis (daily or on such a basis that all holding times will be met), samples will be transferred to the custody of the respective laboratories, via third-party commercial carriers or via laboratory courier service.

Chain-of-custody records are initiated by the samplers in the field. The field portion of the custody documentation should include: (1) the project name; (2) signatures of samplers; (3) the sample number, date and time of collection, and whether the sample is grab or composite; (4) signatures of individuals involved in sampling; and (5) if applicable, air bill or other shipping number. Sample receipt and log-in procedures at the laboratory are described in **Section 5.2.2** of this Plan.

5.1.3. Sample Labeling

Immediately upon collection, each sample will be labeled with a pre-printed adhesive label, which includes the date and time of collection, sampler's initials, tests to be performed, preservative (if applicable), and a unique identifier.

A. The following identification scheme will be used:

Soil borings will be assigned sequential numbers. For soil samples collected from soil borings, sample numbers will be assigned as follows:

GZ-#(sampling interval)

Example:
Sample GZ-4(4-6’) = soil sample collected from soil boring #4 at a depth of 5-6’ below grade.

Groundwater wells will be assigned sequential numbers. Groundwater samples will be identified by the well that the sample was collected from.

Examples:
GMW-01 = groundwater sample collected from permanent well point #1

Sub-slab soil vapor/soil vapor/ambient air will be assigned numbers coordinating with the adjacent soil boring or a sequential number due to sample names being identical to a previous Site sampling event. Vapor samples will be identified by the soil gas point that the sample was collected from.

Examples:
GSV-01 = Soil vapor sample collected from the soil gas point
OA-01 = Outdoor ambient air sample

Duplicate samples will be labeled as blind duplicates by giving them sample numbers indistinguishable from a normal sample.

Blanks should be spelled out and identify the associated matrix, e.g., Equipment Blank, Soil

MS/MSDs will be noted in the Comments column of the COC.

B. The analysis required will be indicated for each sample.

Example: SVOC

C. Date taken will be the date the sample was collected, using the format: MM-DD-YY.

Example: 04-22-22

D. Time will be the time the sample was collected, using military time.

Example: 14:30

E. The sampler’s name will be printed in the “Sampled By” section.

F. Other information relevant to the sample.

<u>Example</u>: Equipment Blank

An example sample label is presented below:

Job No: XXXXXXXXX
Client: Name
Sample No: GZ-01(5-5.5’)
Matrix: Soil
Date Taken: 5/22/24
Time Taken: 14:30
Sampler: B. Smith
Analysis: SVOC

Job No. ______________________________
Client: ______________________________
Sample Number ______________________________
Date ______________ Sample Time ______________
Sample Matrix ______________________________
Grab or Composite (explain) ______________________________
Preservatives ______________________________
Analyses ______________________________
Sampler Signature______________________________

This sample label contains the authoritative information for the sample. Inconsistencies with other documents will be settled in favor of the vial or container label unless otherwise corrected in writing from the field personnel collecting samples or the QEP.

5.2. <u>Sample Custody</u>

Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample or evidence file is considered to be under a person's custody if

- the item is in the actual possession of a person

- the item is in the view of the person after being in actual possession of the person
- the item was in the actual physical possession of the person but is locked up to prevent tampering
- the item is in a designated and identified secure area

5.2.1. Field Custody Procedures

Samples will be collected following the sampling procedures documented in **Section 4.0** of this Plan. Documentation of sample collection is described in **Section 5.1** of this Plan. Sample chain-of-custody and packaging procedures are summarized below. These procedures are intended to ensure that the samples will arrive at the laboratory with the chain-of-custody intact.

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or dispatched properly. Field procedures have been designed such that as few people as possible will handle the samples.

- All bottles will be identified by the use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis.

- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample label because the pen would not function in wet weather.

- Samples will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage location.

- All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler and placed in the project files.

- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. If third party commercial carriers are used for transfer to the laboratory, shipping containers will be secured with strapping tape and custody seals prior to shipment. The custody seals will be attached to the front right and back left of the cooler and covered with clear plastic tape after being signed by field personnel. The cooler will be strapped shut with strapping tape in at least two locations.

- If the samples are sent by third party commercial carrier, the air bill will be used. Air bills will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.

- Samples remain in the custody of the sampler until transfer of custody is completed. This consists of delivery of samples to the laboratory courier or sample custodian, and signature of the laboratory courier or sample custodian on chain-of-custody document as receiving the samples and signature of sampler as relinquishing samples.

5.2.2. Laboratory Custody Procedures

Samples will be received and logged in by a designated sample custodian or his/her designee. Upon sample receipt, the sample custodian will

- Examine the shipping containers to verify that the custody tape is intact,
- Examine all sample containers for damage,
- Determine if the temperature required for the requested testing program has been maintained during shipment and document the temperature on the chain-of-custody records,
- Compare samples received against those listed on the chain-of-custody,
- Verify that sample holding times have not been exceeded,
- Examine all shipping records for accuracy and completeness,
- Determine sample pH (if applicable) and record on chain-of-custody forms,
- Sign and date the chain-of-custody immediately (if shipment is accepted) and attach the air bill,
- Note any problems associated with the coolers and/or samples on the cooler receipt form and notify the Laboratory Project Manager, who will be responsible for contacting the QEP,
- Attach laboratory sample container labels with unique laboratory identification and test, and
- Place the samples in the proper laboratory storage.

Following receipt, samples will be logged in according to the following procedure:

- The samples will be entered into the laboratory tracking system. At a minimum, the following information will be entered: project name or identification, unique sample numbers (both client and internal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field ID provided by field personnel.
- The Laboratory Project Manager will be notified of sample arrival.
- The completed chain-of-custody, air bills, and any additional documentation will be placed in the final evidence file.

6.0 CALIBRATION PROCEDURES

6.1. <u>Field Instruments</u>

Field instruments will be calibrated according to the manufacturer’s specifications. Calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, temperature at which the readings were taken, and the readings.

6.2. Laboratory Instruments

Calibration procedures for a specific laboratory instrument will consist of initial calibrations, initial calibration verifications, and/or continuing calibration verification. Detailed descriptions of the calibration procedures for a specific laboratory instrument are included in the laboratory's standard operating procedures (SOPs), which describe the calibration procedures, their frequency, acceptance criteria, and the conditions that will require recalibration. These procedures are as required in the respective analytical methodologies (summarized in **Table 2** of this Plan). The initial calibration associated with all analyses must contain a low-level calibration standard which is less than or equal to the quantitation limit.

7.0 SAMPLE PREPARATION AND ANALYTICAL PROCEDURES

No field analyses are anticipated for this program. If site conditions were to warrant field analysis, the responsible contractor will prepare an addendum establishing the field analytical procedures. Analyses of all samples will be performed by NYSDOH ELAP certified laboratories. **Table 2** summarizes the analytical methods to be used during the remediation.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

Appropriate QC measures will be used to ensure the generation of reliable data from sampling and analysis activities. Proper collection and organization of accurate information followed by clear and concise reporting of the data is a primary goal in this project. Complete data packages suitable for data validation will be provided by the analytical laboratory.

For all analyses, the laboratory will report results that are below the laboratory's reporting limit; these results will be qualified as estimated (J) by the laboratory. The laboratory may be required to report tentatively identified compounds (TICs) for the VOC and SVOC analyses; this will be requested by the sampler on an as-needed basis. A Data Usability Summary Report (DUSR) will be prepared and will be included in the Remedial Investigation Report (RIR). Qualifications of the DUSR preparer can be found in **Attachment A.**

8.1. Data Evaluation/Validation

8.1.1. Field Data Evaluation

Measurements and sample collection information will be transcribed directly into the field logbook or onto standardized forms. If errors are made, results will be legibly crossed out, initialed and dated by the person recording the data, and corrected in a space adjacent to the original (erroneous) entry. Daily reviews of the field records by the Field Team Leader will ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good record keeping procedures, i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.
- Sample collection, handling, preservation, and storage procedures were conducted in accordance with the protocols described in the Plan, and that any deviations were documented and approved by the appropriate personnel.

8.1.2. Data Usability

A Data Usability Summary Report (DUSR) will be prepared in accordance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

The data usability evaluation will include reviewing the quality assurance/quality control (QA/QC) information including: (1) chain-of-custody; (2) the summary QA/QC information provided by the laboratory; and (3) the project narrative.

For each data package the following questions will be evaluated:

- Is the data package complete as defined under the requirements for the NYSDEC ASP Category B, USEPA CLP deliverables or other standards/guidance?
- Have all holding times and preservation requirements been met?
- Do the quality control (QC) data fall within the laboratory and project established limits and specifications?

8.2. Identification and Treatment of Outliers

Any data point which deviates markedly from others in its set of measurements will be investigated; however, the suspected outlier will be recorded and retained in the data set. One or both of the following tests will be used to identify outliers.

Dixon's test for extreme observations is an easily computed procedure for determining whether a single very large or very small value is consistent with the remaining data. The one-tailed t-test for difference may also be used in this case. It should be noted that these tests are designed for testing a single value. If more than one outlier is suspected in the same data set, other statistical sources may be consulted and the most appropriate test of hypothesis will be used and documented, if warranted.

Since an outlier may result from unique circumstances at the time of sample analysis or data collection, those persons involved in the analysis and data reduction will be consulted. This may provide an experimental reason for the outlier. Further statistical analysis may be performed with and without the outlier to determine its effect on the conclusions. In many cases, two data sets may be reported, one including, and one excluding the outlier.

In summary, every effort will be made to include the outlying values in the reported data. If the value is rejected, it will be identified as an outlier, reported with its data set and its omission noted.

9.0 INTERNAL QUALITY CONTROL

The subcontracting laboratories' Quality Assurance Project Plans will identify the supplemental internal analytical quality control procedures to be used. At a minimum, this will include:

- Matrix spike and/or matrix spike duplicate samples
- Matrix duplicate analyses
- Laboratory control samples
- Instrument calibrations
- Instrument tunes for SW-846 8260B and 8270C and EPA Method TO-15 analyses
- Method and/or instrument blanks
- Surrogate spikes for organic analyses
- Internal standard spikes for SW-846 8260B and 8270C and EPA Method TO-15 analyses
- Quantitation limit determination and confirmation by analysis of low-level calibration standard

As outline on **Table 5** and summarized in **Section 4.13**, field quality control samples will include:

- Equipment blanks
- Field duplicate samples
- Trip blanks
- MS/MSDs

10.0 CORRECTIVE ACTION

The entire sampling program will be under the direction of the QEP. The emphasis in this program is on preventing problems by identifying potential errors, discrepancies, and gaps in the data-collection-laboratory-analysis-interpretation process. Any problems identified will be promptly resolved. Likewise, follow-up corrective action is always an option in the event that preventative corrective actions are not totally effective.

The acceptance limits for the sampling and analyses to be conducted in this program will be those stated in the method or defined by other means in the Plan. Corrective actions are likely to be immediate in nature and most often will be implemented by the contracted laboratory analyst or the Program Manager. The corrective action will usually involve recalculation, reanalysis, or resampling.

10.1. Immediate Corrective Action

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 Plan), or when sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. The field team may identify the need for corrective action. The Field Team Leader will approve the corrective action and notify the Program Manager. The Program Manager will approve the corrective measure. The Field Team Leader will ensure that the corrective measure is implemented by the field team.

Corrective actions will be implemented and documented in the field logbook. Documentation will include:

- A description of the circumstances that initiated the corrective action,
- The action taken in response,
- The final resolution, and
- Any necessary approvals

No staff member will initiate corrective action without prior communication of findings through the proper channels.

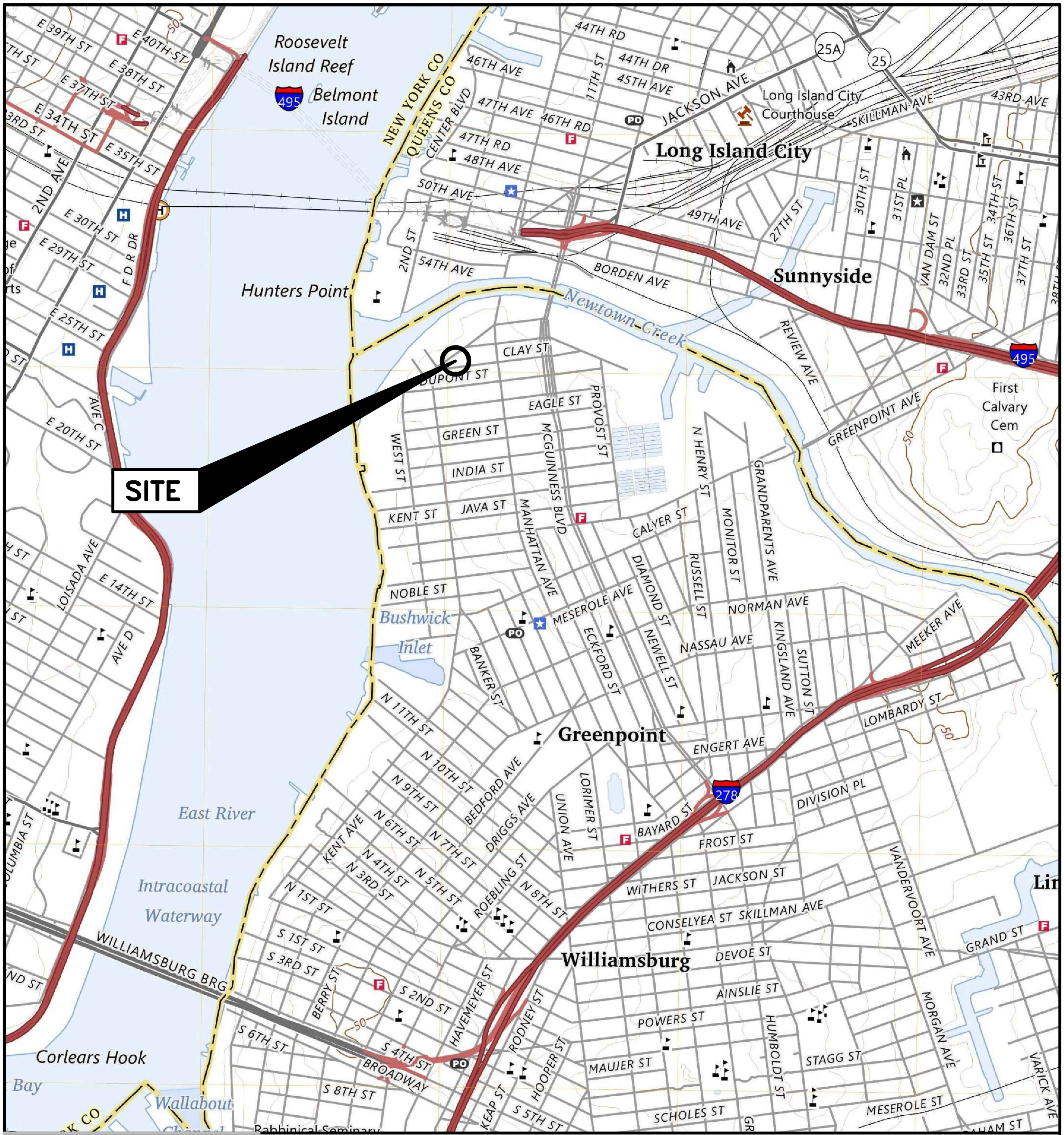
Corrective action in the laboratory may occur prior to, during, and after initial analyses. A number of conditions such as broken sample containers, omissions or discrepancies with chain-of-custody documentation, low/high pH readings, and potentially high concentration samples may be identified during sample log-in or just prior to analysis. Following consultation with laboratory analysts and Laboratory Section Leaders, it may be necessary for the Laboratory QA Manager to approve the implementation of corrective action. The laboratory SOPs specify some conditions during or after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, automatic reinjection/reanalysis when certain QC criteria are not met, loss of sample through breakage or spillage, etc.

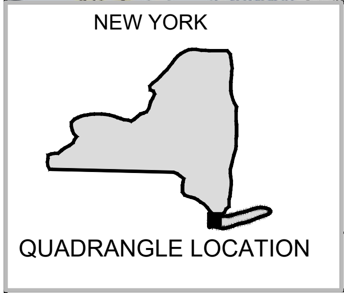
The analyst may identify the need for corrective action. The Laboratory Section Leader, in consultation with the staff, will approve the required corrective action to be implemented by the laboratory staff. The Laboratory QA Manager will ensure implementation and documentation of the corrective action. If the nonconformance causes project objectives not to be achieved, the QEP will be notified. The QEP will notify the Program Manager, who in turn will contact all levels of project management for concurrence with the proposed corrective action.

These corrective actions are performed prior to release of the data from the laboratory. The corrective action will be documented in both the laboratory's corrective action files, and the narrative data report sent from the laboratory to the Program Manager. If the corrective action does not rectify the situation, the laboratory will contact the Program Manager, who will determine the action to be taken and inform the appropriate personnel.

If potential problems are not solved as an immediate corrective action, the contractor will apply formalized long-term corrective action, if necessary.

FIGURES





QUADRANGLE LOCATION

SOURCE:

USGS TOPOGRAPHIC MAPS: BROOKLYN, NY, NJ (2023).
CONTOUR INTERVAL 10FT., NAVD-1988, ORIGINAL SCALE
1:24,000 (1IN.=2,000FT.).

NYSDEC BCP SITE NO. C224408
29-37 CLAY ST
BROOKLYN, NY 11222

PREPARED BY:

GZA GeoEnvironmental of NY
Engineers and Scientists
www.gza.com

PREPARED FOR:

CLAY PROPERTIES, LLC

SITE LOCATION MAP

PROJ MGR: MH	REVIEWED BY: MH	CHECKED BY: VW	FIGURE
DESIGNED BY: SG	DRAWN BY: SG	SCALE: 1"=2000'	1
DATE: JULY 2024	PROJECT NO. 41.0163305.00	REVISION NO. -	SHEET NO. 1 OF 1

GZA-J:\Active 163200 to 163299\163279.00 – 19 Clay Street and 60-62 Commercial St\Drawings\41.0163279.00 Figures 1,2,3,6.dwg [FIG 1 8.5x11] June 19, 2024 – 10:17am Selia.Gupta

TABLES

Table 1 A
Soil Criteria Table

29 Clay Street
Brooklyn, New York
BCP Site No. C224408
QAPP/FSP

Contaminant	Protection of Public Health					Protection of Ecological Resources[n]	Protection of Groundwater
	Unrestricted Use	Residential	Restricted-Residential	Commercial	Industrial		
All soil cleanup objectives (SCOs) are in parts per million (ppm); approximately equivalent to mg/kg.							
Metals							
Arsenic	13 [m]	16 [f]	17 [f]	18 [f]	19 [f]	13 [f]	16 [f]
Barium	350 [m]	350 [f]	400	400	10,000 [d]	433	820
Beryllium	7.2	14	72	590	2,700	10	47
Cadmium	2.5 [m]	2.5 [f]	4.3	9.3	60	4	7.5
Chromium, hexavalent [h]	1 [l]	22	110	400	800	1 [e]	19
Chromium, trivalent[h]	30 [m]	36	180	1,500	6,800	41	NS
Copper	50	270	270	270	10,000 [d]	50	1,720
Total Cyanide [h]	27	27	27	27	10,000 [d]	NS	40
Lead	63 [m]	400	400	1,000	3,900	63 [f]	450
Manganese	1600 [m]	2,000 [f]	2,000 [f]	10,000 [d]	10,000 [d]	1600 [f]	2,000 [f]
Total Mercury	0.18 [m]	0.81 [j]	0.81 [j]	2.8 [j]	5.7 [j]	0.18 [f]	0.73
Nickel	30	140	310	310	10,000 [d]	30	130
Selenium	3.9 [m]	36	180	1,500	6,800	3.9 [f]	4 [f]
Silver	2	36	180	1,500	6,800	2	8.3
Zinc	109 [m]	2200	10,000 [d]	10,000 [d]	10,000 [d]	109 [f]	2,480
PCBs/Pesticides							
2,4,5-TP Acid (Silvex)	3.8	58	100 [a]	500 [b]	1,000 [c]	NS	3.8
4,4'-DDE	0.0033 [l]	1.8	8.9	62	120	0.0033 [e]	17
4,4'-DDT	0.0033 [l]	1.7	7.9	47	94	0.0033 [e]	136
4,4'-DDD	0.0033 [l]	2.6	13	92	180	0.0033 [e]	14
Aldrin	0.005 [m]	0.019	0.097	0.68	1.4	0.14	0.19
alpha-BHC	0.02	0.097	0.48	3.4	6.8	0.04 [g]	0.02
beta-BHC	0.036	0.072	0.36	3	14	0.6	0.09
Chlordane (alpha)	0.094	0.91	4.2	24	47	1.3	2.9
delta-BHC	0.04	100 [a]	100 [a]	500 [b]	1,000 [c]	0.04 [g]	0.25
Dibenzofuran	7	14	59	350	1,000 [c]	NS	210
Dieldrin	0.005 [m]	0.039	0.2	1.4	2.8	0.006	0.1
Endosulfan I	2.4	4.8 [i]	24 [i]	200 [i]	920 [i]	NS	102
Endosulfan II	2.4	4.8 [i]	24 [i]	200 [i]	920 [i]	NS	102
Endosulfan sulfate	2.4	4.8 [i]	24 [i]	200 [i]	920 [i]	NS	1,000 [c]
Endrin	0.014	2.2	11	89	410	0.014	0.06
Heptachlor	0.042	0.42	2.1	15	29	0.14	0.38
Lindane	0.1	0.28	1.3	9.2	23	6	0.1
Polychlorinated biphenyls	0.1	1	1	1	25	1	3.2
Semivolatiles							
Acenaphthene	20	100 [a]	100 [a]	500 [b]	1,000 [c]	20	98
Acenapthylene	100 [k]	100 [a]	100 [a]	501 [b]	1,000 [c]	NS	107
Anthracene	100 [k]	100 [a]	100 [a]	502 [b]	1,000 [c]	NS	1,000 [c]
Benz(a)anthracene	1 [m]	1 [f]	1 [f]	5.6	11	NS	1[f]
Benzo(a)pyrene	1 [m]	1 [f]	1 [f]	1 [f]	1.1	2.6	22
Benzo(b)fluoranthene	1 [m]	1 [f]	1 [f]	5.6	11	NS	1.7
Benzo(g,h,i)perylene	100	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	1,000 [c]
Benzo(k)fluoranthene	0.8 [m]	1	3.9	56	110	NS	1.7
Chrysene	1 [m]	1[f]	3.9	56	110	NS	1[f]
Dibenz(a,h)anthracene	0.33 [l]	0.33 [e]	0.33 [e]	0.56	1.1	NS	1,000 [c]
Fluoranthene	100 [k]	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	1,000 [c]
Fluorene	30	100 [a]	100 [a]	500 [b]	1,000 [c]	30	386
Indeno(1,2,3-cd)pyrene	0.5 [m]	0.5 [f]	0.5 [f]	5.6	11	NS	8.2
m-Cresol	0.33 [l]	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	0.33 [e]
Naphthalene	12	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	12
o-Cresol	0.33 [l]	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	0.33 [e]
p-Cresol	0.33 [l]	34	100 [a]	500 [b]	1,000 [c]	NS	0.33 [e]
Pentachlorophenol	0.8 [l]	2.4	6.7	6.7	55	0.8 [e]	0.8 [e]
Phenanthrene	100	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	1,000 [c]
Phenol	0.33 [l]	100 [a]	100 [a]	500 [b]	1,000 [c]	30	0.33 [e]
Pyrene	100	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	1,000 [c]

Table 1 A
Soil Criteria Table

29 Clay Street
Brooklyn, New York
BCP Site No. C224408
QAPP/FSP

Contaminant	Protection of Public Health					Protection of Ecological Resources[n]	Protection of Groundwater
	Unrestricted Use	Residential	Restricted-Residential	Commercial	Industrial		
All soil cleanup objectives (SCOs) are in parts per million (ppm); approximately equivalent to mg/kg.							
Volatiles							
1,1,1-Trichloroethane	0.68	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	0.68
1,1-Dichloroethane	0.27	19	26	240	480	NS	0.27
1,1-Dichloroethene	0.33	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	0.33
1,2-Dichlorobenzene	1.1	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	1.1
1,2-Dichloroethane	0.02 [m]	2.3	3.1	30	60	10	0.02 [f]
cis-1,2-Dichloroethene	0.25	59	100 [a]	500 [b]	1,000 [c]	NS	0.25
trans-1,2-Dichloroethene	0.19	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	0.19
1,3-Dichlorobenzene	2.4	17	49	280	560	NS	2.4
1,4-Dichlorobenzene	1.8	9.8	13	130	250	20	1.8
1,4-Dioxane	0.1 [l]	9.8	13	130	250	0.1 [e]	0.1 [e]
Acetone	0.05	100[a]	100[b]	500 [b]	1,000 [c]	2.2	0.05
Benzene	0.06	2.9	4.8	44	89	70	0.06
Butylbenzene	12	100[a]	100[a]	500 [b]	1,000 [c]	NS	12
Carbon tetrachloride	0.76	1.4	2.4	22	44	NS	0.76
Chlorobenzene	1.1	100[a]	100[a]	500 [b]	1,000 [c]	40	1.1
Chloroform	0.37	10	49	350	700	12	0.37
Ethylbenzene	1	30	41	390	780	NS	1
Hexachlorobenzene	0.33 [l]	0.33[e]	1.2	6	12	NS	3.2
Methyl ethyl ketone	0.12	100 [a]	100 [a]	500 [b]	1,000 [c]	100 [a]	0.12
Methyl tert-butyl ether	0.93	62	100 [a]	500 [b]	1,000 [c]	NS	0.93
Methylene chloride	0.05	51	100 [a]	500 [b]	1,000 [c]	12	0.05
n-Propylbenzene	3.9	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	3.9
sec-Butylbenzene	11	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	11
tert-Butylbenzene	5.9	100 [a]	100 [a]	500 [b]	1,000 [c]	NS	5.9
Tetrachloroethene	1.3	5.5	19	150	300	2	1.3
Toluene	0.7	100 [a]	100 [a]	500 [b]	1,000 [c]	36	0.7
Trichloroethene	0.47	10	21	200	400	2	0.47
1,2,4-Trimethylbenzene	3.6	47	52	190	380	NS	3.6
1,3,5- Trimethylbenzene	8.4	47	52	190	380	NS	8.4
Vinyl chloride	0.02	0.21	0.9	13	27	NS	0.02
Xylene (mixed)	0.26	100 [a]	100 [a]	500 [b]	1,000 [c]	0.26	1.6
Per-and Polyfluoroalkyl Substances (PFAs)[o]							
PFOA	0.00066	0.0066	0.033	0.5	0.6	NS	0.0011
PFOS	0.00088	0.0088	0.044	0.44	0.44	NS	0.0037

Notes:

[a] The SCOs for residential, restricted-residential and ecological resources use were capped at a maximum value of 100 ppm.

[b] The SCOs for commercial use were capped at a maximum value of 500 ppm.

[c] The SCOs for industrial use and the protection of groundwater were capped at a maximum value of 1000 ppm.

[d] The SCOs for metals were capped at a maximum value of 10,000 ppm.

[e] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the SCO value.

[f] For constituents where the calculated SCO was lower than the rural soil background concentration as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the Track 2 SCO value for this use of the site.

[g] This SCO is derived from data on mixed isomers of BHC.

[h] The SCO for this specific compound (or family of compounds) is considered to be met if the analysis for the total species of this contaminant is below the specific SCO.

[i] This SCO is for the sum of endosulfan I, endosulfan II, and endosulfan sulfate.

[j] This SCO is the lower of the values for mercury (elemental) or mercury (inorganic salts).

[k] The SCOs for unrestricted use were capped at a maximum value of 100 ppm.

[l] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the Track 1 SCO value.

[m] For constituents where the calculated SCO was lower than the rural soil background concentration, as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the Track 1 SCO value for this use of the site.

[n] Protection of ecological resources SCOs were not developed for contaminants identified in Table 375-6.8(b) with "NS". Where such contaminants appear in Table 375-6.8(a), the applicant may be required by the Department to calculate a protection of ecological resources SCO according to the TSD.

[o] SCOs for PFAs are taken from the NYSDEC Sampling, Analysis, and Assessment of Per-and-Polyfluoroalkyl Substances (PFAS) under NYSDEC's Part 375 Remedial Programs, dated April 2023.

Table 1B

Groundwater Criteria Table
29 Clay Street
Brooklyn, New York
BCP Site No. C224408

Contaminant	Aqueous Water Quality Standards[1], ug/L
Metals	
Antimony	3
Arsenic	---
Arsenic	25
Barium	1,000
Beryllium	3
Cadmium	5
Chromium, hexavalent	---
Chromium, trivalent	50
Copper	200
Cyanide	---
Iron	300
Lead	25
Magnesium	35,000
Manganese	300
Mercury	0.7
Nickel	100
Selenium	10
Silver	50
Sodium	20,000
Thallium	0.5
Zinc	2000
PCBs/Pesticides	
alpha-BHC	0.01
2,4,5-TP Acid (Silvex)	---
4,4'-DDD	0.3
4,4'-DDE	0.2
4,4'-DDT	0.2
Aldrin	---
beta-BHC	0.04
Chlordane (alpha)	---
Dibenzofuran	---
Dieldrin	0.004
Endosulfan I	0.12
Endosulfan II	0.12
Endosulfan sulfate	0.12
Endrin	---
Endrin aldehyde	5
Endrin ketone	5
gamma-BHC (Lindane)	0.05

Table 1B
Groundwater Criteria Table
29 Clay Street
Brooklyn, New York
BCP Site No. C224408

Contaminant	Aqueous Water Quality Standards[1], ug/L
PCBs/Pesticides, Con't.	
gamma-Chlordane	0.12
Heptachlor	0.04
Heptachlor epoxide	0.03
Lindane	---
Methoxychlor	35
Polychlorinated biphenyls	---
Toxaphene	0.06
Semivolatiles	
1,1’-Biphenyl	5
2,2’-oxybis(1-Chloropropane)	5
2,4,5-Trichlorophenol	1
2,4-Dichlorophenol	1
2,4-Dimethylphenol	50
2,4-Dinitrophenol	10
2,4-Dinitrotoluene	5
2,6-Dinitrotoluene	5
2-Chloronaphthalene	10
2-Chlorophenol	1
2-Methylnaphthalene	502
2-Methylphenol	1
2-Nitroaniline	5
2-Nitrophenol	1
3,3’-Dichlorobenzidine	5
3-Nitroaniline	5
4-Chloro-3-methylphenol	1
4-Chloroaniline	5
4-Methylphenol	1
4-Nitroaniline	5
4-Nitrophenol	1
Acenaphthene	20
Acenapthylene	202
Anthracene	50
Atrazine	7.5
Benz(a)anthracene	0.002
Benzo(a)pyrene	---
Benzo(b)fluoranthene	0.002
Benzo(g,h,i)perylene	52
Benzo(k)fluoranthene	0.002
bis(2-Chloroethoxy)methane	5

Table 1B

Groundwater Criteria Table
29 Clay Street
Brooklyn, New York
BCP Site No. C224408

Contaminant	Aqueous Water Quality Standards[1], ug/L
Semivolatiles, Con't.	
Bis(2-Chloroethyl)ether	1
bis(2-Ethylhexyl)phthalate	5
Butylbenzylphthalate	50
Chrysene	0.002
Dibenz(a,h)anthracene	502
Dibenzofuran	52
Diethylphthalate	50
Dimethylphthalate	50
Di-n-butylphthalate	50
Di-n-octylphthalate	50
Fluoranthene	50
Fluorene	50
Hexachlorobenzene	0.04
Hexachlorobutadiene	0.5
Hexachlorocyclopentadiene	5
Hexachloroethane	5
Indeno(1,2,3-cd)pyrene	0.002
Isophorone	50
m-Cresol	---
Naphthalene	10
Nitrobenzene	0.4
N-Nitrosodiphenylamine	50
o-Cresol	---
p-Cresol	---
Pentachlorophenol	1
Phenanthrene	50
Phenol	1
Pyrene	50
Volatiles	
1,1,1-Trichloroethane	5
1,1,2,2-Tetrachloroethane	5
1,1,2-Trichloro-1,2,2-trifluoroethane	5
1,1,2-Trichloroethane	1
1,1-Dichloroethane	5
1,1-Dichloroethene	5
1,1-Dichloroethylene	---
1,2,4-Trichlorobenzene	---

Table 1B

Groundwater Criteria Table

29 Clay Street

Brooklyn, New York

BCP Site No. C224408

Contaminant	Aqueous Water Quality Standards[1], ug/L
Volatiles, Con't.	
1,2,4-Trimethylbenzene	5
1,2-Dibromo-3-chloropropane	0.04
1,2-Dibromoethane	0.0006
1,2-Dichlorobenzene	3
1,2-Dichloroethane	0.6
1,2-Dichloropropane	1
1,3,5- Trimethylbenzene	---
1,3-Butadiene	---
1,3-Dichlorobenzene	3
1,3-Dichlorobenzene	---
1,4-Dichlorobenzene	3
1,4-Dichlorobenzene	---
1,4-Dioxane	1[2]
2-Butanone	50
2-Hexanone	50
4-Methyl-2-pentanone	502
Acetone	50
Benzene	1
Bromodichloromethane	50
Bromoform	50
Bromomethane	5
Butylbenzene	---
Carbon Disulfide	60
Carbon tetrachloride	5
Chlorobenzene	5
Chloroethane	5
Chloroform	7
Chloromethane	5
Cis- 1,3-Dichloropropene	0.4
cis-1,2-Dichloroethene	5
cis-1,2-Dichloroethylene	---
Cyclohexane	---
Dibromochloromethane	50
Dichlorodifluoromethane	5
Ethyl Acetate	---
Ethylbenzene	5
Freon 113	---
Hexachlorobenzene	---

Table 1B

Groundwater Criteria Table
29 Clay Street
Brooklyn, New York
BCP Site No. C224408

Contaminant	Aqueous Water Quality Standards[1], ug/L
Volatiles, Con't.	
Hexachlorobutadiene	---
Hexane	---
Isopropylbenzene	5
m,p-Xylene	---
m-Dichlorobenzene	---
Methyl Acetate	NS
Methyl ethyl ketone	---
Methyl Isobutyl Ketone	---
Methyl tert-butyl ether	10
Methylcyclohexane	---
Methylene chloride	5
n-Propylbenzene	---
o-Dichlorobenzene	---
o-Xylene	---
p-Dichlorobenzene	---
sec-Butylbenzene	---
Styrene	5
tert-Butylbenzene	---
Tertiary Butyl Alcohol	---
Tetrachloroethene	5
Toluene	5
trans-1,2-Dichloroethene	5
trans-l,3-Dichloropropene	0.4
Trichloroethene	5
Trichlorofluoromethane	5
Vinyl Acetate	---
Vinyl Chloride	2
Xylene (mixed)	5
Per- and Polyfluoroalkyl Substances (PFAS)	
PFOA	0.01[2]
PFOS	0.01[2]

Notes:

[1] - Division of Water Technical and Operational Guidance Values (TOGS) Ambient Water Quality Standards and Guidance Values (AWQS), ug/L

[2] - Guidance value for 1,4-Dioxane, PFOA, and PFOS is from the NYSDEC Guidance to Regulate PFOA, PFOS, and 1,4-Dioxane in State Waters, dated October 5, 2021

ug/L - micro gram per liter

Table 1C
Soil Vapor Criteria Table
29 Clay Street
Brooklyn, NY
NYSDEC BCP No. C224408

Volatile Organics in Air	CAS No.	NYSDOH Soil Vapor Intrusion Guidance Criteria				Toxicity	Decision Matrix
		1	2	3	4		
1,1,1-Trichloroethane	71556	2.5	20.6	-	-	L	**B**
1,1,2,2-Tetrachloroethane	79345	0.4	-	-	-	M	TD
1,1,2-Trichloroethane	79005	0.4	<1.5	-	-	H	TD
1,1-Dichloroethane	75343	0.4	<0.7	-	-	L	TD
1,1-Dichloroethene	75354	0.4	<1.4	-	-	M	B
1,2,4-Trichlorobenzene	120821	0.5	<6.8	-	-	NA	TD
1,2,4-Trimethylbenzene	95636	9.8	9.5	-	-	NA	D
1,2-Dibromoethane	106934	0.4	<1.5	-	-	H	TD
1,2-Dichlorobenzene	95501	0.5	<1.2	-	-	M	TD
1,2-Dichloroethane	107062	0.4	<0.9	-	-	H	TD
1,2-Dichloropropane	78875	0.4	<1.6	-	-	M	TD
1,3,5-Trimethybenzene	108678	3.9	3.7	-	-	M	D
1,3-Butadiene	106990	-	<3.0	-	-	H	TD
1,3-Dichlorobenzene	541731	0.5	<2.4	-	-	M	TD
1,4-Dichlorobenzene	106467	1.2	5.5	344	-	M	TD
1,4-Dioxane	123911	-	-	-	-	M	TD
2,2,4-Trimethylpentane	540841	5	-	-	-	M	D
2-Butanone	78933	16	12	-	-	M	TD
2-Hexanone	591786	-	-	-	-	NA	TD
3-Chloropropene	107051	-	-	-	-	M	TD
4-Ethyltoluene	622968	-	3.6	-	-	NA	TD
4-Methyl-2-pentanone	108101	1.9	6	-	-	M	TD
Acetone	67641	115	98.9	45.8	-	L	TD
Benzene	71432	13	9.4	10	-	H	D
Benzyl chloride	100447	-	<6.8	-	-	H	TD
Bromodichloromethane	75274	-	-	-	-	M	TD
Bromoform	75252	-	-	-	-	M	TD
Bromomethane	74839	0.5	<1.7	-	-	M	TD
Carbon disulfide	75150	-	4.2	-	-	M	TD
Carbon tetrachloride	56235	1.3	<1.3	1.1	-	H	A
Chlorobenzene	108907	0.4	<0.9	-	-	M	TD
Chloroethane	75003	0.4	<1.1	-	-	L	TD
Chloroform	67663	1.2	1.1	6.34	-	H	TD
Chloromethane	74873	4.2	3.7	-	-	M	TD
cis-1,2-Dichloroethene	156592	0.4	<1.9	-	-	M	B
cis-1,3-Dichloropropene	10061015	0.4	<2.3	-	-	NA	TD
Cyclohexane	110827	6.3	-	-	-	L	D

Table 1C
Soil Vapor Criteria Table
29 Clay Street
Brooklyn, NY
NYSDEC BCP No. C224408

Volatile Organics in Air	CAS No.	NYSDOH Soil Vapor Intrusion Guidance Criteria				Toxicity	Decision Matrix
		1	2	3	4		
Dibromochloromethane	124481	-	-	-	-	NA	TD
Dichlorodifluoromethane	75718	10	16.5	-	-	NA	TD
Ethanol	64175	1300	210	-	-	L	TD
Ethyl Acetate	141786	-	5.4	-	-	M	TD
Ethylbenzene	100414	6.4	5.7	7.62	-	M	D
Freon-113	76131	2.5	3.5	-	-	L	TD
Freon-114	76142	0.4	<6.8	-	-	NA	TD
Heptane	142825	18	-	-	-	M	E
Hexachlorobutadiene	87683	0.5	<6.8	-	-	M	TD
Isopropanol	67630	-	-	-	-	M	TD
Methyl tert butyl ether	1634044	14	11.5	36	-	M	TD
Methylene chloride	75092	16	10	7.5	60	NA	TD
n-Hexane	110543	14	10.2	-	-	M	E
o-Xylene	95476	7.1	7.9	7.24	-	M	D
p/m-Xylene	179601231	11	22.2	22.2	-	M	E
Styrene	100-42-5	1.4	1.9	5.13	-	M	TD
Tertiary butyl Alcohol	75-65-0	-	-	-	-	NA	TD
Tetrachloroethene (PCE)	127184	2.5	15.9	6.01	30	H	B
Tetrahydrofuran	109999	0.8	-	-	-	M	TD
Toluene	108883	57	43	39.8	-	L	F
trans-1,2-Dichloroethene	156605	-	-	-	-	NA	TD
trans-1,3-Dichloropropene	10061026	NC	<1.3	-	-	NA	TD
Trichloroethene	79016	0.5	4.2	1.36	2	H	A
Trichlorofluoromethane	75694	12	18.1	-	-	L	TD
Vinyl bromide	593602	-	-	-	-	H	TD
Vinyl chloride	75014	0.4	<1.9	-	-	H	A

Notes

Decision Criteria used:
Martix A: Sub-Slab >5, Indoor Air >5
Martix B: Sub-Slab >100, Indoor Air >30
Toxicities from DAR-1 Appendix C/SCG/ACG
(H) HIGH Toxicity Contaminant.
(M) MODERATE Toxicity Contaminant.
(L) LOW Toxicity Contaminant.

ND - Non-detect
NA - Not applicable
NFA - No further action
TD - To be determined based on the NYSDOH VI Decision
easonable - Take reasonable/practical actions to identify source/reduce exposure

<u>NYSDOH Soil Vapor Intrusion Guidance Criteria</u>
1 - Table C-1 2003 Upper Fence Study of Volatile Organic Chemicals in air of Fuel Oil Heated Homes for Indoor Air
2 - Table C-2 2001 USEPA BASE 90th Percentile for Indoor Air
3 -Table C-5 2005 Health Effects Institute 95th Percentile for Indoor Air
4 -NYSDOH Air Guidance Value
NYSDOH Specific Compounds for Matrix Eval

Table 2

Typical Analytical Parameters, Methods, Preservation, Holding Time and Container Requirements
29 Clay Street, Brooklyn NY
NYSDEC BCP Site No. C224408

Sample Matrix	Analytical Parameter	Numer of Samples[1]	EPA Analytical Method	Sample Preservation	Holding Time[2]	Sample Container[3]
Soil	VOCs (TCL)	12	SW-846 Method 8260C/5035	1 - Methanol, 2 - Water; Cool to 4° C; no headspace	14 days to analysis	(3) Vial
Soil	PCBs	12	SW-846 Method 8082A	Cool to 4^0 C	365 days to analysis	(1) 250 mL amber glass jar
Soil	Pesticides (TCL)	12	SW-846 Method 8081A	Cool to 4^0 C	14 days to extraction	(1) 250 mL amber glass jar
Soil	SVOCs (TCL)	12	SW-846 Method 8270D	Cool to 4˚ C	14 days to extraction	(1) 250 mL amber glass jar
Soil	1,4-Dioxane	12	SW-846 Method 8270D	Cool to 4˚ C	7 days to extraction	(2) 250 mL amber glass jars
Soil	Metals	12	SW-846 Method 6010DSeries	Cool to 4^0 C	180 days to analysis	(1) 60 mL glass jar
Soil	Mercury	12	SW-846 Method 7471B	Cool to 4^0 C	28 days to analysis	(1) 60 mL glass jar
Soil	Cyanide	12	SW-846 Method 9010C/9012B	Cool to 4^0 C	14 days to analysis	(1) 250 mL amber glass jar
Soil	Herbicides	12	SW-846 Method 8151A	Cool to 4^0 C	14 days to extraction	(1) 250 mL amber glass jar
Soil	PFAs	12	EPA Method 1633	Cool to 4^0 C	14 Days	(1) 250 mL plastic container
Groundwater	VOCs (TCL)	8	SW-846 Method 8260C	HCl; Cool to 4^0 C; no headspace	14 days to analysis	(3) Vial
Groundwater	VOCs with TICs, including 1,4-Dioxane (TCL)	8	SW-846 Method 8260C	HCl; Cool to 4^0 C; no headspace	14 days to analysis	(3) Vial
Groundwater	1,4-Dioxane	8	SW-846 Method 8270D	Cool to 4^0 C	7 days to analysis	(2) 250 mL amber glass jar
Groundwater	SVOCs (TCL)	8	SW-846 Method 8270D	Cool to 4^0 C	7 days to extraction	(2) 250 mL amber glass jar
Groundwater	SVOCs with TICs (TCL)	8	SW-846 Method 8270D	Cool to 4^0 C	7 days to extraction	(2) 250 mL amber glass jar
Groundwater	Metals- total (TAL)	8	SW-846 Method 6020B/7470A Series	HNO$_3$; Cool to 4° C	28 days to analysis for Hg; 180 days to analysis for other	(1) 500 mL plastic container
Groundwater	Metals-dissolved (TAL)	8	SW-846 Method 6020B/7470A Series	HNO3; Cool to 4° C	28 days to analysis for Hg; 180 days to analysis for other metals	(1) 500 mL plastic container
Groundwater	Pesticides (TCL)	8	SW-846 Method 8081B	Cool to 4^0 C	7 days to extraction	(2) 120 mL amber glass jar
Groundwater	Herbicides (TCL)	8	SW-846 Method 8151A	Cool to 4^0 C	7 days to extraction	(2) 1000 mL amber glass jar
Groundwater	PCBs	8	SW-846 Method 8082A	Cool to 4^0 C	365 days to analysis	(1) 250 mL amber glass jar
Groundwater	Cyanide	8	SW-846 Method 9012A	Cool to 4^0 C	14 days to analysis	(1) 250 mL amber glass jar
Groundwater	Mercury	8	SW-846 Method 7470 A	HNO3; Cool to 4˚ C	28 days to analysis	(1) 250 mL plastic container
Groundwater	PFAs	8	EPA Method 1633	Cool to 4^0 C	14 Days	(1) 250 mL plastic container
Soil Gas	VOCs	5	EPA Method TO-15	None	14 days to analysis	(1) Evacuated 6-Liter SUMMA® canister

Notes:

[1] Actual number of samples may vary depending on field conditions, sample material availability, and field observations. See RIWP for estimates.

[2] Holding times listed are method holding time calculated from time of collection and not NYSDEC ASP holding times.

[3] MS/MSDs require duplicate volume for all parameters for solid matrices; MS/MSDs require triplicate volume for organic parameters for aqueous matrices and duplicate volume for inorganic parameters for aqueous matrices

Table 3

Typical Laboratory Data Quality Objectives
Soil Samples
29 Clay Street, Brooklyn, NY
NYCDEC BCP Site No. C224408

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements
VOCs (TCL)	SW-846 Methods 8260B/5035	Soil	Surrogates % Rec. 1,2-Dichloroethane-d4 70-130 4-Bromofluorobenzene 70-130 Dibromofluoromethane 70-130 Toluene-d8 70-130 2-Chloroethoxyethane 70-130 Matrix Spikes 30-151% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 30 per matrix type	Field Duplicates RPD <30 MS/MSDs (RPD) RPD <30	Field Duplicates: One per 20 per soils MS/MSDs: One per 30 per matrix type
VOCs with Tentatively Identified Compounds (TICs)	SW-846 Method 8260C	Soil	Surrogates % Rec. 1,2-Dichloroethane-d4 70-130 4-Bromofluorobenzene 70-130 Dibromofluoromethane 70-130 Toluene-d8 70-130 Matrix Spikes 36-162 % recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <30 MS/MSDs RPD RPD<30	Field Duplicates: One per 20 MS/MSDs: One per 20
PCBs	SW-846 Method 8082A	Soil	Surrogates % Rec. 2,4,5,6-Tetrachloro-m-xylene 30-150 Decachlorobiphenyl 30-150 Matrix Spikes 40-140% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <50 MS/MSDs (RPD) RPD<50	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type
SVOCs	SW-846 Method 8270D	Soil	Surrogates % Rec. Phenol-d6 10-120 2-Fluorophenol 25-120 2,4,6-Tribromophenol 10-136 Nitrobenzene-d5 23-120 2-Fluorobiphenyl 30-120 4-Terphenyl-d14 18-120 Matrix Spikes 14-144% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 50 per matrix type	Field Duplicates RPD <50 MS/MSDs (RPD)	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type
SVOCs with TICs	SW-846 Method 8270D	Soil	Surrogates % Rec. Phenol-d5 10-120 2-Fluorophenol 21-120 2,4,6-Tribromophenol 10-120 Nitrobenzene-d5 23-120 2-Fluorobiphenyl 15-120 4-Terphenyl-d14 41-149 Matrix Spikes 14-144%	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <50 MS/MSDs RPD RPD<50	Field Duplicates: One per 20 MS/MSDs: One per 20
1,4-Dioxane	SW-846 Method 8270D	Soil	Surrogates % Rec. 1,4-Dioxane-d8 15-110 Matrix Spikes 40-140% recovery	Surrogates: All samples, standards, QC samples	Field Duplicates RPD <30 MS/MSDs (RPD) RPD<30	Field Duplicates: One per 20 per soils MS/MSDs: One per 20
Pesticides (TCL)	SW-846 Method 8081A	Soil	Surrogates % Rec. Decachlorobiphenyl 30-150 Tetrachloro-m-xylene 30-150 Matrix Spikes 30-150% Recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <50 MS/MSDs (RPD) RPD<50	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type
Total Petroleum Hydrocarbons	SW-846 Method 8015B	Soil	Surrogates % Rec. o-Terphenyl 27-153 Tetracosane-d50 28-148 5α-androstane 27-148 TPH-DRO 10-149	Surrogates: All samples, standards, QC samples One per 20 per matrix type	Field Duplicates RPD <50 TPH-DRO 44	Field Duplicates: One per 20 per soils One per 20 per matrix type
Herbicides	SW-846 Method 8151A	Soil	Surrogates % Rec. 2,4-DCAA 30-150 Matrix Spikes 30-150% Recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <50 MS/MSDs (RPD) RPD<50	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type
Metals (TAL)	SW-846 Method 6010D	Soil	Surrogates % Rec. Matrix Spikes 75-125% recovery	Surrogates: Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <20 MS/MSDs (RPD) RPD <20	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type

Table 3
Typical Laboratory Data Quality Objectives
Soil Samples
29 Clay Street, Brooklyn, NY
NYCDEC BCP Site No. C224408

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements
PFAs	LCMSMS- Isotope Dilution	Soil	Surrogates % Rec. Perfluoro[13C4]Butanoic Acid (MPFBA) 61-135 Perfluoro[13C4]Butanoic Acid (MPFBA) 58-132 Perfluoro[13C5]Pentanoic Acid (M5PFPEA) 62-163 Perfluoro[13C5]Pentanoic Acid (M5PFPEA) 58-150 Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS) 70-131 Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS) 74-139 Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA) 57-129 Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA) 66-128 Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA) 60-129 Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA) 71-129 Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS) 71-134 Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS) 78-139 Perfluoro[13C8]Octanoic Acid (M8PFOA) 62-129 Perfluoro[13C8]Octanoic Acid (M8PFOA) 75-130 1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-6:2FTS) 14-147 1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-6:2FTS) 20-154 Perfluoro[13C9]Nonanoic Acid (M9PFNA) 59-139 Perfluoro[13C9]Nonanoic Acid (M9PFNA) 72-140 Perfluoro[13C8]Octanesulfonic Acid (M8PFOS) 79-136 Perfluoro[13C8]Octanesulfonic Acid (M8PFOS) 69-131 Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA) 75-130 Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA) 62-124 1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-8:2FTS) 19-175 1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-8:2FTS) 10-162 N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid (d3-NMeFOSAA) 24-116 N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid (d3-NMeFOSAA) 31-134 Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA) 61-155 Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA) 55-137 Perfluoro[13C8]Octanesulfonamide (M8FOSA) 10-112 Perfluoro[13C8]Octanesulfonamide (M8FOSA) 10-117 N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA) 34-137 N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA) 27-126 Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA) 48-131 Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA) 54-150 Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA) 22-136 Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA) 24-159 Matrix Spikes 46-182% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <30 MS/MSDs (RPD) RPD <30	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type
Mercury	SW-846 Method 7471B	Soil	Surrogates % Rec. Matrix Spikes 80-125% recovery	Surrogates: Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <20 MS/MSDs (RPD) RPD <20	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type
Cyanide	SW-846 Method 9012A	Soil	Surrogates % Rec. Matrix Spikes 75-125% Recovery	Surrogates: Matrix Spikes: One per 35 per matrix type	Field Duplicates RPD <35 MS/MSDs (RPD) RPD <35	Field Duplicates: One per 20 per soils MS/MSDs: One per 20 per matrix type

Recovery criteria for laboratory control samples must be at least as stringent as MS/MSD criteria.
Laboratory control limits are periodically updated. The latest control limits will be utilized at the time of sample analysis.

Table 4

Typical Laboratory Data Quality Objectives
Groundwater Samples
29 Clay Street, Brooklyn, NY
NYSDEC BCP Site No. C224408

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements
VOCs (TCL)	SW-846 Method 8260C	Groundwater	Surrogates % Rec. 1,2-Dichloroethane-d4 70-130 4-Bromofluorobenzene 70-130 Dibromofluoromethane 70-130 Toluene-d8 70-130 Matrix Spikes 36-162 % recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <20 MS/MSDs RPD RPD <20	Field Duplicates: One per 20 MS/MSDs: One per 20
VOCs with Tentatively Identified Compounds (TICs)	SW-846 Method 8260C	Groundwater	Surrogates % Rec. 1,2-Dichloroethane-d4 70-130 4-Bromofluorobenzene 70-130 Dibromofluoromethane 70-130 Toluene-d8 70-130 Matrix Spikes 36-162 % recovery	Surrogates: All samples, standards, QC Matrix Spikes: One per 20	Field Duplicates RPD <20 MS/MSDs RPD RPD <20	Field Duplicates: One per 20 MS/MSDs: One per 20
SVOCs TCL	SW-846 Method 8270D	Groundwater	Surrogates % Rec. Phenol-d5 10-120 2-Fluorophenol 21-120 2,4,6-Tribromophenol 10-120 Nitrobenzene-d5 23-120 2-Fluorobiphenyl 15-120 4-Terphenyl-d14 41-149 Matrix Spikes 14-144%	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <50 MS/MSDs RPD RPD <50	Field Duplicates: One per 20 MS/MSDs: One per 20
SVOCs with TICs	SW-846 Method 8270D	Groundwater	Surrogates % Rec. Phenol-d5 10-120 2-Fluorophenol 21-120 2,4,6-Tribromophenol 10-120 Nitrobenzene-d5 23-120 2-Fluorobiphenyl 15-120 4-Terphenyl-d14 41-149 Matrix Spikes 14-144%	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates: RPD <50 MS/MSDs RPD RPD <50	Field Duplicates: One per 20 MS/MSDs: One per 20
1,4-Dioxane	SW-846 Method 8270D	Groundwater	Surrogates % Rec. 1,4-Dioxane-d8 15-110 Matrix Spikes 40-140% recovery	Surrogates: All samples, standards, QC samples	Field Duplicates RPD <30 Matrix Duplicates RPD<30	Field Duplicates: One per 20 per soils MS/MSDs: One per 20
Metals (Total and Dissolved)	SW-846 Methods 6020B	Groundwater	Matrix Spikes 75-125% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <20 Matrix Duplicates RPD <20	Field Duplicates: One per 20 MS/MSDs: One per 20
Mercury (Total and Dissolved)	SW-846 Methods 7470A	Groundwater	Matrix Spikes 75-125% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <35 (dissolved) RPD<20 (Total) Matrix Duplicates RPD <35 (dissolved) RPD<20 (Total)	Field Duplicates: One per 20 MS/MSDs: One per 20
PCBs	SW-846 Method 8082A	Groundwater	Surrogates % Rec. 2,4,5,6-Tetrachloro-m-xylene 30-150 Decachlorobiphenyl 30-150 Matrix Spikes 40-140% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <50 MS/MSDs (RPD) RPD<50	Field Duplicates: One per 20 MS/MSDs: One per 20 per matrix type
Herbicides	SW-846 Method 8151A	Groundwater	Surrogates % Rec. 2,4-DCAA 30-150 Matrix Spikes 30-150% Recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates: RPD <50 MS/MSDs (RPD) RPD<50	Field Duplicates: One per 20 MS/MSDs: One per 20 per matrix type

Table 4
Typical Laboratory Data Quality Objectives
Groundwater Samples
29 Clay Street, Brooklyn, NY
NYSDEC BCP Site No. C224408

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements
Pesticides (TCL)	SW-846 Method 8081B	Groundwater	Surrogates % Rec. Decachlorobiphenyl 15-142 2,4,5,6-Tetrachloro-m-xylene 36-126 Matrix Spikes 30-150% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD <30 MS/MSDs RPD RPD <30	Field Duplicates: One per 20 MS/MSDs: One per 20
PFAs	EPA Method 1633	Grounwater	Surrogates Perfluoro[13C4]Butanoic Acid (MPFBA) Perfluoro[13C4]Butanoic Acid (MPFBA) Perfluoro[13C5]Pentanoic Acid (M5PFPEA) Perfluoro[13C5]Pentanoic Acid (M5PFPEA) Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS) Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS) Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA) Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA) Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA) Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA) Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS) Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS) Perfluoro[13C8]Octanoic Acid (M8PFOA) Perfluoro[13C8]Octanoic Acid (M8PFOA) 1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2- 1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2- Perfluoro[13C9]Nonanoic Acid (M9PFNA) Perfluoro[13C9]Nonanoic Acid (M9PFNA) Perfluoro[13C8]Octanesulfonic Acid (M8PFOS) Perfluoro[13C8]Octanesulfonic Acid (M8PFOS) Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA) Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA) 1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2- 1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2- N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA) Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA) Perfluoro[13C8]Octanesulfonamide (M8FOSA) Perfluoro[13C8]Octanesulfonamide (M8FOSA) N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA) Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA) Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA) Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA) Matrix Spikes 46-182% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	Field Duplicates RPD <30 MS/MSDs (RPD) RPD <30	Field Duplicates: One per 20 MS/MSDs: One per 20 per matrix
Cyanide	EPA Method 9012B	Groundwater	Matrix Spikes 75-125% recovery	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 35	Field Duplicates RPD <35 Matrix Duplicates RPD <35	Field Duplicates: One per 20 Matrix Duplicates: One per 20
Recovery criteria for laboratory control samples must be at least as stringent as MS/MSD criteria. Laboratory control limits are periodically updated. The latest control limits will be utilized at the time of sample analysis.						

Table 5

Typical Laboratory Data Quality Objectives
Soil Gas Samples
29 Clay Street, Brooklyn, NY
NYSDEC BCP Site No. C224408

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements
VOCs	EPA Method TO-15	Soil Gas	Surrogates % Rec. 4-Bromofluorobenzene 78-124	Surrogates: All samples, standards, QC samples	Matrix Duplicates RPD £30	Matrix Duplicates One per 20

Table 6

QC Sample Preservation and Container Requirements
29 Clay St., Brooklyn, NY
NYSDEC BCP Site No. C224408

Sample Matrix	Analytical Parameter	No. of Samples	EPA Analytical Method	Sample Preservation	Holding Time[1]	Sample Container
Soil	VOCs	2	SW-846 Method 8260C/5035	1 - Methanol, 2 - Water; Cool to 4° C;	14 days to analysis	(3) Vial Preserved
	(TCL)			no headspace		
Soil	PCBs	2	SW-846 Method 8082A	Cool to 4^0 C	365 days to analysis	(1) 250 mL amber glass jar
Soil	SVOCs	2	SW-846 Method 8270D	Cool to 4° C	14 days to extraction	(1) 250 mL amber glass jar
	(TCL)					
Soil	1,4-Dioxane	2	SW-846 Method 8270D	Cool to 4° C	7 days to extraction	(2) 250 mL amber glass jars
Soil	Metals	2	SW-846 Method 6010DSeries	Cool to 4^0 C	180 days to analysis	(1) 60 mL glass jar
	(TAL)					
Soil	Mercury	2	SW-846 Method 7471B	Cool to 4^0 C	28 days to analysis	(1) 60 mL glass jar
Soil	Cyanide	2	SW-846 Method 9010C/9012B	Cool to 4^0 C	14 days to analysis	(1) 250 mL amber glass jar
Soil	Herbicides	2	SW-846 Method 8151A	Cool to 4^0 C	14 days to extraction	(1) 250 mL amber glass jar
Soil	Pesticides	2	SW-846 Method 8141A[6]	Cool to 4^0 C	14 days to extraction	(1) 300 mL amber glass jar
Soil	PFAs	2	EPA Method 1633	Cool to 4^0 C	14 Days	(1) 250 mL plastic container

Table 6

QC Sample Preservation and Container Requirements
29 Clay St., Brooklyn, NY
NYSDEC BCP Site No. C224408

Groundwater	VOCs (TCL)	1	SW-846 Method 8260C	HCl; Cool to 4^0 C; no headspace	14 days to analysis	(3) Vial
Groundwater	1,4-Dioxane	1	SW-846 Method 8270D	Cool to 4^0 C	7 days to analysis	(2) 250 mL amber glass jar
Groundwater	SVOCs (TCL)	1	SW-846 Method 8270D	Cool to 4^0 C	7 days to extraction	(2) 250 mL amber glass jar
Groundwater	Metals- total (TAL)	1	SW-846 Method 6020B/7470A Series	HNO$_3$; Cool to 4° C	28 days to analysis for Hg; 180 days to analysis for other metals	(1) 500 mL plastic container
Groundwater	Metals-dissolved (TAL)	1	SW-846 Method 6020B/7470A Series	HNO3; Cool to 4° C	28 days to analysis for Hg; 180 days to analysis for other metals	(1) 500 mL plastic container
Groundwater	Pesticides (TCL)	1	SW-846 Method 8081B	Cool to 4^0 C	7 days to extraction	(2) 120 mL amber glass jar
Groundwater	Herbicides (TCL)	1	SW-846 Method 8151A	Cool to 4^0 C	7 days to extraction	(2) 1000 mL amber glass jar
Groundwater	PCBs	1	SW-846 Method 8082A	Cool to 4^0 C	365 days to analysis	(1) 250 mL amber glass jar
Groundwater	Cyanide	1	SW-846 Method 9012A	Cool to 4^0 C	14 days to analysis	(1) 250 mL amber glass jar
Groundwater	Mercury	1	SW-846 Method 7470 A	HNO3; Cool to 4° C	28 days to analysis	(1) 250 mL plastic container
Groundwater	PFAs	1	EPA Method 1633	Cool to 4^0 C	14 Days	(1) 250 mL plastic container
Soil Gas	VOCs	1	EPA Method TO-15	None	14 days to analysis	(1) Evacuated 6-Liter SUMMA® canister

Notes:
1 Holding times listed are method holding time calculated from time of collection and not NYSDEC ASP holding times.

ATTACHMENT A

QUALIFICATIONS

Chunhua Liu, PhD

Senior Technical Specialist

Summary of Experience

Dr. Liu is a senior chemist with more than 10 years of experience in analytical chemistry, data validation and management, and quality control and quality assurance for remedial investigations and remedial actions. Her experience includes laboratory chemical analysis, EPA Region I and Region II data validation and data usability evaluation, data usability evaluation for Massachusetts Contingency Plan (MCP), sampling and analysis plan development in accordance with the NYSDEC Analytical Service Protocol and Massachusetts Compendium of Quality Assurance and Quality Control Requirements (QA/QC) and Performance Standards for Selected Analytical Methods, and quality control and quality assurance for Superfund and MCP projects.

Dr. Liu majored in environmental chemistry and during her doctoral study at Harvard School of Public Health, she researched analytical methods for sediment and evaluated metal fate and transport in sediment. Dr. Liu worked at Parsons for over seven years and at Gradient for one year before joining GZA. At Parsons, Dr. Liu led the quality control and assurance and data management efforts from developing Quality Assurance Project Plan (QAPP) to assuring implementation of QA/QC requirements and from field sampling preparation and arrangement to chemical data management. Dr. Liu was responsible for the QA/QC and data validation and data usability evaluation for a 10,000-acre BRAC and Superfund NPL site in New York and assisted in the successful transfer of over 8,000 acres of land. Dr. Liu performed data usability evaluation for various Massachusetts Contingency Plan sites at Gradient and GZA.

Relevant Project Experience

Senior Technical Specialist. Leads GZA human health risk assessment efforts for federal and state level superfund and MCP projects. Dr. Liu is also responsible for data usability evaluation for various projects.

Technical Director. Directed preparation and submittal of the Site-Wide Sampling and Analysis Plan (SAP) and the Site-Wide Quality Assurance Project Plan (QAPP) for a 10,000-acre Superfund site in New York in accordance with the Department of Defense (DOD), NYSDEC ASP, EPA Region II and EPA guidance. Directed project field sampling and data management. Supervised data validation in accordance with EPA Region II SOPs and NYSDEC ASP based on the NYSDEC ASP Category B deliverables. Identified laboratories qualified for project chemical analyses and interfaced with various analytical laboratories to address analytical deficiencies. Submitted data summary report to EPA Region II on a quarterly basis.

Lead Chemist and Risk Assessor. Led data usability evaluation and supported the successful closure of a 125-acre Hingham Annex Guaranteed Fixed Price Remediation Project. Dr. Liu also led the risk assessment effort and the effort of evaluating pesticide fate and transport at the site and successfully demonstrated that the pesticide conditions at the site were related to the past normal use of pesticides and therefore were not associated with the release at the Site.

Technical Director. Directed preparation and submittal of the SAP and the QAPP for various Formerly Used Defense (FUD) Sites. Supervised field sampling and data

Education

B.E., 1992, Environmental Engineering,
Tsinghua University, Beijing, China
M.E., 1995, Environmental Engineering,
Tsinghua University, Beijing, China
M.S., 1998, Environmental Health, Harvard
School of Public Health
D.S., 2000, Environmental Chemistry,
Harvard School of Public Health

Areas of Specialization

- Human Health Risk Assessment
- Ecological Risk Assessment
- Data Usability Evaluation
- Project Quality Control and Assurance
- Fate and Transport Modeling

validation in accordance with guidance from various EPA regions. Reviewed data validation and data usability report.

Technical Director. Directed data validation for various Superfund sites in EPA Region I and Region II in accordance with the EPA regional and state SOPs and the EPA Functional Guidelines. Led data validation for numerous MCP sites for various analytical analyses including metal, VOC, SVOC, pesticide, PCB, EPH, VPH, and TPH analyses.

Project Chemist. Evaluated different analytical methods for hexavalent chromium analysis. Compared analytical methods developed by NJDEP and EPA and identified the appropriate method for a CERCLA site in New Jersey.

Project Chemist. Evaluated quantitatively potential impacts to metal data usability by interference caused by common metals in environmental samples for a CERCLA site in New York.

Project Chemist. Performed data validation for indoor air samples for various CERCLA and MCP Sites to assist evaluation of potential vapor intrusion pathway.

Project Chemist. Performed Level IV data validation for a Superfund site in New York for various analytical analyses including metal, VOC, SVOC, pesticide, and PCB analyses. Reviewed TIC identification and quantitation and assessed chromatograms and mass spectrums for VOCs and SVOCs.

Project Chemist. Provided technical support, prepared QAPPs, established proper data quality objectives (DQOs) for various projects, maintained project quality control, trained junior scientists, coordinated project field sampling and laboratory analyses, addressed non-conformance issues associated with the data produced by the laboratory, conducted statistical analysis, and prepared data validation reports on numerous RCRA/CERCLA and MCP projects.

ENVIRONMENTAL ASSESSMENT AND REMEDIATION PROJECTS

(Former Malden MGP) Senior Scientist - Lead Risk Assessor, Chemist, Site Assessment, Malden, Massachusetts. Leading ongoing risk assessment work at large, complex former MGP that encompasses more than 16 acres of land and more than 10 different properties. Work has included vapor intrusion pathway evaluation, imminent hazard evaluation, substantial hazard evaluation, data usability evaluation, and risk characterizations for evaluation of effectiveness of sub-slab depressurization systems and remediation, direction of Site remediation and investigations, and verification of the need for AULs. GZA was able to demonstrate that indoor air impacts in a residential area were not related to MGP residuals, allowing for closure of that portion of the Site. Risk characterizations also demonstrated that Site conditions did not pose substantial hazards, confirming the effectiveness of the Temporary Solution.

(Commercial Point LNG Facility) Senior Scientist - Lead Risk Assessor, Site Assessment and Closure, Dorchester Massachusetts. Directed risk characterization to support MCP closure of former MGP facility that was currently being used as a Liquefied Natural Gas (LNG) storage and distribution facility. Performed risk characterization to support supplemental Phase II – IV MCP investigations and Permanent Solution status while allowing for beneficial reuse of the facility for LNG operations and a solar power generating facility. Also performed focused risk characterizations in support of an AUL filing and potential reuse options for portions of the Site.

(Former Haverhill Holder Site) Senior Scientist - Lead Risk Assessor, Site Closure, Haverhill Massachusetts. Directed risk characterization to support MCP closure of former MGP gas holder facility where wastes had been disposed. Conducted risk characterization to facilitate development of cost-effective cleanup plan involving focused soil excavation and use restrictions that allowed for achievement of a Permanent Solution. Performed a Method 3 risk characterization to support the complex supplemental Phase II investigation. This complex site encompassed properties owned by seven different parties, including residential land and portions of a river/tributary system.

(Gloucester Former MGP) Senior Scientist - Lead Risk Assessor, Human Health Risk Assessment, North Shore, Massachusetts. Performed Method 3 Risk Characterization for multiple parcels to support the Supplemental Phase II Comprehensive Site Assessment initiated by other consultants under the Massachusetts Contingency Plan. This Site included MGP impacts to approximately 45 acres of Gloucester Harbor sediment. GZA evaluated potential human health risks via exposure to soil, groundwater, sediment, surface water, homegrown produce, and consumption of fish. In addition, Risk Characterization was used in the early stages of the project to assist identification of data gaps and Site investigation.

(Salem Power Plant) Project Manager, Cost Recovery Negotiations, Salem, Massachusetts. Working through counsel, provided advice to a prior owner with respect to remedial obligations under the Massachusetts Contingency Plan (MCP) associated with impacts to soil at this power generating facility. Work included review of hot spot evaluation, risk characterization, and remediation performed at the Site. Given the Site use, we concluded that most of the claimed costs that had been incurred by the current owner were not necessary under the MCP and thus should not be subject to recovery from our client.

(Sawyer Passway) Senior Scientist - Lead Risk Assessor, Chemist, MGP Site Closure, Fitchburg, Massachusetts. Performed a Substantial Hazard Evaluation and a Method 3 Risk Characterization to support fast-track Massachusetts Contingency Plan (MCP) Phase II/III study of large, complex former MGP facility on the banks of a major New England river. The work had to be completed within two months to meet a key regulatory deadline. Work included a risk evaluation to support a streamlined supplemental field exploration program, a risk evaluation to direct the focused soil excavation, and a substantial hazard evaluation for the cost-effective temporary solution within the required regulatory deadlines. GZA's continuing work on this project has included technical support for an insurance cost-recovery claim, periodic evaluations of the temporary solution, completion of soil stabilization/solidification pilot studies, implementation of focused remedial programs during site building demolition work and development of remedial, plans directed at achieving a Permanent Solution (PS). Based on updated evaluations, a cost-effective approach to a PS was developed in 2014 and a Method 3 Risk Characterization was performed to support a PSS in 2015.

(Former Army Depot Activity Site), Technical Director, Syracuse, New York. Directed preparation and submittal of the Site-Wide Sampling and Analysis Plan (SAP) and the Site-Wide QAPP for a 10,000-acre Superfund site in New York in accordance with the Department of Defense (DOD), NYSDEC ASP, USEPA Region II and USEPA guidance. Directed project field sampling and data management. Supervised data validation in accordance with USEPA Region II SOPs and NYSDEC ASP based on the NYSDEC ASP Category B deliverables. Identified laboratories qualified for project chemical analyses and interfaced with various analytical laboratories to address analytical deficiencies. Submitted data summary report to USEPA Region II on a quarterly basis.

(Waverley Oaks Road), Senior Scientist - Lead Risk Assessor, Human Health Risk Assessment, Waltham, Massachusetts. This property has been impacted by improper storage of large quantities of waste oil that was to be used to heat on-site green houses, or to be processed and resold. This Site is regulated under the Massachusetts Contingency Plan; Massachusetts Department of Environmental Protection reviewed and approved all work plans and reports for the site investigation and risk assessment; it was downgraded from a Tier 1A to a Tier 1B Site following completion of the Phase II investigations.

Waste oil releases have impacted nearly 10-acres of an on-Site pond, stream and wetland, including 3 acres that have visible oil presented within surficial wetland soil and sediment. GZA conducted a Method 3 Risk Characterization to support the permanent solution of the Site. For the Vapor Intrusion pathway, GZA identified constituents not related to Site release and verified the conclusion based on the evaluation of Site-specific attenuation factors.

Publications and Presentations

Liu, C., J. Jay, T. Ford. Evaluation of Environmental Effects on Metal Transport from Capped Contaminated Sediment under Conditions of Submarine Groundwater Discharge. Env. Sci. Tech. 2001 35: 4549-4555.

Liu, C., J. Jay, R. Ika, S. James, and T. Ford. Capping efficiency for metal-contaminated marine sediment under conditions of groundwater inflow. Env. Sci. Tech. 2001 35: 2334-2340.

Blanchet, R., Liu, C., Bowers, T. Summary of Available Freshwater and Marine Sediment Quality Guidelines and Their Use in North America. Abstract accepted at SEATEC Conference, November, 2001

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Chunhua Liu, PhD

Senior Technical Specialist

Seeley, M.R., Schettler, S., Liu, C., Blanchet, R.J., Bowers, T.S. Assessing Cancer Risks Due to Use of Insecticides to Control the Mosquito-borne West Nile Virus: Use of the Margin of Exposure Approach. Abstract accepted at Society of Toxicology, 41st Annual Meeting, March 17-21, 2002.

Chunhua Liu, Jennifer Jay, Ravi Ika, Shine James, Timothy Ford. Capping Efficiency for Metal-Contaminated Marine Sediment under Conditions of Submarine Groundwater Discharge. Poster presentation at Conference on Dredged Material Management: Options and Environmental Considerations. December 3-6, 2000

Chunhua Liu, Jennifer Jay, Timothy Ford. Evaluation of Environmental Effects on Metal Transport from Capped Contaminated Sediment Under Conditions of Submarine Groundwater Discharge. Poster presentation at Conference on Dredged Material Management: Options and Environmental Considerations. December 3-6, 2000

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Chunhua Liu, Ravi Ika, Tim Ford. 1998. Metal flux in near shore capping sites under conditions of submarine groundwater discharge. In: Fourth Marine & Estuarine Shallow Water Science & Management Conference. March 15-19, 1998

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Wei Lin, Chunhua Liu, Guowei Fu. 1995. Environmental conflict analysis and its application in environmental planning and management: siting of public facilities. Chin. J. Environ. Sci. 1995 16(6): 36-39

Chunhua Liu, Yongfeng Nie, Wei Lin. 1995. Application prospects of landfill gas utilization technique in China. Pollution Control Technology 1995 8(3): 143-145

Chunhua Liu. 1995. Evaluation of gas production from sanitary landfill. Master's thesis. Tsinghua University, Beijing, P.R.China

Wei Lin, Chunhua Liu. 1994. Rudimentary study on countermeasure to comprehensively control air pollution caused by motor vehicles in China. Pollution Control Technology 1994 7(4): 1-3

Xiurong Zhang, Chunhua Liu, Yanru Yang, Qingzhong Bai. 1993. Environmental impact report of wastewater treatment plant project in Xuanhua City, China.

Chunhua Liu, Yongfeng Nie. 1993. Water balance evaluation in Hongmei hazardous waste landfill. In: Environmental Impact Assessment of Hongmei Hazardous Waste Landfill: 25-33

Chunhua Liu. 1992. Modeling landfill leachate production and migration. Bachelor Thesis. Tsinghua University, Beijing, P.R.China

Chunhua Liu. 1991. A discussion with the author of “clean water extraction from ocean water”. Technology of Water Purification 1991(1): 39-41

Affiliations/Memberships

- Member, LSP Association
- Member, Society for Risk Analysis
- Certified EIT in Massachusetts

Biography: Rock J. Vitale, CEAC

Technical Director of Chemistry/Principal
Environmental Standards, Inc.

Current Position

Mr. Vitale has 30 years of analytical quality assurance experience. As the founder and a Principal of Environmental Standards, Mr. Vitale oversees a staff of approximately 30 quality assurance chemists and is responsible for the direction of the technical and managerial aspects of the company's operations. Mr. Vitale is a recognized expert in the following fields: organic and inorganic data validation (including specialty analyses); laboratory auditing; preparation or third-party review of quality assurance project plans (QAPjPs); design of specialty analyses to accommodate project-specific data quality objectives (DQOs); quality assurance oversight of complex projects (sediment projects, biomonitoring projects); and agency negotiations.

Prior Experience and Education

Mr. Vitale received a B.S. in Environmental Science and Biology from Marist College. He completed additional post-graduate Chemistry courses at Villanova University and Rider College and Chemistry Graduate Course Work at Villanova University.

Contact Information

Telephone: (610) 935-5577

E-mail: rvitale@envstd.com

ATTACHMENT B

YORK LAB QULAITY SYSTEMS MANUAL

QUALITY SYSTEMS MANUAL

FOR ENVIRONMENTAL ANALYTICAL SERVICES

Version 2.9
Effective Date July 1, 2021

York Analytical Laboratories, Inc.
120 Research Drive
Stratford, CT 06615

132-02 89th Avenue Suite 217
Richmond Hill, NY 11418

203-325-1371
www.yorklab.com

Name	Title	Signature	Date
Robert Q. Bradley	Chief Technology Officer		July 1, 2021
Cassie Mosher	Laboratory Manager-CT		July 1, 2021
Taylor Pasquence	Laboratory Manager-NY		July 1, 2021
Jon Walsh	QA Officer/Technical Director-NY		July 1, 2021
Sarah Widomski	QA Officer-CT	Sarah Widomski	July 1, 2021

TABLE OF CONTENTS QUALITY SYSTEMS MANUAL

PREFACE TO THE QUALITY SYSTEMS MANUAL

Purpose

The purpose of this document is to provide implementation guidance on the establishment and management of quality systems for York Analytical Laboratories, Inc. and is based on The National Environmental Laboratory Accreditation Institute (TNI) Quality System requirements,

Background

To be accredited by various States and certain other programs under the auspices of TNI and ISO the following are relevant:

1. The National Environmental Laboratory Accreditation Conference (TNI). Accredited laboratories shall have a comprehensive quality system in place, the requirements for which are outlined in The NELAC Institute (TNI) 2016 Volume 1: Management and Technical Requirements for Laboratories Performing Environmental Analysis (EL-V1-2016). This manual was written with guidance primarily from Volume 1: Modules 2, 3, 4, 5, and 7.

   Additional information may be found at:
   - http://www.nelac-institute.org/

2. ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories is for use by laboratories in developing their management system for quality, administrative and technical operations. Laboratory customers, regulatory authorities and accreditation bodies may also use it in confirming or recognizing the competence of laboratories.

   Additional information may be found at:
   - http://www.iso.org/iso/home.html

Project Specific Requirements

Project-specific requirements or regulations may supersede requirements contained in this manual. The laboratory bears the responsibility for meeting all **State requirements**. Nothing in this document relieves the laboratory from complying with contract requirements, or with **Federal, State, and/or local regulations**.

Results and Benefits

- **Standardization of Processes** – Because this manual provides the laboratory with a comprehensive set of requirements that meet the needs of many clients, as well as the NELAP, the laboratory may use it to create a standardized quality system. Ultimately, this standardization saves laboratory resources by establishing one set of consistent requirements for all environmental work. Primarily, the laboratory bears the responsibility for meeting all State requirements as outlined in their respective certification programs.
- **Deterrence of Improper, Unethical, or Illegal Actions** – Improper, unethical, or illegal activities committed by only a few laboratories have implications throughout the industry, with negative impacts on all laboratories. This manual establishes a minimum threshold program for all laboratories to use to deter and detect improper, unethical, or illegal actions.
- **Foundations for the Future** – A standardized approach to quality systems, shared by laboratories and The NELAC Institute, paves the way for the standardization of other processes. For example, this manual might serve as a platform for a standardized strategy for Performance Based Measurement System (PBMS) implementation.

Document Format

This YORK Quality Systems Manual (QSM) is designed to implement the TNI 2016 (EL-V1-2016) standards along with the ISO/IEC 17025:2005 standards.

The section numbering has been changed from that of these standards as the manual is meant to be a stand-alone document. Therefore the numbering in this document is not consistent with the numbering in the above-mentioned standards; however, all required elements are covered, herein.

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ACROYNM LIST

°C: Degrees Celsius
ANSI/ASQC: American National Standards Institute / American Society for Quality Control
ASTM: American Society for Testing and Materials
CAS: Chemical Abstract Service
CCV: Continuing calibration verification
CFR: Code of Federal Regulations
COC: Chain of Custody
CV: Coefficient of Variation
DO: Dissolved Oxygen
DOC: Demonstration of Capability **DQOs:** Data
Quality Objectives
EPA: Environmental Protection Agency
g/L: Grams per Liter
GC/MS: Gas Chromatography / Mass Spectrometry
ICP-MS: Inductively Coupled Plasma / Mass Spectrometer
ICV: Initial Calibration Verification
ID: Identifier
IDOC: Initial Demonstration of Capability

ISO/IEC: International Standards Organization / International Electrotechnical Commission
LCS: Laboratory Control Sample
LCSD: Laboratory Control Sample Duplicate
LOD: Limit of Detection
LOQ: Limit of Quantitation
MDL: Method Detection Limit
ME: Marginal Exceedance
mg/kg: Milligrams per Kilogram
MS: Matrix Spike
MSD: Matrix Spike Duplicate
NELAC: National Environmental Laboratory Accreditation Conference
NELAP: National Environmental Laboratory Accreditation Program
NIST: National Institute of Standards and Technology
OSHA: Occupational Safety and Health Administration
PBMS: Performance Based Measurement System
PC: Personal Computer
PCBs: Polychlorinated Biphenyls
PT: Proficiency Testing
QA: Quality Assurance
QAPP: Quality Assurance Project Plan
QSM: Quality Systems Manual
QC: Quality Control
RL: Reporting Limit
RPD: Relative Percent Difference
RSD: Relative Standard Deviation
SD: Serial Dilutions
SOP: Standard Operating Procedure
TNI: The NELAC Institute
TSS: Total Suspended Solids
UV: Ultraviolet
VOC: Volatile Organic Compound

QUALITY SYSTEMS

Quality Systems include all quality assurance (QA) policies and quality control (QC) procedures that are delineated in a Quality Systems Manual (QSM) and followed to ensure and document the quality of the analytical data. York Analytical Laboratories, Inc. (YORK), accredited under the National Environmental Laboratory Accreditation Program (NELAP), assures implementation of all QA policies and the applicable QC procedures specified in this Manual. The QA policies, which establish essential QC procedures, are applicable to all areas of YORK, regardless of size and complexity.

The intent of this document is to provide sufficient detail about quality management requirements so that all accrediting authorities evaluate laboratories consistently and uniformly.

The NELAC Institute (TNI) is committed to the use of Performance Based Measurement Systems (PBMS) in environmental testing and provides the foundation for PBMS implementation in these standards. While this standard may not currently satisfy all the anticipated needs of PBMS, NELAC will address future needs within the context of State statutory and regulatory requirements and the finalized EPA implementation plans for PBMS.

Chapter 5 is organized according to the structure of ISO/IEC 17025, 2005. Where necessary specific areas within this Chapter deemed may contain more information than specified by ISO/IEC 17025.

All items identified in this QSM shall be available for on-site inspection or data audit.

1.0 SCOPE

a) This QSM sets the general requirements that YORK must successfully demonstrate to be recognized as competent to perform specific environmental analyses.

b) This QSM includes additional requirements and information for assessing competence or for determining compliance by the organization or accrediting authority that grants approval.

If more stringent standards or requirements are included in a mandated test method or by regulation, the laboratory demonstrates that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed.

c) YORK uses this QSM in the development and implementation of its quality systems. Accreditation authorities use this NELAC based standard to assess the competence of environmental laboratories.

2.0 REFERENCES

See Appendix A.

3.0 DEFINITIONS

The relevant definitions from ISO/IEC Guide 2, ANSI/ASQC E-4, 1994, the EPA "Glossary of Quality Assurance Terms and Acronyms," and the *International vocabulary of basic and general terms in metrology (VIM*) are applicable. The most relevant is quoted in Appendix A, Glossary, of Chapter 1 of NELAC, together with further definitions applicable for the purposes of this Standard.

4.0 ORGANIZATION AND MANAGEMENT

4.1 Legal Definition of Laboratory

YORK is legally definable as evidenced by its business license, and current Certifications by the States of Connecticut and New York Depts. of Heath Environmental Laboratory Accreditation Program (ELAP) certifications and the NJDEP and PADEP ELAP certifications. York is organized and operates in such a way that its facilities meet the requirements of the NELAC/TNI Standard. Refer to the presentations of the Organization and QA responsibility as shown in Figures 1 and 2, respectively. Current Certifications are detailed as follows: State of Connecticut Department of Health (CTDOH) Certification no. PH-0723 and PH-0721, New York State Department of Health (NYSDOH) Certifications no. 10854 and 12058 State of New Jersey Dept. of Environmental Protection (NJDEP) Certification nos. CT-005 and NY-037 and State of Pennsylvania DEP Registration No. 68-04440. York's EPA registration ID is CT-005.

4.2 Organization

York Analytical Laboratories Inc.:

a) Has a managerial staff with the authority and resources necessary to discharge their duties;

b) Has processes to ensure that its personnel are free from any commercial, financial and other undue pressure that adversely affect the quality of their work;

c) Is organized in such a way that confidence in its independence of judgment and integrity is maintained at all times;

d) Specifies and documents the responsibility, authority, and interrelationship of all personnel who manage, perform or verify work affecting the quality of calibrations and tests;

Such documentation includes:

1) A clear description of the lines of responsibility in the laboratory, and is proportioned such that adequate supervision is ensured, and

2) Job descriptions for all positions.

e) Provides supervision by persons familiar with the calibration or test methods and procedures, the objective of the calibration or test, and the assessment of the results.

The ratio of supervisory to non-supervisory personnel ensures adequate supervision and adherence to laboratory procedures and accepted techniques.

f) Has technical directors who have overall responsibility for the technical operations of YORK facilities.

The technical director certifies that personnel who perform the tests for which the laboratory is accredited have the appropriate educational and/or technical background. Such certification is documented.

The technical director meets the requirements specified in the Accreditation Process. (See NELAC Section 4.1.1.1.)

g) Has a Quality Assurance Officer (QAO) who has responsibility for the quality system and its implementation.

The quality assurance officer has direct access to the technical director and to the highest level of management at which decisions are made regarding laboratory policy or resources.

The quality assurance officer (and/or designees):

1) Serves as the focal point for QA/QC activities, and is responsible for the oversight and/or review of quality control data;
2) Has functions independent from laboratory operations for which she/he has quality assurance oversight;
3) Is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence;
4) Has documented training and/or experience in QA/QC procedures and is knowledgeable in the quality system, as defined under NELAC;
5) Has a general knowledge of the analytical test methods for which data review is performed;
6) Arranges for and conducts internal audits as per YORK QSM section 5.3 annually; and
7) Notifies YORK management of deficiencies in the quality system and monitors corrective action.

h) Nominates, by way of the “Alternates List,” deputies in case of absence of the Technical Director and/or the Quality Assurance Director;

i) YORK makes every effort to ensure the protection of its clients' information as confidential and proprietary.

ii) YORK is sensitive to the fact that much of the analytical work performed for clientele may be subject to litigation processes. YORK, therefore, holds all information in strict confidence with laboratory release only to the client.
iii) Information released to entities other than the client is performed only upon written request from the client.
iv) Due to the investigative nature of most site assessments, analytical information may become available to regulatory agencies or other evaluating entities during site assessment of the laboratory for the specific purpose of attaining laboratory certifications, accreditations, or evaluation of laboratory qualification for future work. During these occurrences, the laboratory will make every effort to maintain the confidence of client specific information.

j) For purposes of qualifying for and maintaining accreditation, participates in a proficiency test program as outlined in Chapter 2 of NELAC. Results of YORK’s performance in rounds of proficiency testing are available by request.

5.1 QUALITY SYSTEM – ESTABLISHMENT, AUDITS, ESSENTIAL QUALITY CONTROLS, AND DATA VERIFICATION

5.2 Establishment

YORK establishes and maintains quality systems based on the required elements contained in this Manual and appropriate to the type, range and volume of environmental testing activities it undertakes.

a) The elements of this quality system are documented in this quality manual.

b) The quality documentation is available for use by all laboratory personnel.

c) The laboratory defines and documents its policies and objectives for, and its commitment to accepted laboratory practices and quality of testing services.

d) The laboratory management ensures that these policies and objectives are documented in the quality manual and are communicated to, understood and implemented by all laboratory personnel concerned.

   i. All staff members are given access to a controlled copy of the Quality Systems Manual (QSM) for review at the commencement of employment. However, the individual Standard Operating Procedures are the training documents that have precedence. The QSM is provided as a general overview.

   ii. A controlled copy of the quality manual is also available in each department.

e) The quality manual is maintained current under the responsibility of the quality assurance department. This manual is reviewed on an annual basis or more frequently, and revised as necessary.

5.3 Quality Systems Manual (QSM) Elements

This Quality Systems Manual (QSM) and related quality documentation state YORK's policies and operational procedures established in order to meet the requirements of this Standard.

This manual lists on the title page: a document title; the laboratory's full name and address; the name, address, and telephone number of individuals responsible for the laboratory and the effective date of the version.

This quality manual and related quality documentation also contains:

a) A quality ***policy statement***, including objectives and commitments, by top management;

   i. York Analytical Laboratories, Inc. (YORK) is committed to providing quality environmental analytical services. To ensure the production of scientifically sound, legally defensible data of known and documented quality, an extensive Quality Assurance program has been developed and implemented. This document, YORK's Quality Systems Manual for Environmental Analytical Services, presents an overview of the essential elements of our Quality Assurance program. YORK has modeled this systems manual after EPA guidelines as outlined in "Guidance for Quality Assurance Project Plans (EPA QA/G-5)", Office of Monitoring Systems and Quality Assurance, Office of Research and Development, U.S. EPA, EPA/240-R-02/009 December 2002.

   ii. YORK's QA Program is monitored at the Corporate, Divisional, and Group levels, and relies on clearly defined objectives, well-documented procedures, a comprehensive quality assurance/quality control system, and management support for its effectiveness.

   iii. This QA Program Systems Manual is designed to control and monitor the quality of data generated at YORK. The essential elements described herein are geared toward generating data that is in compliance with federal regulatory requirements specified under the Clean Water Act, the Safe Drinking Water Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, Clean Air Act and applicable amendments, and state and equivalents. Although the quality control requirements of these various programs are not completely consistent, each of the programs base data quality judgments on the following three types of information, the operational elements of each being described elsewhere in this manual.

- ⇨ Data which indicates the overall qualifications of the laboratory to perform environmental analyses;
- ⇨ Data which measures the laboratory's daily performance using a specific method; and
- ⇨ Data which measures the effect of a specific matrix on the performance of a method.

iv. It is important to note that the QA guidelines presented herein will always apply unless adherence to specific Quality Assurance Project Plans (QAPPs) or client and/or regulatory agency specific requirements are directed. In these cases, the elements contained within specified direction or documentation shall supersede that contained in this document.

v. This manual is a living document subject to periodic modifications to comply with regulatory changes and technological advancements. All previous versions of this document are obsolete. Users are urged to contact YORK to verify the current revision of this document.

b) The organization and management structure of the laboratory, its place in any parent organization and relevant organizational charts;

See Figures 1 and 2- Organizational Charts.

The relationship between management, technical operations, support services and the quality system;

c) Procedures to ensure that all records required under the NELAP are retained, as well as procedures for control and maintenance of documentation through a document control system which ensures that all standard operating procedures, manuals, or documents clearly indicate the time period during which the procedure or document was in force;

i. Ensuring a quality work product in the environmental laboratory not only requires adherence to the quality issues discussed in the previous sections, but also requires the ability to effectively archive, restore, and protect the records that are generated.

ii. Procedures are in place to ensure that all records are retained. In addition, a documentation control system is employed to clearly indicate the time period during which a standard operating procedure, manual, or document was in force. These procedures are outlined in the laboratory standard operating procedure SOP-T002.

iii. All laboratory logbooks, instrument response printouts, completed analytical reports, chain-of-custodies, and laboratory support documentation are stored for a minimum of five years. Project specific data are stored in sequentially numbered project files and include copies of the applicable laboratory logbooks, instrument response printouts, completed analytical reports, chain-of-custodies, and any other pertinent supporting documentation.

iv. When complete, the project specific data are high speed optically scanned and transformed into digital CD media. Additional copies of these records are created at the time of scanning and are stored off-site for protection of the data. These records are stored for a minimum of five years.

v. Access to all systems is limited by use of log-in and password protection and is maintained by York's IT Manager.

vi. There are four forms of electronic data that are generated in the laboratory. Refer to Table 1 – Data Archiving Schedule below for a synopsis of general data archiving schedules.

vii. All electronic records are stored for a minimum of five years.

TABLE 1 – DATA ARCHIVING SCHEDULE

<u>LIMS Database</u>

Backup frequency:	Hourly
Backup media:	Virtual Machine/Hard Disk

Backup software:	MS SQL Server Backup
Onsite copy:	Redundancy by using mirrored hard drive
Offsite copy:	Hourly to Cloud

Instrument Data

Backup frequency:	Real time back-up to VM then Daily
Backup media:	Hard Disk-File server-VM
Backup software:	Win Backup
Backup versions kept:	All versions-changes only archived
Offsite copy:	One to Cloud/Daily

d) Job Descriptions, Roles and Responsibilities

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to their job function and the quality program as a whole.

The responsibility for quality lies with every employee at YORK. As such, all employees have access to the Quality Assurance Manual and are responsible for knowing the content of this manual and upholding the standards therein. Each employee is expected to conduct themselves in accordance with the procedures in this manual and the laboratory's SOPs.

The following descriptions define the primary roles and their relationship to the Quality Assurance Program. Members of the key staff include the following:

- Management (e.g., President, CTO, Managers);
- Technical managers (e.g., Technical Directors, Group Leaders);
- Quality Assurance Officer and Data Quality Managers;
- Support systems and administrative managers (e.g., IT manager, Facilities manager, project managers, client services); and
- Other staff

In these positions, members of the key staff are responsible for assuring compliance with the National Environmental Laboratory Accreditation Program (NELAP), California Environmental Laboratory Accreditation Program (ELAP), State and Federal Agencies, and ISO 17025:2005 Standard requirements. In these roles, key personnel may set or enforce quality policies, monitor compliance, initiate corrective actions, interface with laboratory, client, and regulatory personnel, and provide general program oversight.

President and Chief technology Officer:

YORK's Top Management which represents YORK to the various York facilities and Client entities.

- ⇨ Ensures that YORK's financial and production performance meets assigned metrics.
- ⇨ Determines need for capital and employee resources and allocates as appropriate.
- ⇨ Serves as the legal representative for YORK.
- ⇨ Responsible for yearly budget and overruns.
- ⇨ Point persons for major new initiatives
- ⇨ Manages Laboratory Managers, Technical Directors, QAO and support personnel

Laboratory Technical Directors:

YORK's Laboratory Technical Directors are the final authorities on all issues dealing with data quality and have the authority to require that procedures be amended or discontinued, or analytical results voided or repeated. They also have the authority to recommend suspension or termination of employees on the grounds of non-compliance with QA/QC procedures. In addition, Technical Directors:

- ⇨ Ensure that YORK remains current with all regulations which affect operations and disseminate all such changes in regulatory requirements to the QA Officer, and Group Leaders;
- ⇨ The Laboratory Manager may also act in the Technical Director capacity if the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, providing they meet the qualifications of the Technical Director to temporarily perform this function. If the absence exceeds 35 consecutive calendar days, the primary accrediting authority will be notified in writing;
- ⇨ Ensure that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented;
- ⇨ Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work;
- ⇨ Oversees the development and implementation of the QA Program which assures that all data generated will be scientifically sound, legally defensible, and of known quality;
- ⇨ In conjunction with the QA Officer, conduct annual reviews of the QA Program;
- ⇨ Oversees the implementation of new and revised QA procedures to improve data quality;
- ⇨ Ensures that appropriate corrective actions are taken to address analyses Identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Manager and Technical Director;
- ⇨ Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to;
- ⇨ Assists the QA Officer with all laboratory accreditation efforts as necessary

Laboratory Managers:

The Laboratory Managers direct log-in and the analytical production sections of the laboratories. They report directly to the Chief Technology Officer and assist in determining the most efficient instrument utilization. More specifically, they:

- ⇨ Evaluate the level of internal/external non-conformances for all departments;
- ⇨ Continuously evaluate production capacity and improves capacity utilization;
- ⇨ Continuously evaluate turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments;
- ⇨ Develop and improve the training of all analysts in cooperation with the Chief Technology Officer, Laboratory Directors, QA Officers and Group Leaders, and in compliance with regulatory requirements;
- ⇨ Ensure that scheduled instrument maintenance is completed;
- ⇨ Are responsible for efficient utilization of supplies;
- ⇨ Constantly monitor and modify the processing of samples through the departments; and
- ⇨ Maintain sufficient personnel, equipment and supplies to achieve production goals.

The Laboratory Managers report to the Chief Technology Officer and are responsible for all laboratory, client, and project technical issues. More specifically, they:

- ⇨ For major projects and/or clients, act as a technical resource for the client and the laboratory in matters of method selection or QC criteria.
- ⇨ Company-wide, maintain all training-related documentation in a single secure location. Develops training guides and other training documentation as needed;
- ⇨ Interface directly with Project Management staff in response to questions pre-release or from the client post-release. Determine root cause and interface with QA Officer to prevent recurrences;
- ⇨ Interface directly with clients, or other client representatives in matters related to technical data quality requests, when required
- ⇨ Provide support to Business Development through the review of QAPPs, and work plans. Provide comment and alternative solutions if unable to meet specific requirements;
- ⇨ Support QA and Operations with SOP revisions, where needed;
- ⇨ Perform full QA reviews and/or data validation where required;
- ⇨ Provide technical solutions to QA with regard to laboratory procedures, data quality issues, possible solutions, and appropriate corrective actions;
- ⇨ Provide technical opinions and support to Operations with regard to current procedures or new method development;

- ⇨ Interface with QA staff as necessary to ensure continuous improvement in all areas of YORK's operations.
- ⇨ Provide LIMS input; and

Quality Assurance Officer:

The Quality Assurance Officer (QAO) has full authority through the Chief Technology Officer in all matters relating to quality assurance and quality control systems. The QAO can make recommendations to the Chief Technology Officer and/or Laboratory Managers/Directors regarding the suspension analytical activities or the suspension or termination of employees on the grounds of non-compliance with QA/QC systems or procedures. An alternate QA Officer is always assigned. In the absence of the primary designate, the alternate will act in the QAO's capacity with the full authority of the position as allowed by YORK governing documents. In addition, the QAO performs the following:

- ⇨ Oversight and monitoring of and compliance with YORK's QA program;
- ⇨ Ensuring continuous improvement in all aspects of YORK's QA program such as:
    - o accreditations/certifications;
    - o analytical method management;
    - o internal and external audits;
    - o documentation;
    - o training;
    - o proficiency evaluation studies;
- ⇨ Ensuring YORK's QA program remains up-to-date consistent with current regulatory requirements and YORK's QA policies;
- ⇨ Supervision and direction of all QA staff; and
- ⇨ Provide assistance to responses for data validation inquiries
- ⇨ Serving as a technical resource for analytical chemistry or QA matters;
- ⇨ Provide support and oversight to QA staff with regard to external audit responses. Provide input on, and define appropriate corrective actions for the laboratory. Document corrective action responses, and monitor the required audit response time frames, as needed.
- ⇨ Oversees in-house training on quality assurance and control.
- ⇨ Provides Ethics training to all relevant personnel

- ⇨ Maintains and updates the QAM on an annual basis;
- ⇨ Implements YORK's QA Program;
- ⇨ Monitors the QA Program within the laboratory to ensure complete compliance with its objectives, QC procedures, holding times, and compliance with client or project spYorkfic data quality objectives;
- ⇨ Distributes performance evaluation (PE) samples on a routine basis to ensure the production of data that meets the objectives of its QA Program;
- ⇨ Maintains all SOPs used at YORK;
- ⇨ Maintains records and archives of all PE results, audit comments, and customer inquiries concerning the QA program;
- ⇨ Performs statistical analyses of QC data and establish controls that accurately reflect the performance of the laboratory;
- ⇨ Conducts periodic performance and system audits to ensure compliance with the elements of YORK's QA Program;
- ⇨ Prescribes and monitors corrective action;
- ⇨ Serves as in-house client representative on all project inquiries involving data quality issues;
- ⇨ Coordinates data review process to ensure that thorough reviews are conducted on all project files;
- ⇨ Develops revisions to existing SOPs;
- ⇨ Reports the status of in-house QA/QC to the Chief Technology Officer;
- ⇨ Maintains records and archives of all QA/QC data including but not limited to method detection limit (MDL) studies, IDOCs, DOCs and completed log books; and
- ⇨ Conducts and/or otherwise ensures that an adequate level of QA/QC training is conducted within the laboratory

Director of Project Management/Client Services:

The Director of Project Management reports to the President and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team, and satellite office/remote personnel. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- ⇨ Technical training and growth of the Project Management team;
- ⇨ Business liaison for the Project Management team;
- ⇨ Human resource management of the Project Management team;
- ⇨ Responsible for the review and negotiation of client contracts and terms and conditions;
- ⇨ Responsible for establishing standard and custom fee schedules for the laboratory;
- ⇨ Responsible for preparation of proposals and quotes for clients and client prospects;
- ⇨ Accountable for response to client inquiries concerning sample status;
- ⇨ Responsible for assistance to clients regarding the resolution of problems concerning Chains-of-Custody;
- ⇨ Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory;
- ⇨ Notifying the department managers of incoming projects and sample delivery schedules;
- ⇨ Accountable to clients for communicating sample progress in with agreed-upon due dates;
- ⇨ Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff;
- ⇨ Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness; and
- ⇨ Ensure that all non-conformance conditions are reported to the QA Officer, Lab Manager, and/or Laboratory Director via the Corrective Action process.

Group Leaders:

The Group Leaders report directly to the Lab Managers. They have the authority to accept or reject data based on pre-defined QC criteria. In addition, with the approval of the QA Officer, the Group Leaders may accept data that falls outside of normal QC limits if, in his or her professional judgment, there are technical justifications for the acceptance of such data. The circumstances must be well documented and any need for corrective action identified must be defined and initiated. The authority of the Group Leaders in QC related matters results directly from the QA Officer. The Group Leaders also:

- ⇨ Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process and providing technical and troubleshooting expertise on routine and unusual or complex problems;
- ⇨ Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis; and
- ⇨ Coordinates audit responses with Laboratory Managers and QA Officer.
- ⇨ Actively support the implementation of YORK's QA Program;
- ⇨ Ensure that their employees are in full compliance with YORK's QA Program;
- ⇨ Maintain accurate SOPs (by reviewing and implementing updates) and enforce routine compliance with SOPs;
- ⇨ Conduct technical training of new staff and when modifications are made to existing procedures;
- ⇨ Maintain a work environment which emphasizes the importance of data quality;
- ⇨ Ensure all logbooks are current, reviewed and properly labeled or archived;
- ⇨ Ensure that all non-conformance conditions are reported to the QA Officer, Lab Manager, and/or Technical Director via Corrective Action reports;
- ⇨ Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Director, Lab Manager, and/or QAO . Each is responsible for 100% of the data review and documentation, nonconformance issues, and the timely and accurate completion of performance evaluation samples and MDLs, for his/her department;
- ⇨ Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and using appropriate documentation techniques;
- ⇨ Ensure that preventive maintenance is performed on instrumentation as detailed in the QA

Manual or SOPs. He or she is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments;

- ⇨ Provide written responses to external and internal audit issues; and
- ⇨ Provide support to all levels of YORK Management.

Sample Control Group:

The Sample Control Group reports to the Laboratory Manager. The responsibilities are outlined below:

- ⇨ Conduct the receipt, handling, labeling and proper storage of samples in compliance with laboratory procedures and policies;
- ⇨ Oversee the training of Sample Control Technicians regarding the above items;
- ⇨ Direct the logging of incoming samples into the Element LIMS and ensure the verification of data entry from login;
- ⇨ Acts as a liaison between Project Managers and Analytical departments in respect to handling rush orders and resolving inconsistencies and problems with chain-of-custody forms, and routing of subcontracted analyses; and
- ⇨ Oversees the handling of samples in accordance with the Waste Disposal SOP
- ⇨ Supervise the recording of the transfer of samples from refrigerated conditions to ambient conditions;
- ⇨ Coordinate the collection of waste throughout the laboratory that will be disposed of through “Lab Packs”;
- ⇨ Coordinate and supervise Hazardous Waste Technician(s);
- ⇨ Dispose of solid waste to an assigned locations;
- ⇨ Supervise the disposal of soils into appropriate drums;.
- ⇨ Prepare and discharge treated wastewater to the sewer system;
- ⇨ Maintain Uniform Hazardous Waste Manifest files;
- ⇨ Prepare weekly sample disposal schedules;
- ⇨ Coordinate and schedule waste pick-up;
- ⇨ Check all waste containers for appropriate labels; and
- ⇨ Maintain safe housekeeping and practices.

Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The responsibilities of the analysts are listed below:

- ⇨ Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, the Data Integrity Policy, and project-specific QA plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- ⇨ Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on work sheets, bench sheets, preparation logbook, and/or a Non-Conformance report;
- ⇨ Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to the Group Leader and/or the QA Officer;
- ⇨ Perform 100% review of the data generated prior to entering and submitting for secondary level review; and
- ⇨ Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

Project Managers/Client Services:

The Project Managers report to the Director of Project Management and/or Business Development Director. These personnel in turn report directly to the President. Typical responsibilities include:

- ⇨ Serving as the laboratories’ primary point of contact for assigned clients;
- ⇨ Working with laboratory chemists to resolve questions on data;
- ⇨ Scheduling of courier deliveries and pick-ups;
- ⇨ Tracking the progress of all laboratory production efforts;

- ⇨ Advising clients of any scheduling conflicts, possible delays, or other problems which may arise;
- ⇨ Resolving any questions or issues that clients may have with regard to our services, especially our reports;
- ⇨ Preparation or directing preparation of bottle kits for use by clients in their sampling efforts;
- ⇨ Reviewing of reports/EDDs (Electronic Data Deliverables) as necessary prior to release;
- ⇨ Invoice review prior to release to client;
- ⇨ Serving as back-up contact person for other Project Managers in the event of his/her absence;
- ⇨ Coordination of all subcontracting efforts for projects assigned;
- ⇨ Preparation and implementation of program QAPPs (Quality Assurance Project Plans), if needed;

Health and Safety Manager:

The Health and Safety Manager (EHS) reports to the Laboratory Manager and ensures that systems are maintained for the safe operation of the laboratory. The EHS Manager is responsible for:

- ⇨ Conducting ongoing, necessary safety training and conducting new employee safety orientations;
- ⇨ Assisting in developing and maintaining the Chemical Hygiene/Safety Manual;
- ⇨ Oversees the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed; and
- ⇨ Completes accident reports, follows up on root causes and defines corrective actions.

Education and Experience

YORK makes every effort to hire analytical staff that possess a college degree (AS, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions are made based upon experience and an individual's ability to learn as there are many in the industry that are more than competent, experts perhaps, who have not earned a college degree.

Selection of qualified individuals for employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Experience and specialized training may be accepted in lieu of a college degree (basic lab skills such as using a balance, aseptic or quantitation techniques, etc. are also considered).

Included in Table 1.0 below are the basic job titles and personnel responsibilities for anyone who manages, performs or verifies work affecting the quality of the laboratory's environmental sample testing. Minimum education and training requirements are summarized as well.

When an analyst does not meet these minimum requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Group Leader, and are considered an analyst in training. The person supervising an analyst in training is directly accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

Table 1.0 Minimum Education/Experience requirements for each York position

Position	General Duties	Minimum Education Requirements	Minimum Experience Requirements
Sr. Scientist/Technical Director/Chief Tech. Officer	Responsible for technical aspects of the laboratory operations and related SOPs, training and troubleshooting. Provide Client technical support	B.S. in Chemistry	Ten years hands-on lab experience with GC, GCMS, ICP, AAS, IC and wet chem procedures for the analysis of environmental samples. A minimum of two year front line supervisory experience
Laboratory Manager	Responsible for Lab operations, including all lab disciplines.	B.S. in one of the physical sciences or A.S. plus 10 years' experience	Two years hands-on laboratory experience at the bench and management levels. Familiarity with licensing requirements.
QA/QC Officer	Responsible for overseeing the QA aspects of data. Also provides for review of data	B.S. in one of the physical sciences or A.S. plus 10 years' experience	Four years hands-on lab experience demonstrated familiarity with QA principles and practices in analytical

	packages and internal audits/training.		laboratory.
Data Quality Manager	Responsible for second level review of Lab data for all disciplines	B.S. in one of the physical sciences or A.S. plus 5 years' experience	5 years' experience in lab operations with all major disciplines including intimate knowledge of lab instrumentation and related software. Familiar with data review and data validation guidelines.
Group Leader GC/MS	Responsible for all technical efforts of the GC/MS labs.	B.S. in one of the physical sciences	Four years hands-on GC and/or GC/MS experience with environmental methods. Capable of troubleshooting instrumentation, and interpretation of GCMS data. Also experienced in data package preparation and review.
GC/MS Analyst	Responsible for GC/MS sample/data analysis, reduction and reporting.	B.S. in one of the physical sciences	One year of experience in operating and maintaining GC/MS systems, one year interpreting MS data or one external MS interpretation course.
GC/MS Operator	Responsible for operating subsampling systems and GC/MS systems.	A.S. or B. in a science discipline	Six months experience in operating GC/MS systems. Internal training and certification require.
GC Analyst	Responsible for analysis of samples for Pesticides, PCBs, herbicides and special analytes by GC techniques.	A.S. or B.S. in a science discipline	Five years of hands-on experience with analysis using capillary GC with flame ionization electron capture, flame photometric and thermal conductivity detectors. Also, experience interpreting GC data for pesticide, PCBs, herbicides and other environmental contaminants.
Group Leader Metals	Responsible for all sample preparation and analysis for metals.	B.S. in a science discipline	Five years of hands-on experience with ICP, GFAAS and CVAA. Minimum of three years of experience with environmental sample prep and analysis for all metals including mercury.
Metals Technician	Responsible for sample preparation for metals analysis, including Hg.	High school diploma	Six months experience in laboratory procedures
Group Leader-Wet Chemistry	Responsible for all wet chemistry analyses, Ion Chromatography and TCLP extractions/preparation.	B.S. in a science discipline or A.S.	Two years of hands-on environmental laboratory experience with Wet Chem procedures , Ion Chromatography and TCLP extractions
Lab Technician-Wet Chemistry	Responsible for wet chem analyses and TCLP extractions	A.S. or B.S. in a science discipline	Six months hands-on experience with Wet chem procedures and TLP extractions. In lieu of educational requirement, a High school diploma with one year experience in wet chem procedures is acceptable.
Ion Chromatography Analyst	Responsible for all anion and cation analysts by IC.	B.S. in a science discipline	Six months hands-on experience with IC procedures, including data interpretation, review and reporting.
Group Leader-Organic Extractions	Responsible for all organic extractions for BNAs, Pest/PCB, Herbicides and other target compounds	A.S. or B.S. in a science discipline	Two years of experience of environmental sample for target organics compounds. In lieu of the education requirement, a high school diploma and four years of experience in education including one year of supervisory experience will suffice.
Extractions Technician	Responsible for extraction/concentration of environmental samples for BNAs, PCB/Pests, and herbicides	A.S. or B.S. in a science discipline	Six months of experience in extraction/concentration techniques. In lieu of a degree, a high school diploma and one year of experience in laboratory procedures will suffice.
Sample Manager	Reportable for all sample receipts, chain-of-custody, and log-in.	A.S. or B.S. in a science discipline	Three years of experience in an environmental laboratory or A.M.B. + one year experience

Sample Custodian	Assist Sample Manager with log-in duties and sample disposal	High School Diploma	One year of general laboratory experience or environmental industry experience.
System Manager	Responsible for the management of all computing systems including hardware, software, documentation, archive procedures and LIMS management.	Outsourced to Corcystems, Inc.	Three years of experience in hardware troubleshooting, system design/build, software installation and maintenance.
Client Services Managers/Project Mgrs.	Responsible for all client interface from both technical and scheduling perspective	B.S. in a science discipline	Five years laboratory analysis experience and/or three years of sales experience in environmental business.

e) Identification of the laboratory's approved signatories; at a minimum, the title page of the quality manual has the signed and dated concurrence (with appropriate titles) of all responsible parties including the QA Manager, Operations, QA, Technical, Laboratory and Operations Directors.

f) The laboratory's procedures for achieving traceability of measurements;

g) A list of all test methods under which the laboratory performs its accredited testing may be found in the Index of Standard Operating Procedures, a separate document.

h) Mechanisms for ensuring that the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work;

i) Reference to the calibration and/or verification test procedures used;

Calibration procedures and verification of acceptability for each set of required calibrations are defined in Section 13 (Calibration) and Section 12 (Quality Control) of each standard operating procedure.

j) Procedures for handling samples received;

The generation of quality analytical data begins with the collection of the sample and, therefore, the integrity of the sample collection process is of importance to YORK. Samples must be collected in such a way that foreign material is not introduced into the samples and that analytes of interest do not escape from the samples or degrade prior to their analysis. To ensure sample integrity and representativeness, the following items must be considered:

- ⇨ Samples must be collected in appropriate containers. In general, glass containers are used for organic analytes except for PFAS (HDPE or PP) and polyethylene for inorganic/metal analytes;
- ⇨ Only new sample containers which are certified and documented clean by the vendor in shall be provided by YORK for sample collection;
- ⇨ Certain extremely hazardous samples or samples that have the potential to become extremely hazardous will not be accepted. These include (but are not limited to)

1. Radioactive samples that significantly exceed background levels
2. Biohazardous samples (medical wastes, body fluids, etc.)
3. Explosive samples in pure form (gunpowder, ammunition, flares, etc.)
4. Neurological or other toxic agents (Sarin, Anthrax, Ricin, etc.)
5. Drum samples which are concentrated acids, organic solvents or know oxidizers
6. Unknowns with no historical information on character of the material

YORK's chain-of-custody document is used to forward samples from the client to the laboratory. As the basic elements of most all chain-of-custody (COC) documents are similar, clientele may choose to use their own chain-of-custody document to forward samples to YORK, however York prefers use of its COC.

Any discrepancies in the COC must be documented on the Sample Receipt Form and resolved prior to analysis of samples.

Upon receipt by YORK, samples proceed through an orderly processing sequence designed to ensure continuous integrity of both the sample and its documentation from sample receipt through its analysis and beyond.

All coolers that are received by the Sample Control Group undergo a preliminary examination in accordance with the Sample Receipt checklist in Element. Specifically, each sample is carefully examined for label identification, proper container (type and volume), chemical preservation when applicable, container condition, and chain-of-custody documentation consistency with sample labels. Discrepancies are noted in Element on both the Sample Receipt Form and, if possible, discussed with the client by Project Management. If this is not possible, the discrepancies are communicated to the client for resolution prior to the completion of the log-in process. The temperature of the cooler is measured and, with other observations, are recorded on the COC and in Element (temperature).

During the log-in process each sample is assigned a unique laboratory identification number through a computerized Laboratory Information Management System (LIMS), which stores all essential project information. YORK maintains multiple security levels of access into LIMS to prevent unauthorized tampering/release of sample and project information.

Once all analyses for a sample have been completed and the sample container is returned to its designated location where, it shall remain in refrigerated storage for a period not less than 14 days following sample receipt unless the client requests return/forwarding of the sample. Following the 14-day refrigerated storage period, the samples are placed into ambient storage for another period not less than 16 days after which the samples are bulked into drums for later disposal. Samples are retained for 30 days in total unless other arrangements pre-empt this.

k) Reference to the major equipment and reference measurement standards used as well as the facilities and services used by the laboratory in conducting tests;

A list of major equipment is kept up-to-date on the List of Major Assets, reference Appendix G. This, as well as a list of reference measurement standards and their certificates of calibration, is maintained by the QA Officer or the respective departments. In general, all calibrations and references should be traceable to NIST

l) Reference to procedures for calibration, verification and maintenance of equipment; Laboratory SOPs are available to staff for calibration, verification and maintenance of equipment. In general,

m) Reference to verification practices which may include inter-laboratory comparisons, proficiency testing programs, use of reference materials and internal quality control schemes;

Instrument calibration is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity such that required reporting limits can be met. Each instrument is calibrated with standard solutions appropriate to the type of instrument and the linear range established for the analytical method. The manufacturer's guidelines, the analytical method, and/or the requirements of special contracts determine the frequency of calibration and the concentration of calibration standards, whichever is most applicable. The following are very general guidelines and are not meant to be all-inclusive. Detailed calibration procedures are specified in the SOP for each method performed.

Gas Chromatography/Mass Spectroscopy (GC/MS): Each day prior to analysis of samples, all GC/MS instruments are tuned with 4-bromofluorobenzene (BFB) for VOCs and decafluorotriphenylphosphine (DFTPP) for SVOCs in accordance with the tuning criteria specified in the applicable methods. Samples are not analyzed until the method-specific tuning requirements have been met. These have been eliminated in newer versions SW846 methods of 8260D and 8270E. Tuning is only required upon performance of an initial calibration.

After the tuning criteria are met, the instrument is then calibrated for all target analytes and an initial multipoint calibration curve established. The calibration curve is then validated by the analysis of a second source standard, referred to as the initial calibration verification (ICV). Alternatively, the previous calibration curve may be used if validated by a continuing calibration verification (CCV) standard. All target analytes are represented in the calibration. For the initial calibration to be deemed acceptable, 80% of the target compounds must show average Response factor RSDs <20% or for regressions >0.990 and must be re-evaluated and meet the acceptance criteria, at a minimum, every twelve (12) hours thereafter.

Non-GC/MS Chromatography: The field of chromatography involves a variety of instrumentation and detectors. While calibration standards and control criteria vary depending upon the type of system and analytical methodology required for a specific analysis, the general principles of calibration apply uniformly. Each chromatographic system is calibrated prior to sample analysis. An initial multipoint calibration curve is generated using all target analytes. All target analytes must meet the acceptance criteria for the calibration to be deemed acceptable. The calibration curve is then validated by the analysis of a second source standard, referred to as the initial calibration verification (ICV). The continued validity of the initial multipoint calibration is verified every 12 hours using continuing calibration verification (CCV) standard containing all target analytes. If the CCV fails to meet the acceptance criteria, the system is re-calibrated and all samples analyzed since the last acceptable CCV must be re-analyzed.

Inductively Coupled Plasma Emission Spectroscopy: Initial calibration consists of a calibration blank (CB) plus one calibration standard. The calibration is verified by the re-analysis of the standard and initial calibration verification (ICV) standard. If the standard and the ICV fail to meet the acceptance criteria, the initial calibration is considered invalid and is re-performed.

Continuing calibration verification (CCV) consists of a mid-concentration standard plus a calibration blank (CB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CB must be re-analyzed.

ICP/MS Spectroscopy: Each day prior to the analysis of samples, all ICP/MS instruments undergo mass calibration and resolution checks prior to initial calibration. Initial calibration consists of a calibration blank (CB) and at least three calibration standards. The calibration is verified by the re-analysis of the standard and initial calibration verification (ICV) standards. If the standard and the ICV fail to meet the acceptance criteria, the initial calibration is considered invalid and is re-performed.

Continuing calibration verification (CCV) consists of a mid-concentration standard plus a calibration blank (CB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CB must be re-analyzed.

Cold Vapor Atomic Absorption Spectroscopy: Initial calibration consists of a calibration blank plus a series of at least 5 standards. The calibration curve is then validated by the analysis of a second source standard, referred to as the initial calibration verification (ICV). Continuing calibration verification (CCV) consists of midpoint calibration standard plus a continuing calibration blank (CCB) analyzed every 10 samples and at the end of the sequence. If the CCV and/or CCB fail to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV and/or CCB must be re-analyzed. If the calibration blanks contain target analyte concentrations exceeding the acceptance limits, the cause must be determined and corrected.

General Inorganic Analyses: General inorganic (non-metal) analyses involve a variety of instrumental and wet chemistry techniques. While calibration procedures vary depending on the type of instrumentation and methodology, the general principles of calibration apply universally. Each system or method is initially calibrated using standards prior to analyses being conducted with continual verification that the calibration remains acceptable throughout analytical processing. If continuing calibration verification fails to meet the acceptance criteria, the instrument must be re-calibrated and all samples analyzed since the previous acceptable CCV must be re-analyzed.

PERIODIC CALIBRATION

Periodic calibration shall be performed for instrumentation such as balances, thermometers, ovens, and furnaces that are required in analytical methods, but which are not routinely calibrated as part of the analytical procedure. Documentation of calibration is kept for each instrumentation item.

Calibration requirements are determined within the York laboratory depending upon the instrumentation used and its operating function. Following are brief example discussions for the calibration of balances and thermometers with examples of calibration data sheets to serve as a guideline for the preparation of laboratory- specific procedures.

Balances (Example Procedure)

All balances are verified by using weights traceable to the National Bureau of Standards (NIST) on use. Calibration weights shall be Class S or better and shall be recertified every year. If balances are calibrated by an external agency, verification of their weights shall be provided.

Calibration of balances shall be over the range in which they are most commonly used. The weighs used for calibration of each balance shall be 0.5g, 2.0g, 10.0g, 20.0g, and 100g. Acceptance for balances which are direct reading to 0.01 gram shall be ± 0.01g, to 0.0001g shall be ± 0.007g, and to 0.00001g shall be ± 0.0007g.

Thermometers (Example Procedure)

Certified, or reference, thermometers shall be maintained for use in calibrating working thermometers including other temperature measurement devices such as thermocouples, probes and infrared temperature sensors. Reference thermometers shall be provided with NIST traceability for initial calibration and shall be recertified every year with instrumentation directly traceable to the NIST. Working thermometers shall be compared with reference thermometers every 12 months. In addition, working thermometers shall be visually inspected by laboratory personnel prior to use.

Calibration temperatures and acceptance criteria shall be based upon the working range of the thermometer and the accuracy required for its use.

n) Procedures to be followed for feedback and corrective action whenever testing discrepancies are detected, or departures from documented policies and procedures occur;

o) The laboratory management arrangements for permitting exceptions and departures from documented policies and procedures or from standard specifications;

YORK's SOPs are in substantial conformity with their corresponding published method references. Departure from approved SOPs shall be approved if necessary or appropriate due to the nature or composition of the sample or otherwise based on the reasonable judgment of YORK's Laboratory Manager, Technical Director, or QA Officer.

Departures shall be made on a case-by-case basis consistent with recognized standards of the industry. In no case shall significant departures be approved without written communication between Cleint Services and the affected client.

p) Procedures for dealing with complaints;

Procedures for dealing with complaints may be found in the SOP, Handling of Inquiries and Complaints.

q) Procedures for protecting confidentiality and proprietary rights;

YORK is sensitive to the fact that some of the analytical work performed for clients may be subject to litigation. YORK, therefore, holds all information in strict confidence with laboratory release only to the client or designee. Information released to entities other than the client is performed only upon written (facsimile or e-mail) request from the client.

Due to the investigative nature of most site assessments, analytical information may become available to regulatory agencies or other evaluating entities during site assessment of the laboratory for the specific purpose of attaining laboratory certifications, accreditations, or evaluation of laboratory qualification for future work. During these occurrences, the laboratory will make its best effort to maintain the confidence of client specific information.

r) Procedures for audits;

YORK participates in a wide variety of system and performance audits conducted by various state agencies, as well as through its major clients. These audits are conducted to verify that analytical data produced conforms to industry standards on a routine basis.

A System Audit is a qualitative evaluation of the measurement systems utilized at YORK, specifically, that YORK has, in place, the necessary facilities, staff, procedures, equipment, and instrumentation to generate acceptable data. This type of audit typically involves an on-site inspection of the laboratory facility, operations, and interview of personnel by the auditing agency.

A Performance Audit verifies the ability of YORK to correctly identify and quantitate compounds in blind check samples. This type of audit normally is conducted by the auditing agency through laboratory participation in round robin Performance Evaluation (PE) programs. Examples of current PE program involvement include those offered by commercial suppliers like ERA (WS/WP/SOIL and DMR-QA), or other inter-laboratory studies not required for certification but done to ensure laboratory performance, as well as programs administered by major clients.

Outliers in required PE samples will be investigated and corrective actions documented using the Corrective/Preventive Action Record.

Should the result of any audit detect a significant error, which has been identified to adversely affect released data, the situation shall be thoroughly investigated. Corrective measures shall be enacted to include system re-evaluation, the determined effect on released data and client notification, as necessary. These measures shall be documented using the Corrective/Preventive Action Record.

s) Processes/procedures for establishing that personnel are adequately experienced in the duties they are expected to carry out and are receiving any needed training;

Quality control begins prior to sample(s) receipt at the laboratory. The selection of well qualified personnel, based upon education and/or experience is the first step in successful laboratory management. A thorough screening of job applicants and selection of the best candidate to fulfill a well-defined need is as important an aspect of a successful QA/QC program as a careful review of analytical data.

Employee training and approval procedures used at YORK are detailed in the SOP on Employee Training, and includes but is not limited to the following:

- ⇨ A thorough understanding of the applicable regulatory method and YORK SOP;
- ⇨ A review of YORK's QA Program Manual and thorough understanding of the specifics contained therein that are directly related to the analysis to be performed;
- ⇨ Instruction by the applicable Group Leader or Tech. Director on all aspects of the analytical procedure;
- ⇨ Performance of analyses under supervision of experienced laboratory personnel, which shall include analysis of blind QC check samples, when deemed appropriate;
- ⇨ Participation in in-house seminars on analytical methodologies and procedures;
- ⇨ Participation in job related seminars outside of the laboratory; and

t) Ethics policy statement developed by the laboratory and processes/procedures for educating and training personnel in their ethical and legal responsibilities including the potential punishments and penalties for improper, unethical, or illegal actions;

A vital part of YORK’s analytical laboratory services is their Laboratory Ethics Training Program. An effective program starts with an Ethics Policy Statement that is supported by all staff, and is reinforced with initial and ongoing ethics training.

“It shall be the policy of YORK to conduct all business with integrity and in an ethical manner. It is a basic and expected responsibility of each staff member and manager to hold to the highest ethical standard of professional conduct in the performance of all duties."

A proactive ethics training program is the most effective means of deterring and detecting improper, unethical, or illegal actions in the laboratory. There are six facets to the program: (1) clearly define improper, unethical, and illegal actions; (2) outline elements of prevention and detection programs for

improper, unethical, or illegal actions; and (3) identify examples of inappropriate (i.e., potentially fraudulent) laboratory practices; (4) Annual Ethics and Data Integrity Training to be documented and maintained in the personnel file of each employee., (5) Documented training on new revisions of the Quality Systems Manual (QSM) and for new employees as needed. (6) Signed Ethics and Data Integrity Agreement (to be completed for new employees and annually thereafter).

Definition of Improper, Unethical, and Illegal Actions

Improper actions are defined as deviations from contract-specified or method-specified York analytical practices and may be intentional or unintentional.

Unethical or illegal actions are defined as the deliberate falsification of analytical or quality assurance results, where failed method or contractual requirements are made to appear acceptable.

Prevention of laboratory improper, unethical, or illegal actions begins with a zero-tolerance philosophy established by management. Improper, unethical, or illegal actions are detected through the implementation of oversight protocols.

Prevention and Detection Program for Improper, Unethical, or Illegal Actions

YORK management has implemented a variety of proactive measures to promote prevention and detection of improper, unethical, or illegal activities. The following components constitute the basic program:

- ⇨ Data Integrity Standard Operating Procedure
- ⇨ Data Integrity Documentation Procedures
- ⇨ An Ethics and Data Integrity Agreement that is read and signed by all personnel;
- ⇨ Initial and annual ethics training;
- ⇨ Internal audits;
- ⇨ Analyst documentation on certain types of manual integration changes to data;
- ⇨ Active use of electronic audit functions when they are available in the instrument software; and
- ⇨ A "no-fault" policy that encourages laboratory personnel to come forward and report fraudulent activities directly to the QA Officer.

A proactive, "beyond the basics" approach to the prevention of improper, unethical, or illegal actions are a necessary part of laboratory management. As such, in addition to the requirements above, YORK has a designated ombudsman (Data Quality Manager) to whom laboratory personnel can report improper, unethical, or illegal practices, or provide routine communication of training, lectures, and changes in policy intended to reduce improper, unethical, or illegal actions.

Examples of Improper, Unethical, or Illegal Practices

Documentation that clearly shows how all analytical values were obtained are maintained by YORK and supplied to the data user as needed. To avoid miscommunication, YORK clearly documents all errors, mistakes, and basis for manual integrations within the project file and case narrative as applicable. Notification is also made to the appropriate supervisor so that appropriate corrective actions can be initiated. Gross deviations from specified procedures are investigated for potential improper, unethical, or illegal actions, and findings of fraud are fully investigated by senior management. Examples of improper, unethical, or illegal practices are identified below:

- ⇨ Improper use of manual integrations to meet calibration or method QC criteria (for example, peak shaving or peak enhancement are considered improper, unethical, or illegal actions if performed solely to meet QC requirements);
- ⇨ Intentional misrepresentation of the date or time of analysis (for example, intentionally resetting a computer system's or instrument's date and/or time to make it appear that a time/date requirement was met);

- Falsification of results to meet method requirements;
- Reporting of results without analyses to support (i.e., dry-labbing);
- Selective exclusion of data to meet QC criteria (for example, initial calibration points dropped without technical or statistical justification);
- Misrepresentation of laboratory performance by presenting calibration data or QC limits within data reports that are not linked to the data set reported, or QC control limits presented within QAPP that are not indicative of historical laboratory performance or used for batch control;
- Notation of matrix inference as basis for exceeding acceptance limits (typically without implementing corrective actions) in interference-free matrices (for example, method blanks or laboratory control samples);
- Unwarranted manipulation of computer software (for example, improper background subtraction to meet ion abundance criteria for GC/MS tuning, chromatographic baseline manipulations);
- Misrepresentation of QC samples (for example, adding surrogates after sample extraction, omitting sample preparation steps for QC samples, over- or under-spiking); and
- Reporting of results from the analysis of one sample for those of another.

v) Reference to procedures for reporting analytical results;

Standard operating procedures pertaining to the reporting of results are available to all laboratory personnel and are included in the specific SOP for each procedure.

All analytical data generated within YORK is thoroughly checked for accuracy and completeness. The data validation process consists of data generation, reduction, and two levels of review as described below.

The analyst generating the analytical data has the primary responsibility for its correctness and completeness. All data is generated and reduced following protocols specified in the appropriate SOPs. Each analyst reviews the quality of his or her work based upon an established set of guidelines specified in the SOPs or as detailed by project requirements. The analyst reviews the data to ensure that:

- Holding times have not been exceeded;
- Sample preparation information is correct and complete;
- Analysis information is correct and complete;
- The appropriate procedures were employed;
- Analytical results are correct and complete;
- All associated QC is within established control limits and, if not, out-of-control forms are completed thoroughly explaining the cause and corrective action taken;
- Any special sample preparation and analytical requirements have been met; and
- Documentation is complete, i.e., all anomalies in the preparation and analysis have been documented; out-of-control forms, if required, are complete, etc.

This initial review step, performed by the analyst, is designated as primary review. The Data Quality Manager then conducts an independent check equivalent to that of the primary review and are designed to ensure that:

- Calibration data is scientifically sound, appropriate to the method, and completely documented;
- QC data is within established guidelines or reported with appropriate clarification/qualification;
- Qualitative identification of sample components is correct;
- Quantitative results are correct;
- Documentation is complete and any anomalies properly addressed and documented;
- The data is ready for incorporation into the final report package; and
- The data package is complete and ready for release.

A significant component of the secondary review is the documentation of any errors that have been identified and corrected during the review process. YORK believes that the data package that is submitted for a secondary review should be free from errors. Errors that are discovered are documented and formally transmitted to the appropriate Group Leader. The cause of the errors is then addressed by additional training or clarification of procedures (SOP revisions) to ensure that similar errors do not recur and high quality data will be generated.

These procedures are done electronically. Once set to Reviewed in Element LIMS, this constitutes approval for data release and generation of analytical report.

During both of the QC review processes, 100% of the raw data associated with the entire project is available to the reviewer.

Following draft report generation, the report is reviewed by the Project Manager to ensure that the data set and quality control data are complete and meet the specific requirements of the project. When available, the data are also evaluated against historical site information. Once all requested analytical work has been verified as complete, a final report is generated and electronically signed by the Laboratory Manager.

Following approval for release, the Quality Assurance Manager or other qualified personnel may review 10% of the project files back to the raw data as an additional check, if a situation so warrants.

A variety of reporting formats, from Portable Document File (PDF), normal reports to computerized data tables (Execl and special EDDs) to complex reports discussing regulatory issues are available. In general, YORK reports contain the following information.

Analytical Data

Analytical data is reported by sample identification (both client and laboratory) and test. Pertinent information including date(s) sampled, received, prepared, and analyzed; any required data qualifiers are included on each results page. The reporting limit for each method analyte is also listed. Additional data may include Method Detection Limits (MDLs) and any dilution factors used.

QC Data

A QC Summary is provided with each QA Summary report when requested. Unless otherwise specified in a QAPP or requested by the client, QC Summaries include results for method blanks, blank spikes, site-specific matrix spikes, matrix spike duplicates, and surrogate spikes. The effective control limits for the reported QC values are also provided on the QC Summary as well as explanations for any QC outliers. Case Narratives may be included as appropriate.

As required for the project, data reports from “results only” through “full ASP-B like” will be generated and provided. Numerous custom EDD formats are also provided as needed including EquIS, NYSDEC EquIS, Giskey and numerous other formats.

Methodology

References for the preparative and analytical methodology employed is included on all preliminary or final analytical reports.

Signatory

Final reports are ready for release to the client following review and approval by the Laboratory Manager, as evidenced by his/her signature on the final report.

Preliminary Data

Upon client request, preliminary data shall be released prior to completion of a full QC review. Preliminary data is subject to change pending QC review and, therefore, shall be clearly marked as “DRAFT”. This qualification is provided as notification to the client that the data review process has not been completed yet and that the data is subject to possible modification resulting therefrom.

Revised Data

Analytical reports that have been revised for any reason from the original sent report shall be noted as being revised with a report note, case narrative or indication as to the reason for the revision.

Formatting

At a minimum, an analytical report shall consist of the Report Cover Page, Analytical Results, Footnotes/Comments Page, and COC. Paginated reports shall be employed for all reports. All reports are bookmarked for ease of navigation. York offers approximately forty different reporting formats from a simple report (Results only) to a complex validation ready deliverable, along with various Electronic Data Deliverables (EDDs). All data are posted to our website for client access through our DataPort access portal.

Figure 1. Company Organizational Chart

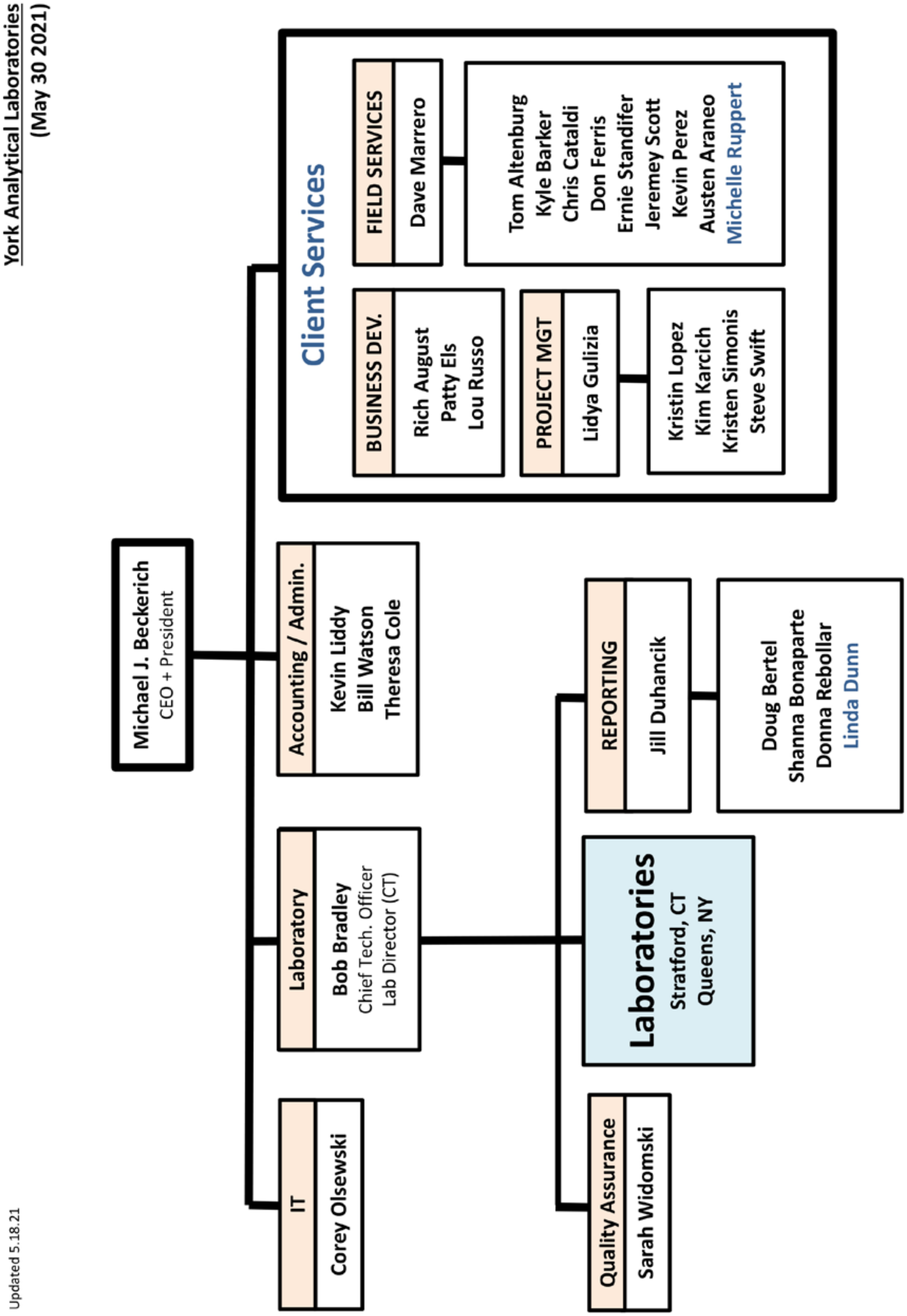
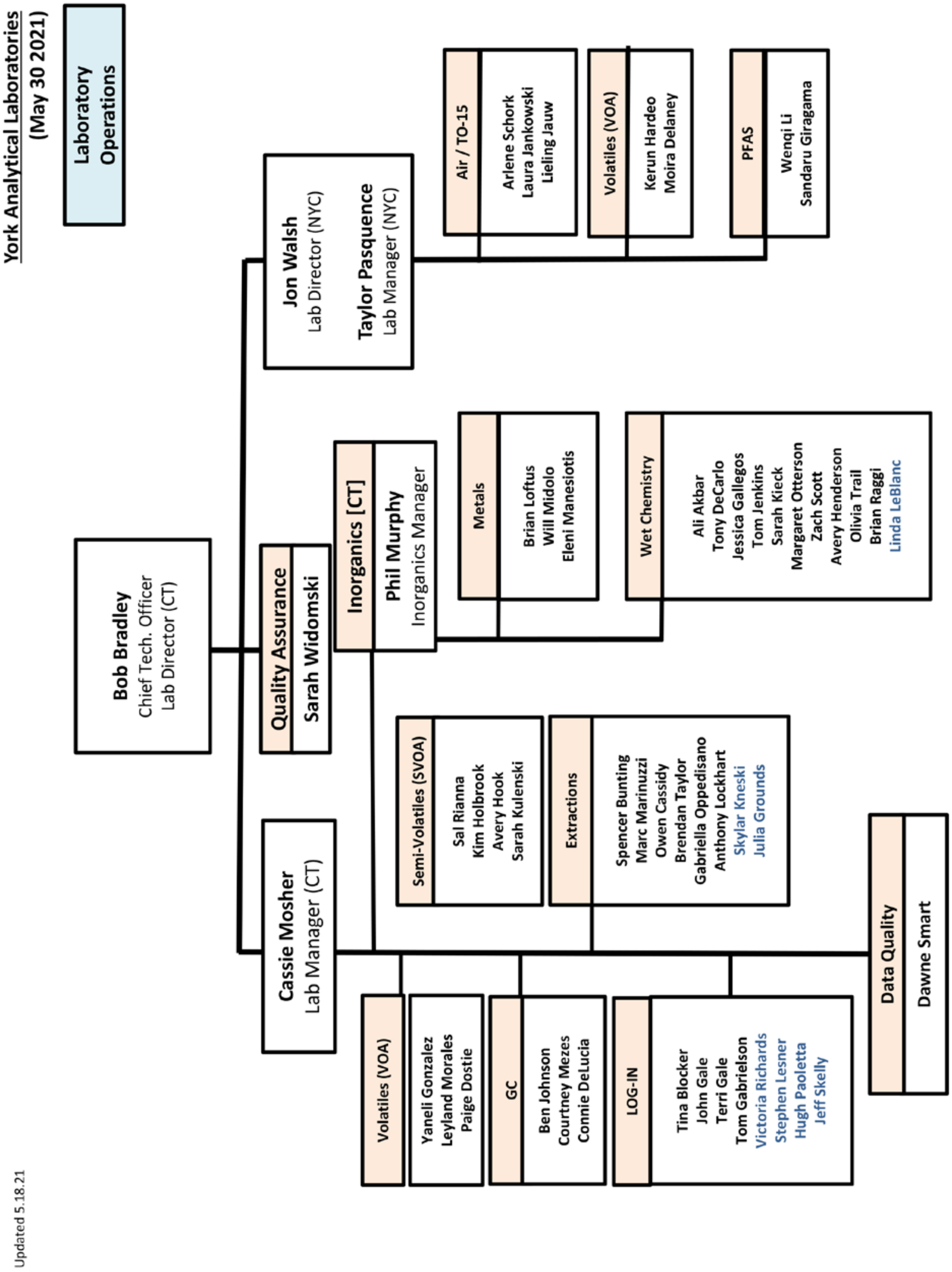


Figure 2. Laboratory Functional Organizational Chart



5.4 Audits

5.4.1 Internal Audits

The laboratory arranges comprehensive annual internal audits to verify that its operations continue to comply with the requirements of the laboratory's quality system. The Quality Assurance Officer or designee plans and organizes audits as required by a predetermined schedule and requested by management. The internal audits also serve the purpose of ensuring that SOPs meet the requirements of the reference methods and their updates.

The QAO or other qualified personnel, independent of the activity to be audited, will carry out such audits following the procedures in the SOP, Internal Audit Procedures.

Personnel do not audit their own activities except when it can be demonstrated that an effective audit will be carried out.

Where the audit findings cast doubt on the correctness or validity of the laboratory's calibrations or test results, the laboratory takes immediate corrective actions and where deemed relevant notifies, in writing, any client whose work was involved.

i. List of available qualified personnel for internal audits include:
   - QA Officer
   - Lab Manager or Technical Director
   - QA Assistant
   - Group Leader (For departments other than their own)
   - Any Senior Chemist (With training in proper internal auditing procedures) not working in the area to be audited

ii. The minimum qualifications for an internal auditor shall be:
   - Education: A Bachelors (BS) Degree in an applied science with 12-16 semester hours in chemistry.
   - Experience: Two years' experience in an instrumental analytical technique for environmental analysis of representative environmental samples. Training to the most current revision of the SOP on Internal Audits.
   - Any outside audit findings will also be included in the Internal Audits.

5.4.2 Management Review

YORK management conducts an annual review of its quality system and its testing and calibration activities to ensure its continuing suitability and effectiveness and to introduce any necessary changes or improvements in the quality system and laboratory operations.

This review takes account of reports from managerial and supervisory personnel, the outcome of recent internal audits, assessments by external bodies, the results of inter-laboratory comparisons or proficiency tests, any changes in the volume and type of work undertaken, feedback from clients, senior lab personnel, corrective actions, and other relevant factors.

The laboratory shall have a procedure for review by management, and maintain records of review findings and actions.

5.4.3 Audit Review

All audit and review findings and any corrective actions that arise from them are documented. The laboratory management ensures that these actions are discharged within the agreed time frame as indicated in the quality manual and/or SOPs. Specific Audit checklists are employee for each discipline/method.

5.4.4 Performance Audits

In addition to periodic audits, the laboratory ensures the quality of results provided to clients by implementing checks to monitor the quality of the laboratory's analytical activities. Examples of such checks are:

a) Internal quality control procedures using statistical techniques (see Section 5.4 below);-Control charts

b) Participation in proficiency testing or other inter-laboratory comparisons;

c) Use of certified reference materials and/or in-house quality control using secondary reference materials as specified in YORK QSM Section 5.4;

d) Replicate testing using the same or different test methods;

g) Re-testing of retained samples;

h) Correlation of results for different but related analysis of a sample (for example, total phosphorus should be greater than or equal to ortho-phosphate).

5.4.5 Corrective / Preventive Actions

a) In addition to providing acceptance criteria and specific protocols for corrective/preventive actions in, the laboratory implements general procedures to be followed to determine when departures from documented policies, procedures and quality control have occurred. These procedures include but are not limited to the following:

   1) Identify the individual(s) responsible for assessing each QC data type;

   2) Identify the individual(s) responsible for initiating and/or recommending corrective/preventive actions;

   3) Define how the analyst shall treat a data set if the associated QC measurements are unacceptable;

   4) Specify how out-of-control situations and subsequent corrective actions are to be documented; and

   5) Specify procedures for management (including the QA officer) to review corrective/preventive action reports.

b) To the extent possible, sample results are reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data are to be reported, all samples associated with the failed quality control measure are reported with the appropriate data qualifier(s).

5.4 Essential Quality Control Procedures

These general quality control principles apply, where applicable, to all testing at YORK. The manner in which each is implemented is dependent on the types of tests performed by the laboratory and is further described in specific SOPs for each test. The standards for any given test type assure that the applicable principles are addressed:

a) All laboratories have detailed written protocols in place to monitor the following quality controls:

   1) Positive and negative controls (blanks, spikes, reference materials, etc.) to monitor tests;

   2) Tests to define the variability and/or repeatability of the laboratory results such as replicates;

   3) Measures to assure the accuracy of the test method including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, or other measures;

   4) Measures to evaluate test method capability, such as detection limits and quantitation limits or range of applicability such as linearity;

   5) Selection of appropriate formulae to reduce raw data to final results such as regression analysis, comparison to internal/external standard calculations, and statistical analyses;

6) Selection and use of reagents and standards of appropriate quality as define din the SOPs;

7) Measures to assure the selectivity of the test for its intended purpose; and

8) Measures to assure constant and consistent test conditions (both instrumental and environmental) where required by the test method, such as temperature, humidity, or specific instrument conditions.

b) All quality control measures are assessed and evaluated on an on-going basis, and quality control acceptance criteria are used to determine the usability of the data.

c) The laboratory has procedures for the development of acceptance/rejection criteria where no method or regulatory criteria exist.

d) The quality control protocols specified in the method manual (YORK QSM Section 10.1.2) is followed. YORK ensures that the essential standards outlined in NELAC 5, Appendix D, or mandated methods or regulations (whichever are more stringent) are incorporated into the SOP/method manuals. When it is not apparent which is more stringent the QC in the mandated method or regulations is to be followed.

The essential quality control measures for testing are found in Appendix D.

6.1 PERSONNEL

6.2 General Requirements for Laboratory Staff

YORK's testing departments have a sufficient level of personnel with the necessary education, training, technical knowledge and experience to perform the assigned functions.

All personnel are responsible for complying with all quality assurance/quality control requirements that pertain to their organizational/technical function. Each technical staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular function and a general knowledge of laboratory operations, test methods, quality assurance/quality control procedures and records management.

6.3 Laboratory Management Responsibilities

In addition to YORK QSM Section 4.2.d, the laboratory management:

a) Defines the minimum level of qualification, experience and skills necessary for all positions in the laboratory. In addition to education and/or experience, basic laboratory skills such as using a balance and quantitative techniques, are considered.

b) Ensures that all technical laboratory staff members demonstrate capability in the activities for which they are responsible. Such demonstration is documented (See Appendix C). Note: In departments with specialized "work cells" (a well-defined group of analysts that together perform the method analysis), the group as a unit meets the above criteria and this demonstration is fully documented.

c) Ensures that the training of each member of the technical staff is kept up-to-date (on-going) by the following:

1) Keeping evidence on file that demonstrates that each employee has read, understood, and is using the latest version of the laboratory's in-house quality documentation that relates to his/her job responsibilities.

2) Documenting training courses or workshops on specific equipment, analytical techniques, or laboratory procedures.

3) Documenting employee attendance at training courses on ethical and legal responsibilities including

the potential punishments and penalties for improper, unethical or illegal actions. Keeping on file evidence that demonstrates that each employee has read, acknowledges, and understands their personal ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions.

4) Maintains up-to-date analyst training records that contain a certification that technical personnel have read, understood and agreed to perform the most recent version of the test method (the approved method or SOP as defined by the laboratory document control system, YORK QSM Section 5.2.d) and documentation of continued proficiency by at least one of the following once per year:

    i. Acceptable performance of a blind sample (single blind to the analyst);

    ii. Another demonstration of capability;

    iii. Successful analysis of a blind performance sample on a similar test method using the same technology (e.g., GC/MS volatiles by purge and trap for Methods 524.2, 624, or 5035/8260) would only require documentation for one of the test methods;

    iv. At least four consecutive laboratory control samples with acceptable levels of precision and accuracy;

    v. If subsections i-iv cannot be performed, analysis of authentic samples with results statistically indistinguishable from those obtained by another trained analyst.

d) Documents all analytical and operational activities of the laboratory;

e) Supervises all personnel employed by the laboratory with the exception of the QA Officer;

f) Ensures that all sample acceptance criteria (YORK QSM Section 11.0) are verified and that samples are logged into the sample tracking system and properly labeled and stored.

g) Documents the quality of all data reported by the laboratory.

h) In conjunction with the QA Officer, develops a proactive program for the prevention and detection of improper, unethical, or illegal actions. Components of this program could include: internal proficiency testing (single and double blind); post-analysis electronic audits; effective reward program to improve employee vigilance and co-monitoring; and separate SOPs identifying appropriate and inappropriate laboratory and instrument manipulation practices.

6.2.1 Ownership Transfer / Out of Business

a) In the event that the laboratory transfers ownership or goes out of business, YORK will ensure that the records are maintained or transferred according to client instruction.

b) Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives will be clearly established. In cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records will be followed.

c) In the event that the laboratory goes out of business, all records will revert to the control of the client or regulatory agency, as applicable. As much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

6.3 Personnel Records

Records on the relevant qualifications, training, skills and experience of the technical personnel are maintained by the laboratory, including records on demonstrated proficiency for each laboratory test method, such as the criteria outlined in YORK QSM Section 10.5 for analysis.

7.1 PHYSICAL FACILITIES – ACCOMMODATION AND ENVIRONMENT

7.2 Environment

a) Laboratory accommodations, test areas, energy sources, lighting, heating and ventilation are such that they facilitate proper performance of tests.

b) The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of the measurements. Particular care shall be taken when such activities are undertaken at sites other than the permanent laboratory premises.

c) The laboratory shall provide for the effective monitoring, control and recording of environmental conditions as appropriate. Such environmental conditions may include dust, electromagnetic interference, humidity, main voltage, temperature, and sound and vibration levels.

d) In instances where monitoring or control of any of the above-mentioned items is specified in a test method or by regulation, the laboratory meets and documents adherence to the laboratory facility requirements.

7.3 Work Areas

a) There is effective separation between neighboring areas when the activities therein are incompatible including volatile organic chemicals handling areas.

b) Access to and use of all areas affecting the quality of these activities are defined and controlled.

c) Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality.

d) Workspaces are available to ensure an unencumbered work area. Work areas include:

   1) Access and entryways to the laboratory;

   2) Sample receipt areas;

   3) Sample storage areas;

   4) Chemical and waste storage areas; and

   5) Data handling and storage areas.

8.0 EQUIPMENT AND REFERENCE MATERIALS

a) YORK is furnished with all items of equipment (including reference materials) required for the correct performance of tests for which accreditation is maintained. Note that YORK does not use equipment outside its permanent control.

b) All equipment is properly maintained, inspected, and cleaned. Maintenance procedures are documented.

c) Any equipment item that has been subjected to overloading or mishandling, or that gives suspect results, or has been shown by verification or otherwise to be defective, is taken out of service, clearly identified and wherever possible stored at a specified place until it has been repaired and shown by calibration, verification or test to perform satisfactorily. The laboratory shall examine the effect of this defect on previous calibrations or tests.

d) When appropriate, each item of equipment, including reference materials, is labeled, marked, or otherwise identified to indicate its calibration status.

e) Records are maintained of each major item of equipment and all reference materials significant to the tests performed. These records include documentation on all routine and non-routine maintenance activities in assigned log books and reference material verifications.

The records include:

1) The name of the item of equipment;
2) The manufacturer's name, type identification, and serial number or other unique identification;
3) Date received and date placed in service (if available);
4) Current location, where appropriate;
5) If available, condition when received (e.g., new, used, reconditioned);
6) Copy of the manufacturer's instructions, where available;
7) Dates and results of calibrations and/or verifications and date of the next calibration and/or verification;
8) Details of maintenance carried out to date and planned for the future; and
9) History of any damage, malfunction, modification or repair.

9.1 MEASUREMENT TRACEABILITY AND CALIBRATION

9.2 General Requirements

All measuring operations and testing equipment having an effect on the accuracy or validity of tests are calibrated and/or verified before being put into service and on a continuing basis. The laboratory has an established program for the calibration and verification of its measuring and test equipment. This includes balances, thermometers and control standards.

9.3 Traceability of Calibration

a) The overall program of calibration and/or verification and validation of equipment is designed and operated so as to ensure that measurements made by the laboratory are traceable to national standards of measurement.

b) Calibration certificates indicate the traceability to national standards of measurement and provide the measurement results and associated uncertainty of measurement and/or a statement of compliance with an identified metrological specification. The laboratory maintains records of all such certification in the QA office.

c) Where traceability to national standards of measurement is not applicable, the laboratory provides satisfactory evidence of correlation of results, for example, by participation in a suitable program of inter-laboratory comparisons, proficiency testing, or independent analysis.

9.4 Reference Standards

a) Reference standards of measurement held by the laboratory (such as Class S or equivalent weights, or N I S T traceable thermometers) are used for calibration only and for no other purpose, unless it can be demonstrated that their performance as reference standards has not been invalidated. A body that can provide traceability calibrates reference standards of measurement. Where possible, this traceability is to a national standard of measurement.

b) There is a program of calibration and verification for reference standards.

   i. Two weeks prior to their date of calibration expiration, individual thermometers are removed from service and replaced by newly calibrated units from the supplier.

   ii. YORK keeps two sets of Class S weights on hand for use in the laboratory. One set is used for daily calibration checks, and the second set is kept for back up use should the first set be damaged, lost or otherwise compromised. The second set of weights is also place in service when the daily use set is shipped off site for recalibration.
   iii. Analytical balances are serviced and calibrated on a routine, annual schedule by an outside vendor.

c) Where relevant, reference standards and measuring and testing equipment are subjected to in-service checks between calibrations and verifications. Reference materials are traceable. Where possible, traceability is to national or international standards of measurement, or to national or international standard reference materials.

d) NIST-Traceable Weights and Thermometers

i. Reference standards of measurement shall be used for the purposes of calibration only. NIST traceable thermometers and NIST-traceable weights shall not be used for routine testing. If NIST traceable reference sources are used for routine testing they shall not be used for calibration purposes unless it can be shown that their performance as reference standards would not be invalidated.

ii. For NIST-traceable weights and thermometers, YORK requires that all calibrations be conducted by a calibration laboratory accredited by ACLASS, A2LA or other recognized accrediting body.

a. The calibration laboratory must hold proper accreditation for the services rendered. Prior to use, QA verifies that the selected vendor holds the appropriate scope of accreditation for the services required.

b. The calibration certificate or report supplied by the calibration laboratory must contain a traceability statement, the conditions under which the calibrations were made, a compliance statement with an identified metrological specification and the pertinent clauses when applicable, and a clearly identified record of the quantities and functional test results before and after re-calibration.

c. The certificate and scope of accreditation is kept on file at the laboratory and is reviewed yearly.

iii. If significant amendments are made to a calibration certificate, it must have its own unique report identifier and must reference the one it is replacing. The piece of equipment must be identified in the amended report using its unique serial number or other laboratory defined identifier. The amended report is maintained with the original calibration report.

iv. Laboratory balances are recalibrated annually by an external, certified vendor that is certified to ISO 17025 / ISO 9001 standards for calibration. Prior to use, QA verifies that the selected vendor holds the appropriate scope of accreditation for the services required. This service is documented on each balance with a signed and dated certification sticker.

v. NIST mercury thermometers are sent out for recalibration every five years, or are replaced. All working mercury thermometers are calibrated annually against a NIST-traceable reference thermometer. All digital temperature measuring devices (min/max thermometers, IR guns) are calibrated quarterly. Equipment that does not meet acceptance criteria is removed from service and repaired or replaced. Calibration reports are maintained by the QA Officer.

vi. Balance calibrations and temperature readings of ovens, refrigerators, and incubators are checked on each day of use. Min/Max thermometers are used for refrigerators and freezers to continually monitor temperature performance.

e) Traceable Reference Standards and Materials

i. Reference standards and materials are traceable to certified reference materials, where available. Commercially prepared standard materials are purchased from vendors accredited by A2LA, NVLAP (National Voluntary Lab Accreditation Program) or other recognized vendor, and come with a Certificate of Analysis that documents the purity of the standard and expiration date, if assigned. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis against a known reference.

ii. Analytical reagents must be at a minimum the purity required by or stated in the test method. Commercial materials that are purchased for the preparation of calibration, verification or spiking solutions, are usually accompanied by an assay certificate or the purity is noted on the label. If the purity is >96%, the weight provided by the vendor may be used without correction. If the purity is <96%, a correction will be made to solution concentrations prepared from that material.

iii. The receipt of all reference standards and materials, including received date and expiration date, is documented by the laboratory at the time of receipt, in chemical receiving logbooks. All documentation received with the reference standard or material (Certificate of Analysis or Purity Certificates) is retained by the laboratory. To prevent contamination and/or deterioration in quality, all standards and materials are handled and stored according to the method or manufacturer's requirements.

iv. Preparation of standard or reference materials are documented in SOPs and in Element LIMS by department. These records show the traceability to the purchased standards or materials, and include the method of preparation, date of preparation, expiration date, and preparer's initials, at a minimum.

v. All standards, reference, primary and working, whether purchased from a commercial vendor or prepared by the laboratory, must be checked regularly to ensure that the variability of the standard from the 'true' value does not exceed method requirements. Calibration standards are checked by comparison with a standard from a second source, usually another manufacturer and vendor. In cases where a second manufacturer is not available, a different lot, with vendor certification, may be used as a second source.

vi. Quality control (QC) criteria for primary and second source standards are defined in laboratory SOPs and/or in Element LIMS. In most cases, the analysis of an Initial Calibration Verification (ICV) is used as the second source verification of a primary calibration source.

9.5 Calibration

Calibration requirements are divided into two parts: (1) requirements for analytical support equipment, and (2) requirements for instrument calibration. In addition, the requirements for instrument calibration are divided into initial calibration and second source or initial calibration verification, and continuing calibration verification.

9.4.1 Support Equipment

These standards apply to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, thermometers, and volumetric dispensing devices (such as Eppendorf®, or automatic dilutor/dispensing devices) if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume.

a) All support equipment is maintained in proper working order. The records of all repair and maintenance activities, including service calls is kept.

b) All support equipment is calibrated or verified at least annually, using NIST traceable references when available, over the entire range of use. The results of such calibration are within the specifications required of the application for which this equipment is used or:

   1) The item is removed from service until repaired; or

   2) The laboratory maintains records of established correction factors to correct all measurements.

c) Raw data records are retained to document equipment performance.

d) Prior to use on each working day, balances, ovens, refrigerators, freezers, and water baths are checked in the expected use range, with NIST traceable calibrated references. The acceptability for use or continued use is according to the needs of the analysis or application for which the equipment is being used.

e) Mechanical volumetric dispensing devices including burettes (except Class A glassware) are checked for accuracy on at least a quarterly use basis. Glass microliter syringes are to be considered Class A glassware, and come with a certificate from the manufacturer attesting to established accuracy or the accuracy is initially demonstrated and documented by the laboratory.

9.4.2 Instrument Calibration

This manual specifies the essential elements that define the procedures and documentation for initial instrument calibration and continuing instrument calibration verification to ensure that the data are of known quality and be appropriate for a given regulation. This manual does not specify detailed procedural steps ("how to") for calibration, but establishes the essential elements for selection of the appropriate technique(s). This approach allows flexibility and permits the employment of a wide variety of analytical procedures and statistical approaches currently applicable for calibration. If more stringent standards or requirements are included in a mandated test method or by regulation, the laboratory demonstrates that such requirements are met. If it is not apparent which standard is more stringent, then the requirements of the regulation or mandated test method are to be followed.

Note: In the following sections, initial instrument calibration is directly used for quantitation and continuing instrument calibration verification is used to confirm the continued validity of the initial calibration, unless otherwise stipulated by the analytical method.

9.4.2.1 Initial Instrument Calibrations

The following items are essential elements of initial instrument calibration:

a) The details of the initial instrument calibration procedures including calculations, integrations, acceptance criteria and associated statistics are included or referenced in the test method SOP. When initial instrument calibration procedures are referenced in the test method, the referenced material is retained by the laboratory and is available for review.

b) Sufficient raw data records are retained to permit reconstruction of the initial instrument calibration, e.g., calibration date, test method, instrument, analysis date, each analyte name, analyst's initials or signature; concentration and response, calibration curve or response factor; or unique equation or coefficient used to reduce instrument responses to concentration.

c) Sample results are quantitated from the initial instrument calibration and may not be quantitated from any continuing instrument calibration verification unless specifically stated in a mandated test method.

d) All initial instrument calibrations are verified with a standard obtained from a second manufacturer or lot. Traceability shall be to a national standard, when available.

e) Criteria for the acceptance of an initial instrument calibration is established, e.g., correlation coefficient or relative percent difference. The criteria used are appropriate to the calibration technique employed.

f) Results of samples not bracketed by initial calibration standards (within calibration range) are reported as having less certainty, e.g., defined qualifiers or flags or explained in the case narrative. As determined by the method, the lowest calibration standard is at or above the method detection limit and at or below the reporting limit.

g) If the initial instrument calibration results are outside established acceptance criteria, corrective actions are performed. Data associated with an unacceptable initial instrument calibration is not reported.

h) Calibration standards include concentrations at or below the regulatory limits/Action levels where technologically feasible.

i) If a reference or mandated method does not specify the number of calibration standards, the minimum number is two for ICP metals and a minimum of 5 for all other calibrations. The laboratory's standard operating procedure defines the number of points for establishing the initial instrument calibration.

9.4.2.2 Continuing Instrument Calibration Verification

When an initial instrument calibration is not performed on the day of analysis, the validity of the initial calibration is verified prior to sample analyses by analyzing continuing calibration verification standards with each analytical batch. The following items are essential elements of continuing calibration verification:

a) The details of the continuing calibration procedure, calculations and associated statistics are included or referenced in the test method SOP.

b) A continuing calibration verification standard (s) must be analyzed at the beginning and end of each analytical batch, and where required by method or project, at a specific frequency, every 10 or 20 samples or 12 hours, within the batch.

c) Sufficient raw data electronic records must be retained to permit reconstruction of the continuing calibration verification, e.g., test method, instrument, analysis date, each analyte name, concentration and response, calibration curve or response factor, or unique equations or coefficients used to convert instrument responses into concentrations. Continuing calibration verification records must explicitly connect the continuing calibration verification data to the initial calibration.

d) Criteria for the acceptance of a continuing calibration verification must be established, e.g., relative percent difference or Percent Drift.

e) If the continuing calibration verification results obtained are outside established acceptance criteria, corrective actions must be performed. If routine corrective action procedures fail to produce a second (consecutive and immediate) calibration verification within acceptance criteria, then the laboratory shall demonstrate performance after corrective action with two consecutive successful calibration verifications, or a new instrument calibration must be performed. If the laboratory has not demonstrated acceptable performance, sample analyses shall not occur until a new initial calibration curve is established and verified.

   As an exception, sample data associated with an unacceptable continuing calibration verification may be reported as qualified data under the following specific conditions:

   i. When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise the samples affected by the unacceptable calibration verification are reanalyzed after a new calibration curve has been established, evaluated and accepted.

   ii. When the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/action level. Otherwise the samples affected by the unacceptable verification are reanalyzed after a new calibration curve has been established, evaluated and accepted.

10.1 TEST METHODS AND STANDARD OPERATING PROCEDURES

10.2 Methods Documentation

a) The laboratory has documented instructions on the use and operation of all relevant equipment, on the handling and preparation of samples and for calibration and/or testing, where the absence of such instructions could jeopardize the calibrations or tests.

b) All instructions, standards, manuals, and reference data relevant to the work of the laboratory are maintained up-to-date and be readily available to the staff.

10.1.1 Standard Operating Procedures (SOPs) Administrative

YORK maintains standard operating procedures that accurately reflect all phases of current laboratory activities such as instrument operation, assessing data integrity, corrective actions, handling customer complaints, reporting of test results, etc.

a) These documents, for example, may be equipment manuals provided by the manufacturer or internally written documents.

b) The test methods may be copies of published methods as long as any changes or selected options in the methods are documented and included in the SOP (See 10.1.2.)

c) Copies of all SOPs are accessible to all personnel.

d) The SOPs are organized.

e) Each SOP clearly indicates the effective date of the document, the revision number and the signatures of the approving authorities.

10.1.2 Standard Operating Procedures (SOPs) Analytical

a) The laboratory has and maintains SOPs for each accredited analyte or test method.

b) This SOP may consist of copies of published or referenced test methods or standard operating procedures that have been written by the laboratory. In cases where modifications to the published method have been made by the laboratory or where the referenced test method is ambiguous or provides insufficient detail, these changes or clarifications are clearly described. Each test method includes or references where applicable:

1) Identification of the test method;
2) Applicable matrix or matrices;
3) Detection limit;
4) Scope and application, including components to be analyzed;
5) Summary of the test method;
6) Definitions;
7) Interferences;
8) Safety;
9) Equipment and supplies;
10) Reagents and standards;
11) Sample collection, preservation, shipment, and storage;
12) Quality control;
13) Calibration and standardization;
14) Procedure;
15) Calculations;
16) Method performance;
17) Pollution prevention;
18) Data assessment and acceptance criteria for quality control measures;
19) Corrective actions for out-of-control data;
20) Contingencies for handling out-of-control or unacceptable data;
21) Waste management;
22) References; and
23) Any tables, diagrams, flowcharts, and validation data.
24) Modifications
25) Revision History

10.2 Exceptionally Permitting Departures from Documented Policies / Procedures

a) If it is necessary to depart from a documented procedure or policy due to circumstances outside of YORK's control or due to conditions encountered while preparing or analyzing a sample, the following will be documented.

1) The nature of the exception
2) How the data or procedure may be impacted
3) Any Corrective Action that may be needed.
4) Any approval from a client that may be required.
5) Approval by management to report or proceed with the exception.
6) A Case Narrative with the Final Report explaining the exception.

10.3 Test Methods

The laboratory uses appropriate test methods and procedures for all tests and related activities within its responsibility (including, as applicable, sample collection, sample handling, transport and storage, sample preparation and sample analysis). The method and procedures shall be consistent with the accuracy required, and with any standard specifications relevant to the calibrations or tests concerned.

a) When the use of specific test methods for a sample analysis is mandated or requested, only those methods are used.

b) Where test methods are employed that are not required, as in the Performance Based Measurement System approach, the methods are fully documented and validated (see YORKQSM Section 10.1.2 and Appendix C), and are available to the client and other recipients of the relevant reports.

10.4 Test Method Assessment

The laboratory will periodically conduct a Test Method Assessment on the analytical methods in use. These assessments are typically done during annual internal audit activities. The purpose is to evaluate the compliance between bench performance of the method versus the current YORK Standard Operating Procedure versus the promulgated or published method. Discrepancies will need to be addressed and resolved. Note that some methods are totally prescriptive while others may contain prescriptive aspects, and still others are performance based. In many cases, modifications to the published method may be required due to circumstances outside the laboratories' control.

10.5 Demonstration of Capability

a) Prior to acceptance and initiation of any test method, satisfactory demonstration of method capability is required. This demonstration does not test the performance of the method in real world samples, but in the applicable and available clean matrix (sample of a matrix is which no target analytes or interferences are present at concentrations that impact the results of a specific test method), e.g., water, solids and air. In addition, for analytes that do not lend themselves to spiking, the demonstration of capability may be performed using quality control samples.

b) Continuing demonstration of method performance, per the quality control requirements is required annually as DOCs.

c) In all cases, the appropriate forms, such as the Certification Statement, is completed and retained by the laboratory to be made available upon request. The laboratory retains all associated supporting data necessary to reproduce the analytical results summarized in the Certification Statement.

d) Demonstration of capability is completed each time there is a significant change in instrument type, personnel, or test method.

e) In departments with specialized "work cell(s)" (a group consisting of analysts with specifically defined tasks that together perform the test method), the group as a unit must meet the above criteria and this demonstration of capability is fully documented.

f) When a work cell is employed, and the members of the cell change, the new employee(s) must work with an experienced analyst in that area of the work cell where they are employed. This new work cell must demonstrate acceptable performance through acceptable continuing performance checks such as laboratory control samples). Such performance is documented and the four preparation batches following the change in personnel must not result in the failure of any batch acceptance criteria, e.g., method blank and laboratory control sample, or the demonstration of capability must be repeated. In addition, if the entire work cell is changed or replaced, the new work cell must perform the demonstration of capability.

g) Performance of the work cell is linked to the training records of the individual members of the work cell (See YORK QSM Section 6.2).

10.6 Sample Aliquots

Where sampling (as in obtaining sample aliquots from a submitted sample) is carried out as part of the test method, the laboratory shall use documented procedures and appropriate techniques to obtain representative subsamples.

10.7 Data Verification

Calculations and data transfers are subject to appropriate checks.

a) The laboratory has Standard Operating Procedures that ensure that the reported data are free from transcription and calculation errors.

b) The laboratory has Standard Operating Procedures that ensure that all quality control measures are reviewed, and evaluated before data are reported. Refer to internal Quality Control Checks, Project Management and Analytical Report Review

c) The laboratory has Standard Operating Procedures that address manual calculations including manual integrations. Refer to appropriate SOPs.

10.8 Documentation and Labeling of Standards and Reagents

Documented procedures exist for the purchase, receipt and storage of consumable materials used for the technical operations of the laboratory. Most records are electronically documented in Element LIMS whilke oters may be log book entries with references.

a) The laboratory retains records for all standards, reagents and media including the manufacturer/vendor, the manufacturer’s Certificate of Analysis or purity (if supplied), the date of receipt, recommended storage conditions, and an expiration date after which the material is not used, unless the laboratory verifies its suitability for testing use.

b) Original containers (such as those provided by the manufacturer or vendor) are labeled with an expiration date.

c) Records are maintained on reagent and standard preparation. These records indicate traceability to purchased stocks or neat compounds, reference to the method of preparation, date of preparation, expiration date and preparer's initials.

d) All containers of prepared reagents and standards bear a unique identifier and expiration date and are linked to the documentation requirements in YORKQSM Section 10.8.c above.

10.9 Computers and Electronic Data Related Requirements

Where computers, automated equipment, or microprocessors are used for the capture, processing, manipulation, recording, reporting, storage or retrieval of test data, YORK ensures that:

a) All requirements of the NELAC Standard (i.e., Chapter 5 of NELAC) are met;

b) Computer software is tested and documented to be adequate for use, e.g., internal audits, personnel training, focus point of QA and QC;

c) Procedures are established and implemented for protecting the integrity of data. Such procedures include, but are not limited to, integrity of data entry or capture, data storage, data transmission and data processing;

d) Computer and automated equipment are maintained to ensure proper functioning and provided with the environmental and operating conditions necessary to maintain the integrity of calibration and test data; and,

e) It establishes and implements appropriate procedures for the maintenance of security of data including the prevention of unauthorized access to, and the unauthorized amendment of, computer records.

11.1 SAMPLE HANDLING, SAMPLE ACCEPTANCE POLICY AND SAMPLE RECEIPT

While YORK does not have control of field sampling activities, the following are essential to ensure the validity of the laboratory's data.

11.2 Sample Tracking

a) The laboratory has a documented system for uniquely identifying the items to be tested, to ensure that there can be no confusion regarding the identity of such items at any time. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates. The laboratory assigns a unique identification (ID) code to each sample container received in the laboratory. (The use of container shape, size, or other physical characteristic, such as amber glass, or purple top, is not an acceptable means of identifying the sample.)

b) This laboratory code is maintained as an unequivocal link with the unique field ID code assigned each container.

c) The laboratory ID code is placed on the sample container as a durable label.

d) The laboratory ID code is entered into the laboratory records (see YORKQSM Section 11.3.d) and is the link that associates the sample with related laboratory activities such as sample preparation or calibration.

e) In cases where the sample collector and analyst is the same individual or the laboratory pre-assigns numbers to sample containers, the laboratory ID code may be the same as the field ID code.

11.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy that clearly outlines the circumstances under which samples are accepted or rejected. Data from any samples that do not meet the following criteria are flagged in an unambiguous manner, and the nature of the variation is clearly defined. The sample acceptance policy is available to sample collection personnel and includes, but is not limited to, the following areas of concern:

a) Proper, full, and complete documentation, that includes sample identification, the location, date and time of collection, collector's name, preservation type, sample type and any special remarks concerning the sample;
b) Proper sample labeling that includes a unique identification and a labeling system for the samples with requirements concerning the durability of the labels (water resistant) and the use of indelible ink;
c) Use of appropriate sample containers;
d) Adherence to specified holding times;
e) Adequate sample volume. Sufficient sample volume must be available to perform the necessary tests; and,
f) Procedures to be used when samples show signs of damage, contamination or inadequate preservation.
g) Samples are NOT accepted if classified as extremely hazardous, such as drum waste or neat chemicals.

11.4 Sample Acceptance Policy (Posted)

This sample acceptance policy outlines the circumstances in which received samples are accepted or rejected by York Analytical Laboratories, Inc. (YORK). If any of the below criteria are not met, it may delay YORK's processing of samples, possibly compromising "short" holding time analyses. Where received samples do not meet these criteria, YORK will contact the client.

If immediate client contact cannot be made, and hold times are not an issue, samples will be appropriately stored until the situation is clarified with the client. If a delay in sample processing will result in missed holding times, and YORK deems there is sufficient information provided on the Chain-of-Custody (COC), the lab will proceed with sample log-in and processing; however, YORK will not assume any liability for samples processed under these circumstances.

Data from samples that do not meet the sample acceptance criteria are flagged and/or addressed in a case narrative, with the nature of the deviation clearly defined. Samples must have written authorization to proceed if not in compliance with this guidance.

1. Complete COC with the following information:

   Unique sample identification, date and time of collection, sample matrix, analysis requested, sampler's name, preservation type (if applicable), client name and address, any additional comments, signature of relinquishing party and date and time that samples were relinquished.

2. Sample temperature upon receipt of >0°C to 6°C, as applicable to the method.

   In the event that samples are collected on the same day that they are received by the laboratory, they are deemed acceptable if they are received on ice and the cooling process has begun.

3. Sample containers and preservatives must be appropriate for the test and method being requested on the COC.
4. Sample labels must include a unique identification written with indelible ink on water resistant labels that correspond with the COC.
5. Adequate sample volume must be provided for the analyses requested on the COC, and containers for volatile analyses must be free of headspace. This includes Tedlar bags and Summa canisters.
6. Sufficient holding time available to perform the analyses requested:

   Samples shall be received at the laboratory within 48 hours of sampling, or with at least 1/2 of the holding time left for the analysis, whichever is less. YORK always makes a best effort to ensure that holding times are not exceeded under these circumstances. In the event that a preparation or analysis is performed outside of the associated holding time, the client will be notified and the data will be qualified in the report.

7. Coolers and samples must be received in good condition, with no obvious signs of damage or tampering.
8. Please note, mixed waste, or samples classified as extremely hazardous are **NOT** accepted.

If you require additional information or clarification, please do not hesitate to contact YORK, or your Project Manager at (203) 325-1371.

11.5 Sample Receipt Protocols

a) Upon receipt, the condition of the sample, including any abnormalities or departures from standard condition as prescribed in the relevant test method, is recorded*.* All items specified in YORKQSM Section 11.2 above are checked.

   1) All samples that require cold temperature preservation are considered acceptable if the arrival temperature is within 2°C of the required temperature or the method-specified range. For samples with a specified temperature of 4°C, samples with a temperature ranging from just above the freezing temperature of water to 6°C shall be acceptable. Samples that are hand delivered to the laboratory immediately after collection may not meet these criteria. In these cases, the samples shall be considered acceptable if there is evidence that the chilling process has begun, such as arrival on ice.

2) The laboratory shall implement procedures for checking chemical preservation using readily available techniques, such as pH or free chlorine, prior to or during sample preparation or analysis.

   Certain measurements, such a pH, are performed and recorded just prior to analysis.

   Field filtration for dissolved metals may also be required. If there is no documentation of field filtration on the Chain of Custody when required, the Project Manager is notified and the client asked. If samples are not field filtered, they are sent to the lab for filtration within 24 or 48 hours depending on the analysis.

b) The results of all checks are recorded on Sample Receipt and, as needed, in the Corrective Action field on the login in LIMS.

c) When there is any doubt as to the item's suitability for testing, when the sample does not conform to the description provided, and when the test required is not fully specified, the laboratory makes every attempt to consult the client for further instruction before proceeding. The laboratory establishes whether the sample has received all necessary preparation, or whether sample preparation has yet to be performed. If the sample does not meet the sample receipt acceptance criteria listed in this standard, the laboratory:

   1) Retains correspondence and/or records of conversations concerning the final disposition of rejected samples; or

   2) Fully documents any decision to commence with the analysis of samples not meeting acceptance criteria.

      i. The condition of these samples is, at a minimum, noted on the chain of custody record or transmittal form, and laboratory receipt documents.

      ii. The analysis data is/are appropriately "qualified" on the final report.

d) The laboratory utilizes a permanent chronological electronic database to document receipt of all sample containers.

   1) This sample receipt log records the following:

      i. Client/Project Name;

      ii. Date and time of laboratory receipt;

      iii. Unique laboratory ID code (see YORKQSM Section 11.1); and

      iv. Signature or initials of the person making the entries.

   2) During the login process, the following information is linked to the log record or included as a part of the log. If such information is recorded/documented elsewhere, that document becomes part of the laboratory's permanent records, easily retrievable upon request, and readily available to individuals who will process the sample. Note: The placement of the laboratory ID number on the sample container is not considered a permanent record.

      i. The field ID code that identifies each container is linked to the laboratory ID code in the sample receipt log.
      ii. The date and time of sample collection is linked to the sample container and to the date and time of receipt in the laboratory.
      iii. The requested analyses (including applicable approved test method numbers) are linked to the laboratory ID code.
      iv. Any comments resulting from inspection for sample rejection are linked to the laboratory ID code.

e) All documentation (i.e., memos or transmittal forms) that are conveyed to the laboratory by the sample submitter is retained.

f) A complete chain of custody record form is maintained.

11.6 Storage Conditions

The laboratory has documented procedures and appropriate facilities to avoid deterioration, contamination, and damage to the sample during storage, handling, preparation, and testing; any relevant instructions provided with the item are followed. Where items must be stored or conditioned under specific environmental conditions, these conditions are maintained, monitored, and recorded.

a) Samples are stored according to the conditions specified by preservation protocols:

   1) Samples that require thermal preservation are stored under refrigeration at +/-2° of the specified preservation temperature unless method-specific requirement pre-empt this, such as volatile soil samples using Terracore (frozen). For samples with a specified storage temperature of 4°C, storage at a temperature above the freezing point of water to 6°C is acceptable.

   2) Samples are stored away from all standards, reagents, food, and other potentially contaminating sources. Samples are stored in such a manner to prevent cross contamination. Samples for analysis of volatile organics are stored in separate storage refrigerators/freezers to reduce vross contamination potential.

b) Sample fractions, extracts, leachates, and other sample preparation products are stored according to YORKQSM Section 11.4.a above or according to specifications in the test method.

c) When a sample or portion of a sample needs to be held secure (for example, for reasons of record, safety or value, or to enable check calibrations or tests to be performed later), the laboratory has storage and security arrangements that protect the condition and integrity of the secured items or portions concerned.

11.7 Sample Disposal

The laboratory has standard operating procedures for the disposal of samples, digestates, leachates and extracts or other sample preparation products.

12.1 RECORDS

The laboratory maintains a record system to suit its particular circumstances and comply with any applicable regulations. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the test report for a minimum of five years and for lead and copper in potable water, 12 years.

There are two levels of sample handling: 1) sample tracking and 2) legal chain of custody protocols that are used for evidentiary or legal purposes. All essential requirements for sample tracking (e.g., chain of custody form) are outlined in YORKQSM Sections 12.1, 12.2 and 12.3. YORK details the Legal/Evidentiary and Chain of Custody procedures in the appropriate SOPs.

12.2 Record Keeping System and Design

The YORK record keeping system allows historical reconstruction of all laboratory activities that produced the analytical data. The history of the sample is readily understood through the documentation. This includes inter-laboratory transfers of samples and/or extracts.

a) The records include the identity of personnel involved in sampling, sample receipt, preparation, and calibration or testing.

b) All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification, are documented.

c) The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes, e.g., set format for naming electronic files.

d) All changes to records are signed or initialed by responsible staff. The reason for the signature or initials is clearly indicated in the records such as “sampled by,” “prepared by,” or “reviewed by.”

e) All generated data, except those that are generated by automated data collection systems, are recorded directly, promptly, and legibly in permanent ink.

f) Entries in records are not be obliterated by methods such as erasures, overwritten files or markings. All corrections to record-keeping errors are made by one line marked through the error. The individual making the correction signs (or initials) and dates the correction. These criteria also apply to electronically maintained records.

g) Refer to 10.9 for Computer and Electronic Data.

12.3 Records Management and Storage

a) All records (including those pertaining to calibration and test equipment), certificates and reports are safely stored, and held secure and in confidence to the client. NELAP-related records are available to the accrediting authority.

b) All records, including those specified in YORKQSM Section 12.3, are retained for a minimum of five years from generation of the last entry in the records. The laboratory maintains all information necessary for the historical reconstruction of data. Records stored only on electronic media are supported by the hardware and software necessary for their retrieval. For potable water lead and copper data are retained for 10 years.

c) Records that are stored or generated by computers or personal computers have hard copy or write-protected backup copies.

d) The laboratory has an established record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation storage and reporting.

e) Access to archived information is documented with an access log. These records are protected against fire, theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources.

f) The laboratory has a plan to ensure that the records are maintained or transferred according to the clients’ instructions (see 4.1.8.e of NELAC) in the event of Laboratory Transfer of Ownership, Going out of Business or Bankruptcy. In all cases, appropriate regulatory and state legal requirements concerning laboratory records will be followed.

12.4 Laboratory Sample Tracking

12.4.1 Sample Handling

A record of all procedures to which a sample is subjected while in YORK’s possession is maintained. These include but are not limited to all records pertaining to:

a) Sample preservation, including appropriateness of sample container and compliance with holding time requirement;
b) Sample identification, receipt, acceptance or rejection, and log-in;
c) Sample storage and tracking, including shipping receipts, sample transmittal forms (chain of custody form); and
d) Documentation procedures for the receipt and retention of test items, including all provisions necessary to protect the integrity of samples.

12.4.2 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following is retained:

a) All original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);

b) A written description or reference to the specific test method used, which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;

c) Copies of final reports;

d) Archived standard operating procedures;

e) Correspondence relating to laboratory activities for a specific project;

f) All corrective/preventive action reports, audits and audit responses;

g) Proficiency test results and raw data; and,

h) Results of data review, verification, and cross-checking procedures.

12.4.3 Analytical Records

The essential information associated with analyses, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

a) Laboratory sample ID code;

b) Date of analysis and time of analysis if the method-specified holding time is 72 hours or less, or when time critical steps are included in the analysis, e.g., extractions, and incubations;

c) Instrument identification and instrument operating conditions/parameters (or reference to such data);

d) Analysis type;
e) All manual calculations e.g., manual integrations;

f) Analyst's or operator's initials/signature;

g) Sample preparation including cleanup, separation protocols, incubation periods, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;

h) Sample analysis;

i) Standard and reagent origin, receipt, preparation, and use;

j) Calibration criteria, frequency and acceptance criteria;

k) Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;

l) Quality control protocols and assessment;

m) Electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and,

n) Method performance criteria including expected quality control requirements.

12.4.4 Administrative Records

The following are maintained:

a) Personnel qualifications, experience and training records;

b) Ethics Statements;

c) Records of demonstration of capability for each analyst; and

d) A log of names, initials and signatures for all individuals who are responsible for signing or initialing any laboratory record.

13.0 LABORATORY REPORT FORMAT AND CONTENTS

The results of each test, or series of tests carried out by the laboratory must be reported accurately, clearly, unambiguously and objectively. The results normally reported in a test report and include all the information necessary for the interpretation of the test results and all information required by the method used. Some regulatory reporting requirements or formats, such as monthly operating reports may not require all items listed below, however, YORK will provide all the required information to their client for use in preparing such regulatory reports.

a) Except as discussed in 13.b, each report to an outside client includes at least the following information (those prefaced with "where relevant" are not mandatory):

  1) A title, e.g., "Technical Report";

  2) Name and address of laboratory, and location where the test was carried out if different from the address of the laboratory and phone number with name of contact person for questions;

  3) Unique identification of the certificate or report (such as Work order no.) and of each page, and the total number of pages;

     This requirement may be presented in several ways:

     i. The total number of pages may be listed on the first page of the report as long as the subsequent pages are identified by the unique report identification and consecutive numbers, or

     ii. Each page is identified with the unique report identification, the pages are identified as a number of the total report pages (example: 3 of 10, or 1 of 20).

     Other methods of identifying the pages in the report may be acceptable as long as it is clear to the reader that discrete pages are associated with a specific report, and that the report contains a specified number of pages.

  4) Name and address of client, where appropriate and project name if applicable;

  5) Description and unambiguous identification of the tested sample including the client identification code;

  6) Identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature;

  7) Date of receipt of sample, date and time of sample collection, date(s) of performance test, and time of sample preparation and/or analysis if the required holding time for either activity is less than or equal to 72 hours;

  8) Identification of the test method used, or unambiguous description of any nonstandard method used;

  9) If the laboratory collected the sample, reference to sampling procedure;

  10) Any deviations from (such as failed quality control), additions to or exclusions from the test method (such as environmental conditions), and any nonstandard conditions that may have affected the quality of results, and including the use and definitions of data qualifiers.

11) Measurements, examinations and derived results, supported by tables, graphs, sketches, and photographs as appropriate, and any failures identified; identify whether data are calculated on a dry weight or wet weight basis; identify the reporting units such as µg/l or mg/kg;

12) When required, a statement of the estimated uncertainty of the test results;

13) A signature and title, or an equivalent electronic identification of the person(s) accepting responsibility for the content of the report (however produced), and date of issue;

14) At the YORK's discretion, a statement to the effect that the results relate only to the items tested or to the sample as received by the laboratory;

15) At the YORK's discretion, a statement that the certificate or report shall not be reproduced except in full, without the written approval of the laboratory;

16) Clear identification of all test data provided by outside sources, such as subcontracted laboratories, clients, etc.; and

17) Clear identification of numerical results with values outside of quantitation limits.

b) Where the certificate or report contains results of tests performed by subcontractors, these results are clearly identified by subcontractor name or applicable accreditation number and the entirety of the subcontract report is included with the final YORK report.

c) After issuance of the report, the laboratory report remains unchanged. Material amendments to a calibration certificate, test report or test certificate after issue may be made only in the form of a further document, or data transfer, including the statement "Revision No. . . . [or as otherwise identified]" with explanation, or equivalent form of wording. Such amendments meet all the relevant requirements of the NELAC Standard.

d) YORK notifies clients promptly, in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any calibration certificate, test report or test certificate or amendment to a report or certificate.

e) The laboratory will, where clients require transmission of test results by telephone, telex, facsimile or other electronic means, follow documented procedures that ensure that the requirements of this Standard are met and that confidentiality is preserved.

f) YORK will certify that all its NELAC-certified test results reported meet all requirements of NELAC or provide reasons and/or justification if they do not.

14.0 SUBCONTRACTING ANALYTICAL SAMPLES

When YORK subcontracts work whether because of unforeseen circumstances (e.g. workload, need for further expertise or temporary incapacity) or on a continuing basis (e.g. through client direction, contractual arrangement or permanent subcontracting), this work shall be placed with a laboratory accredited under NELAP, or other appropriate certification, for the tests to be performed or with a laboratory that meets applicable statutory and requirements for performing the tests and submitting the results of tests performed. All subcontracted work shall be referenced and so noted in the final YORK analytical report.

Subcontract laboratories will provide or make available, current copies of the following documents prior to YORK submitting samples. This information will be updated annually or on an as needed basis.

a) Laboratory accreditations / certifications

b) Upon request, any Proficiency Testing (PT) or Performance Evaluation (PE) results relevant to the subcontracted samples.

c) Insurance Certificates

d) Quality Assurance Manual

e) Subcontract laboratories will also submit statements affirming that YORK will be notified if any of the following occur.

  - There is a change or loss in accreditation for the applicable analysis.
  - Most recent PT or PE study results for the applicable analysis are unacceptable *AND* are not able to be addressed via Corrective Action.
  - There is a need to subcontract YORK project samples. Prior YORK approval is required in writing for subcontracting samples.

f) The client project requirements will be used to evaluate the subcontract laboratories and to determine their acceptability. Approval by either: the QA Manager, Laboratory Manager or Client Services Director (or designee) is required.

g) A master list of approved laboratories will be created and distributed to Sample Control and all Project Managers. All subcontracting must utilize a laboratory from this list.

The procedure for subcontracting samples will follow these guidelines:

a) YORK will advise its client via written, facsimile or e-mail notification of its intention to subcontract any portion of the testing to another party in cases when unforeseen circumstances occur. YORK shall gain approval by the client in writing, facsimile or via e-mail response.

b) YORK may subcontract samples on a continuing basis without written, facsimile or e-mail notification under the following (but not limited to) cases:

  - Standing Client direction or instruction
  - Contractual specification or requirement
  - Project historical precedent

c) A separate Chain of Custody will be created specifically for the subcontracted sample(s). This (or a copy) will be included with the full and complete subcontract report in the final YORK analytical report.

d) YORK shall retain records demonstrating that the above requirements have been met.

15.0 OUTSIDE SUPPORT SERVICES AND SUPPLIES

YORK does not procure outside services and supplies, other than those referred to in this Manual.

Service providers and vendors are evaluated in accordance with ISO/IEC 17025:2005 or ISO 9001 guidelines prior to use by YORK with detailed vendors listed in each SOP.

16.0 INQUIRIES AND COMPLAINTS

York’s SOP addresses the policies and procedures for the resolution of inquiries and complaints received from clients or other parties about the laboratory's activities. Where an inquiry or complaint, or any other circumstance, raises doubt concerning the laboratory's compliance with the laboratory's policies or procedures, or with the requirements of this manual or otherwise concerning the quality of the laboratory's calibrations or tests, the laboratory shall ensure that those areas of activity and responsibility involved are promptly audited in accordance with NELAC Section 5.3.1. Records of the complaint and subsequent actions are maintained and are available for audits.

17.0 REVIEW OF WORK REQUESTS, CONTRACTS AND TENDERS

YORK has established procedures for the review of work requests contracts and tenders. Projects, proposals and contracts are reviewed for adequately defined requirements and the ability of YORK to meet those requirements. A thorough review of all technical and quality control requirements contained in these requests is performed to ensure a project's success. The appropriateness of requested methods, and the lab's capability to perform them must be established. A review of the laboratory's capability to analyze non-routine analytes is also part of this review process. Additionally, alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, detection and reporting levels, and quality control limits. During the review process, the laboratory determines whether it has the necessary physical, personnel and information resources to meet the project requirements, and if the personnel have the expertise needed to perform the required testing. Each proposal is also checked for its impact on the overall capacity of the laboratory. The proposed turnaround time will be checked for feasibility. Electronic or hard copy deliverable requirements are evaluated against the laboratory's ability to produce such documentation.

This review process ensures that the laboratory's test methods are suitable to achieve regulatory and/or client requirements and that the laboratory holds the appropriate certifications to perform the work. In the event that the use of a subcontract laboratory is needed, also confirming that they meet all project requirements and maintain the appropriate certifications for the proposed subcontract analyses. If the laboratory cannot provide all services and therefore intends to use the services of a subcontract laboratory, this will be documented and discussed with the client prior to project or contract approval.

Following the review process, the laboratory (Client Services) informs the client of the results of the review and notes any potential conflict, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the capability of the laboratory to meet those requirements is resolved in writing before acceptance of the project or contract. It is necessary that the project requirements or contract be acceptable to both the client and the laboratory prior to the start of the work. The review process is repeated when there are amendments to the original contract by the client.

All contracts, Quality Assurance Project Plans (QAPPs), contract amendments, and documented communications become part of the project record.

Review Personnel

Depending upon the scope of a project or contract, one or more key persons may review and accept work on behalf of the laboratory. For routine projects, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has the necessary certifications, that it can meet the clients' data quality, reporting and turn-around time requirements.

For new, complex or large projects, the proposed project proposal or contract is given to the Business Development Director and/or Client Services Director for an initial review that encompasses all facets of the operation. The scope of work is then distributed to the following personnel, as needed based on scope of contract, to evaluate all of the project related requirements:

- Chief Technology Officer
- Laboratory Manager
- Technical Director (s)
- Quality Assurance Officer
- Group Leaders
- Project Manager(s)

Appropriate records are maintained for every contract or work request. Copies of the agreed-upon contract will be distributed to key personnel as needed and the signed copies maintained by the Business Development Director and/or Laboratory Manager(s).

Project Kick-off and Status Meetings

For routine project work, project managers ensure that specific technical and QC requirements are effectively evaluated and communicated to laboratory personnel through the use of the LIMS system: special requirements/Comments section in the appropriate work order field. These comments then appear on the lab staff worklists for implementation.

Prior to work on a new or complex project, project managers or key personnel will hold meetings via Zoom with operations personnel to discuss schedules and any unique aspects of the project. Items discussed include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, and any other special requirements.

Project requirements are given to the laboratory staff during project kick-off meetings or the daily status meetings. Information disseminated during these meetings provides direction to the laboratory staff in order to maximize production, maintain high quality and ensure client satisfaction.

During the project, changes to the scope of work may occur due to client, sampling or regulatory reasons. If these changes impact the laboratory's role in the project (use of a non-standard method or modification of a method to comply with revised requirements) then the changes need to be discussed with and agreed upon with the client prior to continuing with the work. These changes must be documented prior to implementation and communicated to the laboratory staff via email, zoom meeting or via the Laboratory Manager.

And at all times, records of all pertinent discussions with a client relating to the project or contract are documented and maintained as a part of the project record using the "Other Documents" in the work Order LIMS field.

18.0 MANAGEMENT REVIEW, MANAGEMENT OF CHANGE AND CONTINUOUS IMPROVEMENT

Management Review

A comprehensive Management Review of the entire YORK Quality System will be conducted by the Laboratory Managers on an annual basis, no later than the end of the first quarter for the previous year's review. All major stakeholders will be given an opportunity to provide comment or input for the review. These will include:

- Chief Technology Officer
- Client Services Director
- Lab Managers
- Technical Directors
- Senior Project Managers
- Other Operational / Project Management personnel as appropriate.
- Clients

The purpose and goal of the Management Review will identify areas of improvement, areas requiring more resources or oversight, opportunities for continuous improvement and follow up on previous recommendations.

The final completed review is part of the NELAP laboratory documentation requirements and may be submitted to YORK authorized auditing agencies or clients upon request.

18.1 Management of Change

Whenever a change is made in a controlled environment (not just production) the laboratory is put at risk. However, one needs to constantly make changes to keep pace with business / regulatory requirements. The challenge to the laboratory is to minimize the risk and impact of that change.

An organization must have an operating process in place for which an evaluation has been conducted, and that allows proper lead times and approvals to ensure that the laboratory is unaffected when changes are made. But to successfully implement a change, one also needs to have a comprehensive understanding of the infrastructure that supports the services to determine the overall impact.

The Management of Change process will track and implement the following types of changes:

a) Permanent Change: – A change that is considered long term and durable. Any change which is not categorized as a Temporary Change.
b) Temporary Change: – A change which has a defined lifetime and which will be removed before a defined date (usually no more than six months).
c) Emergency Change: – An emergency change path that allows the change to be implemented and commissioned immediately in order to address an immediate safety, operational, health, environmental, or product quality situations.

The functional categories that will be managed include:
a) Laboratory Facility Acquisition
b) Laboratory Instrument Acquisition
c) Analytical Method Development and Validation
d) Laboratory Operations Process Change
e) Department Relocation
f) Activation of Analytical Method
g) Information Technology (Major Initiatives)
h) New Accreditation or Certification

18.2 Continuous Improvement

In order for YORK to be proactive and a leader in the industry, the entire YORK Quality system is designed to ensure the production of scientifically sound, legally defensible data of known and proven quality. The addition of the Management Review and Management of Change processes enhances YORK's ability to foster continuous improvement.

Continuous improvement is an ongoing effort to improve data integrity, services or processes. These efforts can seek "incremental" improvement over time or "breakthrough" improvement all at once. All staff at YORK participates in continuous improvement, from the Chief Technology Officer down to the beginning technician, as well as external stakeholders when applicable.

The following procedures / inputs have direct involvement in the continuous improvement process:
a) External Audits (Regulatory and Client Based)
b) Internal Audits
c) Corrective / Preventive Actions
d) Statistical Quality Control (SQC) Monitoring
e) Proficiency Testing Performance
f) Client Feedback – Complaints and Commendations
g) Management Review
h) Management of Change

The Management of Change process will guide and document the major improvements. The Corrective / Preventive Action procedure will enable and record the more incremental changes.
The principal elements are commitment to quality, focused effort, involvement of all employees, willingness to change, and communication.

NELAC APPENDICES

APPENDIX A - REFERENCES

NELAC Standards, Chapters 1-6., Effective July 01, 2016

40 CFR Part 136, Appendix A, paragraphs 8.1.1 and 8.2.

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EPA/503/8-91/001 Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual. Office of Water, Washington, DC, 1991.

EPA/600/4-90/031 Manual for Evaluation of Laboratories Performing Aquatic Toxicity Tests, Office of Research and Development, Washington, DC, 1991.

EPA/600/3-88/029 Protocol for Short-term Toxicity Screening of Hazardous Wastes, Office of Research and Development, Washington, DC, 1991.

EPA/600/4-90/027F Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 4th Ed., Office of Research and Development, Washington, DC, 1993.

EPA/823/B-98/004 Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Inland Testing Manual. Office of Water, Washington, DC, 1994.

"Glossary of Quality Assurance Terms and Acronyms," Quality Assurance Division, Office of Research and Development, USEPA.

"Guidance on the Evaluation of Safe Drinking Water Act Compliance Monitoring Results from Performance Based Methods," September 30, 1994, Second draft.

ISO/IEC 17025: 2005. General requirements for the competence of calibration and testing laboratories. "

Manual for the Certification of Laboratories Analyzing Drinking Water, Revision 4, EPA 815-B-97-001.

Performance Based Measurement System, EPA EMMC Method Panel, PBMS Workgroup, 1996.

APPENDIX B - GLOSSARY

The following definitions are used in the text of Quality Systems. In writing this document, the following hierarchy of definition references was used: ISO 8402, ANSI/ASQC E-4, EPA's Quality Assurance Division Glossary of Terms, and finally definitions developed by NELAC. The source of each definition, unless otherwise identified, is the Quality Systems Committee.

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority: The Territorial, State, or Federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation. (NELAC) [1.5.2.3]

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analysis Duplicate: The second measurement of the target analyte(s) performed on a single sample or sample preparation.

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Analytical Reagent (AR) Grade: Designation for the high purity of certain chemical reagents and solvents given by the American Chemical Society. (Quality Systems)

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NELAC). (NELAC)

Audit: A systematic evaluation to determine the conformance to quantitative and qualitative spYorkfications of some operational function or activity. (EPA-QAD)

Batch: Environmental samples, which are prepared and/or analyzed together with the same process and personnel using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Blind Sample: A sub-sample for analysis with a composition known to the submitter. The analyst/ laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process. (NELAC)

Calibration: To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Curve: The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method: A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard: A substance or reference material used to calibrate an instrument. (QAMS)

Certified Reference Material (CRM): A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30 - 2.2)

Chain of Custody Form: A record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses. (NELAC)

Compromised Samples: Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions compromised samples are not analyzed. If emergency situations require analysis, the results must be appropriately qualified. (NELAC)

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

- Second column confirmation;
- Alternate wavelength;
- Derivatization;
- Mass spectral interpretation;
- Alternative detectors; or
- Additional cleanup procedures. (NELAC)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ ASQC E4-1994)

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet spYorkfied acceptance criteria). (NELAC)

Data Reduction: The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate acceptable accuracy. (NELAC)

Desorption Efficiency: The mass of target analyte recovered from sampling media, usually a sorbent tube, divided by the mass of target analyte spiked on to the sampling media expressed as a percentage. Sample target analyte masses are usually adjusted for the desorption efficiency. (NELAC)

Detection Limit: The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

Document Control: The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed. (ASQC)

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA- QAD)

Holding Times (Maximum Allowable Holding Times): The maximum times that samples may be held prior to analysis and still be considered valid or not compromised. (40 CFR Part 136)

Inspection: An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ ASQC E4-1994)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method. (NELAC)

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Laboratory: A body that calibrates and/or tests. (ISO 25)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst-spYorkfic prYorksion and bias or to assess the performance of all or a portion of the measurement system. (NELAC)

Laboratory Duplicate: Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Limit of Detection (LOD): Limit of Detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate (Type II error) is 1%. (NELAC)

Limit of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. (NELAC)

Manager (however named): The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

- Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
- Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.
- Non-aqueous Liquid: Any organic liquid with <15% settleable solids.
- Solids: Includes soils, sediments, sludges and other matrices with >15% settleable solids.
- Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.
- Air: Whole gas or vapor samples including those contained in flexible or rigid wall containers.

Matrix Spike (spiked sample or fortified sample): A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precsion of the recovery for each analyte.

May: Denotes permitted action, but not required action. (NELAC)

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit: The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136 Appendix B)

Must: Denotes a requirement that must be met.

National Accreditation Database: The publicly accessible database listing the accreditation status of all laboratories participating in NELAP. (NELAC)

National Environmental Laboratory Accreditation Conference (NELAC): A voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP): The overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

Objective Evidence: Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measures, or tests that can be verified. (ASQC)

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS): A set of processes wherein the data quality needs, mandates or limitations of a program or project are spYorkfied and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within spYorkfied acceptance criteria. (QAMS)

Protocol: A detailed written procedure for field and/or laboratory operation (e.g., sampling, and analysis) which must be strictly followed. (EPA- QAD)

Pure Reagent Water: Shall be water (defined by national or international standard) in which no target analytes or interferences are detected as required by the analytical method. (NELAC)

Quality Assurance: An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

Quality Assurance (Project) Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EPA-QAD)

Quality Control: The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample: An uncontaminated sample matrix with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (EPA-QAD)

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. (ANSI/ ASQC E-41994)

Quantitation Limits: Levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported at a spYorkfic degree of confidence. (NELAC)

Range: The difference between the minimum and the maximum of a set of values. (EPA-QAD)

Raw Data: Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include computer printouts and recorded data from automated instruments. If exact copies of raw data have been prepared.

Reagent Blank (method reagent blank): A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions. (EPA-QAD)

Reference Material: A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30- 2.1)

Reference Method: A method of known and documented accuracy and prYorksion issued by an organization recognized as competent to do so. (NELAC)

Reference Standard: A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.08)

Reference Toxicant: The toxicant used in performing toxicity tests to indicate the sensitivity of a test organism and to demonstrate the laboratory's ability to perform the test correctly and obtain consistent results (see Chapter 5, Appendix D, Section 2.1.f). (NELAC)

Replicate Analyses: The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Requirement: Denotes a mandatory specification; often designated by the term "shall". (NELAC)

Sampling Media: Material used to collect and concentrate the target analytes(s) during air sampling such as solid sorbents, filters, or impinger solutions.

Selectivity: (Analytical chemistry) The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Shall: Denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled. (ANSI)

Should: Denotes a guideline or recommendation whenever noncompliance with the specification is permissible. (ANSI)

Spike: A known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes. (NELAC)

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard Operating Procedure (SOP): A written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Standardized Reference Material (SRM): A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Supervisor (however named): The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses. (NELAC)

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes. (QAMS)

Systems Audit (also Technical Systems Audit): A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Director: Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

Test: A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method: An adoption of a scientific technique for a specified measurement problem, as documented in a laboratory SOP. (NELAC)

Testing Laboratory: Laboratory that performs tests. (ISO/ IEC Guide 2 - 12.4)

Test Sensitivity/Power: The minimum significant difference (MSD) between the control and test concentration that is statistically significant. It is dependent on the number of replicates per concentration, the selected significance level, and the type of statistical analysis (see Chapter 5, Appendix D, Section 2.4.a). (NELAC)

Traceability: The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM - 6.12)

Validation: The process of substantiating specified performance criteria. (EPA- QAD)

Verification: Confirmation by examination and provision of evidence that spYorkfied requirements have been met. (NELAC)

NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell: A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

Sources:

- American Society for Quality Control (ASQC), Definitions of Environmental Quality Assurance Terms, 1996
- American National Standards Institute (ANSI), Style Manual for Preparation of Proposed American National Standards, Eighth Edition, March 1991
- International Standards Organization (ISO) Guides 2, 30, 8402
- International Vocabulary of Basic and General Terms in Metrology (VIM): 1984. Issued by BIPM, IEC, ISO
- National Institute of Standards and Technology (NIST)
- 40 CFR Part 31

APPENDIX C - DEMONSTRATION OF CAPABILITY

C.1 PROCEDURE FOR DEMONSTRATION OF CAPABILITY

A demonstration of capability (DOC) must be made prior to using any test method, and at any time there is a change in instrument type, personnel or test method. (See NELAC 10.2.1.)

Note: Where tests are performed by specialized “work cells” (a well-defined group of analysts that together perform the method analysis), the work cell as a unit meets the above criteria and this demonstration is fully documented.

In general, this demonstration does not test the performance of the method in real world samples, but in the applicable and available clean matrix (a sample of a matrix in which no target analytes or interferences are present at concentrations that impact the results of a specific test method), e.g., water, solids and air. However, before any results are reported using this method, actual sample spike results may be used to meet this standard, i.e., at least four consecutive matrix spikes within the last twelve months. In addition, for analytes that do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples.

All demonstrations shall be documented through the use of the form in this appendix.

The following steps, which are adapted from the EPA test methods published in 40 CFR Part 136, Appendix A, are performed if required by mandatory test method or regulation. Note: For analytes for which spiking is not an option and for which quality control samples are not readily available, the 40 CFR approach is one way to perform this demonstration. The laboratory documents that other approaches to DOC are adequate, and this is documented in the laboratory’s Quality Manual.

a) A quality control sample is obtained from an outside source. If not available, the QC sample may be prepared by the laboratory using stock standards that are prepared independently from those used in instrument calibration.

b) The analyte(s) is diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified, or if unspecified, to a concentration approximately 10 times the method-stated or laboratory-calculated method detection limit.

c) At least four aliquots are prepared and analyzed according to the test method either concurrently or over a period of days.

d) Using all of the results, the mean recovery ($\overline{X}$) is calculated in the appropriate reporting units (such as µg/L) and the standard deviations of the population sample (n-1) (in the same units) for each parameter of interest. When it is not possible to determine mean and standard deviations, such as for presence/absence and logarithmic values, the laboratory will assess performance against established and documented criteria.

e) Compare the information from (d) above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory-generated acceptance criteria (if there are no established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples may begin. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

f) When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to 1) or 2) below.

1) Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with c) above.

2) Beginning with c) above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with c).

C.2 CERTIFICATION STATEMENT

The following certification statement shall be used to document the completion of each demonstration of capability. A copy of the certification statement shall be retained in the personnel records of each affected employee (see YORKQSM Section 6.3 and 12.3.4.b.).

Demonstration of Capability
Certification Statement

Date: Page of ___
Laboratory Name:
Laboratory Address:
Analyst(s) Name(s):

Matrix: ___________
Examples: laboratory pure water, soil, air, solid)

Method number, SOP#, Rev #, and Analyte, or Class of Analytes or Measured Parameters:
_________________ (examples: barium by 200.7, trace metals by 6010, benzene by 8021, etc.)

We, the undersigned, CERTIFY that:

1. The analysts identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

2. The test method(s) was performed by the analyst(s) identified on this certification.

3. A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.

4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory (1).

5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

Technical Director's Name and Title	Signature	Date
Quality Assurance Officer's Name	Signature	Date

This certification form must be completed each time a demonstration of capability study is completed.

(1) True: Consistent with supporting data.
Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.
Complete: Includes the results of all supporting performance testing.
Self-explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation.

(Note: Form may be modified so long as the essential items are included in the revised form)

APPENDIX D - ESSENTIAL QUALITY CONTROL REQUIREMENTS

The quality control protocols specified by the laboratory's method manual (10.1.2) shall be followed. The laboratory shall ensure that the essential standards outlined in Appendix D are incorporated into their method manuals.

All quality control measures shall be assessed and evaluated on an ongoing basis and quality control acceptance criteria shall be used to determine the validity of the data. The laboratory shall have procedures for the development of acceptance/rejection criteria where no method or regulatory criteria exists.

The requirements from the body of Chapter 5, e.g., Section 5.4, apply to all types of testing. The specific manner in which they are implemented is detailed in each of the sections of this Appendix, i.e., chemical testing.

D.1 CHEMICAL TESTING

D.1.1 Positive and Negative Controls

a) Negative Controls

1) Method Blanks - Shall be performed at a frequency of one per preparation batch of samples per matrix type. The results of this analysis shall be one of the QC measures to be used to assess the batch. The source of contamination must be investigated and measures taken to correct, minimize or eliminate the problem if

   i) the blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated sample batch or

   ii) the blank contamination exceeds the concentration present in the samples and is greater than 1/10 of the specified regulatory limit.

Any sample associated with the contaminated blank shall be reprocessed for analysis or the results reported with appropriate data qualifying codes.

b) Positive Controls

1) Laboratory Control Sample (LCS) - (QC Check Samples) Shall be analyzed at a minimum of 1 per preparation batch of 20 or less samples per matrix type, except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to assess the batch. NOTE: The matrix spike (see 2 below) may be used in place of this control as long as the acceptance criteria are as stringent as for the LCS.

      a. The NELAC requirements (2009 Standard, Section 1.7.4.2 b) allow the usage of LCS Marginal Exceedance control limits for those analyses with multiple reporting analytes.
      b. The NELAC standards state that if a large number of analytes are in the LCS, it becomes statistically likely that a few will be outside control limits. This may not indicate that the system is out of control; therefore, corrective action may not be necessary. Upper and lower marginal exceedance (ME) limits can be established to determine when corrective action is necessary. ME is defined as being beyond the LCS control limit but within the ME limits. ME limits are between 3 and 4 standard deviations around the mean.
      c. The number of allowable marginal exceedance is based on the number of analytes in the LCS. If there is any analyte that exceed the LCS control limits, it does not necessary mean the LCS fails. The NELAC standard states if the number of analytes fails LCS control limits but is within the ME limits, it is acceptable.

2) Matrix Spikes (MS) - Shall be performed at a frequency of one out of every 20 samples per matrix type prepared over time, except for analytes for which spiking solutions are not available such as, total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike.

3) Surrogates - Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with the sample composition and shall be reported to the client whose sample produced the poor recovery.

4) If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene, and PCBs in Method 608), the test method has an extremely long list of components or components that are incompatible, a representative number (minimum of 10%) of the listed components may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit-specified analytes, and other client-requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

D.1.2 Analytical Variability/Reproducibility

Matrix Spike Duplicates (MSDs) or Laboratory Duplicates - Shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. The laboratory shall document its procedure to select the use of appropriate type of duplicate. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate.

D.1.3 Method Evaluation

In order to ensure the accuracy of the reported result, the following procedures shall be in place:

a) Demonstration of Analytical Capability - (Section 10.5) shall be performed initially (prior to the analysis of any samples) and with a significant change in instrument type, personnel, matrix or test method.

b) Calibration - Calibration protocols specified in Section 9.4 shall be followed.

c) Proficiency Test Samples - The results of such analyses (4.2.j or 5.3.4) shall be used by the laboratory to evaluate the ability of the laboratory to produce accurate data.

D.1.4 Analytical Measurement Uncertainty Estimation

Uncertainty is “a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand” (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1).

Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. For environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error.

Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to have a Gaussian distribution, and be reducible by increasing the total number of measurements.

Knowledge of the uncertainty of a measurement provides additional confidence in the validity of a result as its value accounts for all the factors which could possibly affect the result. Certain test methods will specify limits to the values of sources of uncertainty of measurement (EPA 500 series methods, etc.) and will specify the form of presentation of calculated results.

When the method makes these stipulations, there is no need to provide a mechanism for calculating the uncertainty. Where this information is not provided within a method or other regulatory device, the uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte because LCS recoveries incorporate all of the laboratory-related variables associated with a given test over time. It is recognized that other approaches exist; however, YORK's standard for estimating analytical data uncertainty uses this approach.

D.1.4.1 Using the Laboratory Control Sample (LCS) to Estimating Analytical Uncertainty

a) The estimated measurement uncertainty can be expressed as a range (±) around the reported analytical results at a specified confidence level. For methods that use statistically-derived LCS control limits based on historical LCS recovery data to assess the performance of the measurement system, these limits are considered an estimate of the minimum laboratory contribution to measurement uncertainty at a 99% confidence interval, The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

- Uncertainty values may be reported for specific projects upon request. In absence of alternate client-specified approaches or confidence levels,

  YORK will use the following procedure:

  > To calculate the uncertainty value of a reported analytical result, the lower uncertainty range value is calculated by subtracting the product of the result and the lower LCS percent recovery from the result; and the upper uncertainty value result is calculated by adding the product of the result and the upper LCS percent recovery.
  >
  > These calculated values represent approximately a 99% confidence level. In other words, approximated 99% of the measured values for the analyte will fall within this calculated range.

- Example: If the reported result is 1.0 mg/l, and the LCS percent recovery range is 75 to 125%. The uncertainty range would be 0.75 to 1.25 mg/l, which could also be written as 1.0 +/- 0.25 mg/l.

- The Laboratory Quality and Accreditation Office has made available to the public both a spreadsheet that calculates analytical measurement uncertainty and an SOP describing how to use it. This SOP applies to test methods that are within the scope of ISO/IEC 17025-1999 Standard: General Requirements for the Competence of Testing and Calibration Laboratories and it is based on the general rules outlined in Guide to the Expression of Uncertainty in Measurement (GUM).

  The spreadsheet provides a QC-based nested approach for estimating measurement uncertainty using laboratory generated calibration and QC spike results

D.1.4.2 Additional Components to Estimating Analytical Uncertainty

When estimating analytical measurement uncertainty, all significant components of uncertainty must be identified and quantified. Components that affect analytical measurement uncertainty include sampling, handling, transport, storage, preparation and testing. A typical environmental laboratory will have the greatest contribution to uncertainty in the storage, preparation and testing portion of the analytical train, hence the estimation can be limited to those three areas, assuming all other factors are within recommended guidelines for sample size, container type, preservation (chemical, temperature, temporal) and handling/transport. If the latter are *NOT* within guidelines then these additional estimations of variability must be accounted for, and may supersede the laboratory contribution to uncertainty.

Definitive references and procedural manuals for calculating Analytical Measurement Uncertainty are listed below. Note that there are different theories on the "best" way to estimate uncertainty, it is up to the end user to determine that which best meets their project needs.

a) “Environmental Analytical Measurement Uncertainty Estimation – Nested Hierarchical Approach”, William Ingersoll, Defense Technical Information Center # ADA396946, 2001

b) “Quantifying Uncertainty in Analytical Measurement”, EuraChem / CITAC Guide CG 4, Second Edition, QUAM 2000.1

c) “Quantifying Measurement Uncertainty in Analytical Chemistry – A Simplified Practical Approach”, Thomas W. Vetter, National Institute of Standards and Technology

d) ISO Guide to the Expression of Uncertainty in Measurement (GUM), 1993

e) “Estimation of Analytical Measurement Uncertainty - Laboratory Quality and Accreditation Office Uncertainty Calculator Standard Operating Procedure. Downloaded from http://www.denix.osd.mil/edqw/upload/UNCERTAINTY-SOP.PDF, 2013

f) QC-based Nested Approach for Estimating Measurement Uncertainty Spreadsheet, Microsoft Excel Spreadsheet, Ingersoll, William Stephen, 2002

The process in general involves the following steps:

1. Specify the Measurand – Write down a clear statement of what is being measured, including the relationship between the measurand and the input quantities, i.e., measured quantities, constants, calibration standard values, etc.

2. Identify uncertainty sources – This will include sources that contribute to the uncertainty on the parameters in the relationships identified in step 1, but may include other sources and must include sources arising from chemical assumptions.

3. Quantify uncertainty components – Measure or estimate the size of the uncertainty component associated with each potential source of uncertainty identified. It is often possible to estimate or determine a single contribution to uncertainty from the aggregate of multiple sources.

4. Calculate combined uncertainty – The information obtained in step 3 will consist of a number of quantified contributions to overall uncertainty, whether associated with individual sources or with the combined effects of several sources.

The process outlined above relates to the measurement of uncertainty for the preparative / analytical laboratory procedure. However, there are uncertainty contributions from other factors outside the preparative / analytical procedure. These can be controlled to a great extent by specifying uniform and standardized training or conditions.

Examples: Human Factors

a) All personnel at YORK undergo documented training in the method and / or instrument used. Minimum levels of education or experience are required.

b) Initial and continuing Demonstrations of Capability (DOC) must be performed and documented prior to and in continuance of analytical work related to their areas of responsibilities.

c) Blind Proficiency Testing samples are analyzed twice a year to gauge each department, matrix and method.

d) Data Integrity and Ethics Training are provided to new employees and on an annual basis to all employees.

Accommodation and Environmental Conditions

a) YORK has standardized operating procedures for transport, storage and tracking of samples, extracts and digests throughout the laboratory. All incoming orders are logged into a Laboratory Information System that assigns a specific identifier code to each work order, sample container and analytical result.

b) The sample control areas are secured with restricted access using card key portals. Internal chain of custody is available if the project requires.

c) The laboratory has over 13,000 sq ft of laboratory space with temperature controlled and air positive or negative environmental controls.

d) Regular safety inspections are performed to identify potentially hazardous conditions and to ensure general cleanliness.

Environmental Test Methods and Method Validation

a) All methods in use have Standard Operating Procedures (SOPs) based upon published methods from the EPA, ASTM, Standard Methods or other established body. These are controlled documents assigned to each department. An annual review is performed.

b) Each method has internal and external quality control criteria for preparative efficiency, instrument performance, calibration, continuing method performance and possible matrix effects as appropriate.

c) Ongoing Proficiency Testing program.

Equipment and Instrumentation

a) Each instrument in use has performance parameters that must be evaluated to specific standards based on the established method prior to any analytical use.

b) Routine and preventative maintenance is performed to maintain optimum operational performance.

c) Complex instrument systems are covered under manufacturer service contracts as appropriate.

Measurement Traceability

a) Every reagent used must meet the indicated purity and fitness for usage as referenced in the method SOPs.

b) All calibration standards are certified by the manufacturer to meet or exceed purity levels as recorded in the accompanying Certificate of Traceability to NIST or other standards verification.

c) Each reagent, standard or working standard is recorded, assigned a tracking identifier. This is referenced in the analytical log book as needed to assure traceability to the original source.

d) All Balances, Dispensers, Pipettors, Refrigerators, Freezers and Thermometers are checked on a daily or other routine basis to specified tolerances.

D.1.5 Detection Limits

The laboratory shall utilize a test method that provides a detection limit that is appropriate and relevant for the intended use of the data. Detection limits shall be determined by the protocol in the mandated test method or applicable regulation, e.g., Reporting Limit and or Method Detection Limit (MDL). If the protocol for determining detection limits is not specified, the selection of the procedure must reflect instrument limitations and the intended application of the test method.

a) A detection limit study is not required for any component for which spiking solutions or quality control samples are not available such as temperature.

b) The detection limit shall be initially determined for the compounds of interest in each test method in a matrix in which there are not target analytes nor interferences at a concentration that would impact the results or the detection limit must be determined in the matrix of interest (see definition of matrix).

c) Detection limits must be determined each time there is a change in the test method that affects how the test is performed, or when a change in instrumentation occurs that affects the sensitivity of the analysis.

d) All samples processing steps of the analytical method shall be included in the determination of the detection limit.

e) All procedures used must be documented. Documentation must include the matrix type. All supporting data must be retained.

f) The laboratory must have established procedures to relate detection limits with quantitation limits.

g) The test method's quantitation limits must be established and must be above the detection limits.

D.1.6 Data Reduction

The procedures for data reduction, such as use of linear regression or Quadratic regression shall be documented.

D.1.7 Quality of Standards and Reagents

a) The source of standards shall comply with 9.3.

b) Reagent Quality, Water Quality and Checks:

  1) Reagents - In methods where the purity of reagents is not specified, analytical reagent grade (ACS) shall be used. Reagents of lesser purity than those specified by the test method shall not be used. The labels on the container should be checked to verify that the purity of the reagents meets the requirements of the particular test method. Such information shall be documented.

  2) Water - The quality of water sources shall be monitored and documented and shall meet method specified requirements.

  3) The laboratory will verify the concentration of titrants in accordance with written laboratory procedures.

D.1.8 Selectivity

a) Absolute retention time and relative retention time aid in the identification of components in chromatographic analyses and to evaluate the effectiveness of a column to separate constituents. The laboratory shall develop and document acceptance criteria for retention time windows.

b) The laboratory shall document acceptance criteria for mass spectral tuning.

D.1.9 Constant and Consistent Test Conditions

a) The laboratory shall assure that the test instruments consistently operate within the specifications required of the application for which the equipment is used.

b) Glassware Cleaning - Glassware shall be cleaned to meet the sensitivity of the test method.

   Any cleaning and storage procedures that are not specified by the test method shall be documented in laboratory records and SOPs.

D.1.10 Method Validation – Modified Procedures, Non-Standard Methods, Additional Analytes

Often times, modifications to published methods are promulgated to allow the laboratory flexibility, increased productivity and, in some cases, it allows for better hazardous waste management, all while maintaining the quality of the data generated. But, this cannot be done without following standard method validation procedures to guarantee that the results achieved from the modified version are equal to or greater than the actual published or routinely accepted method.

Validation procedures are done to make sure that the sensitivity and selectivity of the process is appropriate for the method or analytes chosen. Interference checks are performed to show that the changes or additions will not contribute interferences to previous analytes or on-going processes. Accuracy and precsion requirements are established, or previously defined, and used to demonstrate the capability of an analyst to perform the method, initially and on-going.

In the event that a non-standard method (significantly modified or newly-developed) is needed to meet client requirements, the method specifications and how they impact the project requirements must be relayed to the client for approval prior to beginning work on project samples. The client must understand the limits of the method, why it was developed and when it will be used on their project samples, and they must agree to its use.

Any significantly modified or newly-developed method (including the addition of analytes to established procedures) must be fully defined in a Standard Operating Procedure. The validation must be performed by qualified personnel, using appropriate reagents, standards and equipment/instrumentation and that process must be documented. The following items must be performed (as applicable to the method) and the completed documentation with all raw data provided to the Laboratory Manager and QA Officer for review prior to granting approval for use. A new method cannot be put into production without Operations and QA approval. For situations where NELAP approval is being sought, the method cannot be used for client samples until the certification has been received from the State, unless approval is given by the client.

D.1.10.1 Significant Modification / New Method / Additional Analyte Documentation:

Prior to the acceptance of client samples for analysis, the following documentation, as applicable to the type of modification or method status, must be provided to both Operations and QA for review and approval.

1. Approved Standard Operating Procedure for Analytical or Preparation Processes. Include all related raw data for the SOP revision with the draft version.
    a) Modification of existing method: - Revised SOP with modifications clearly spelled out:
    b) New Method: - New SOP in NELAC format – QA will assign SOP number
    c) Additional Analytes: - Revised SOP with modifications clearly spelled out:
2. Method Detection Limit (MDL) Study: Compliant with 40CFR, Part 136.
    a) Include summary form and all raw data for the review
3. MDL Verification Standard spiked at 1-4x the MDL, or the level specified by the specific program or contract. Example: 1-2x the MDL, reference specific program requirements.
    b) Recovery within 30 -150%, or a minimum response distinguishable from the established instrument noise level.
4. Reporting Limit Verification (when an MDL verification is not performed)
    a) For analytical methods, reprocess the low calibration standard as percent recovery – recovery between 50% and 150% is acceptable.
    b) For extraction methods, or where required by project or program, spike a blank matrix at the 1-2x the reporting limit and process through all steps of the procedure. Note the spike level and percent recoveries. Method defined control limits are used for recovery evaluation, or default recoveries between 40% and 160% if method defined limits are not available.
5. Tuning Check (as applicable to the method)
6. Degradation Check (as applicable to the method)
7. A Valid Initial Calibration and Verification
    a) Minimum of 5 sequential points, unless otherwise stated in the method or in-house SOP.

  b) Low calibration standard at or below the Reporting/Quantitation Limit where required.
  c) Initial Calibration Verification Standard

8. Retention Time Window Study where required by the method

9. Second Column Confirmation for all analytes (as applicable to the method)

10. Inter-element Correction (as applicable to the method)

11. Linear Range Study (as applicable to the method)

12. GCMS Spectral Profile(s) (as applicable to the method)

13. Interference Check – Method Blank
    a) Analysis of a blank matrix that has gone through all related steps, preparation and /or analysis, as applicable.

14. Acceptable PT Sample required for all new analytes where NELAP accreditation is being sought.
    a) At least one PT sample (preferably two) required for all new methods
    b) Where a PT sample is not available, or accreditation is not needed, accuracy can be measured through the use of a second source standard.
    c) Use Tap Water for drinking water only methods, tap or other clean water source for ground, surface, etc. methods
    d) Local Soil sample or Ottawa sand for SW-846 methods (if applying for soil or soil/water)

15. Initial Demonstration of Capability (IDOC) per analyst
    a) 4 LCS for each matrix, spiked with all associated new analytes – most acceptance criteria are in the methods, if none, use an initial recovery range of 40-160% and an RPD of 30%.
    b) Non-Standard methods – Follow the procedure in the 2003 NELAC Standards, Chapter 5 appendix C.3.3 (b).

16. Certification / Approval from Regulatory Agency where available.

APPENDIX E – LIST OF CERTIFICATIONS, ACCREDITED METHODS AND ANALYTE CLASSES

To View all details click on our Dataport link below and log in
To request a user name and password please contact clientservices@yorklab.com

http://24.187.239.122/ElmntCC/DataPORT/LabCertifications

- **New York State Department of Health Lab Cert. No. 10854 (CT Lab)**
    - Volatiles Organics – soil, non-potable water, potable water
    - Semi-Volatiles Organics - soil, non-potable water
    - Pesticides, Herbicides, PCBs - soil, non-potable water
    - TPH-DRO, TPH-GRO - soil, non-potable water
    - Metals, including Mercury- soil, non-potable water, potable water
    - Wet Chemistry parameters - soil, non-potable water, potable water

- **New York State Department of Health Lab Cert. No. 12058 (NYC Lab)**
    - Volatiles Organics – soil, non-potable water
    - Volatile Organics- Air
    - PFAS – potable water

- **New Jersey Dept. of Environmental Protection Lab Cert. No. CT-005 (CT Lab)**
    - Volatiles Organics – soil, non-potable water
    - Semi-Volatiles Organics - soil, non-potable water
    - Pesticides, Herbicides, PCBs - soil, non-potable water
    - EPH, TPH-DRO, TPH-GRO - soil, non-potable water
    - Metals, including Mercury- soil, non-potable water
    - Wet Chemistry parameters - soil, non-potable water

- **New Jersey Dept. of Environmental Protection Lab Cert. No. NY-037 (NYC Lab)**
    - Volatiles Organics – soil, non-potable water
    - Volatile Organics - Air

- **Pennsylvania Environmental Protection Lab Cert. No. 68-04440 (CT Lab)**
    - Volatiles Organics – soil, non-potable water
    - Semi-Volatiles Organics - soil, non-potable water
    - Pesticides, Herbicides, PCBs - soil, non-potable water
    - TPH-DRO, TPH-GRO - soil, non-potable water
    - Metals, including Mercury- soil, non-potable water
    - Wet Chemistry parameters - soil, non-potable water

APPENDIX F – LIST OF PHYSICAL LOCATIONS

F.1 Main Laboratory

- 120 Research Drive Stratford, CT 06615
- 203-325-1371 Fax 203-357-0166
  - clientservices@yorklab.com

F.2 New York City Laboratory

- 132-02 89th Avenue Suite 217 Richmond Hill, NY 11418
- 203-325-1371 Fax 203-357-0166
  - clientservices@yorklab.com

F.3 New Jersey Service Center

- 94 Planten Avenue Prospect Park, NJ 07506
- 203-325-1371 Fax 203-357-0166
  - clientservices@yorklab.com

F.4 New York Executive Offices

- 50 Gedney Street Nyack, NY 10960
- 203-325-1371
  - clientservices@yorklab.com

APPENDIX G – LISTING OF MAJOR ANALYTICAL INSTRUMENTATION

Equipment & Instrumentation	*Year Acquired*	*Quantity*
Accelerated Solvent Extraction System-Buchi-Speed Extractor	2012	1
Automated Concentration Systems – Biotage TurboVap II and LV	2014, 2016, 2021	8
Balances, Analytical Mettler AT 200)	2003	1
Balance, Analytical (Sartorius E24-15)	2016	1
Balance, Analytical (S/P 120, ASP, Inc.)	2019	1
Balances-Scout and Radwag Pro top loaders	2008-2021	7
Balance, Top Loading (EC, Symmetry)	2010	1
Balance, Top Loading (ANDEJ)	2015-2016	3
Barometer (Airguide Model 211B)	1991	1
Centrifuges, low speed	2020,2021	3
Class S Weights, 10 mg to 100 g (Troemner, Inc.)	2008, 2012,2020	3
Clean_up System_Florisil/Alumina_ 12 Position (Supelco, Inc.)	1997	1
Cold Vapor Mercury Analysis System (Buck Scientific, Inc.)	2018	1
Computers –Data Server/LIMS Servers/E-mail server, Terminal Server	2021	6
Computers –Backup servers on site DATTO and off site-Hypervisor/cloud	2013, 2014, 2016,2021	6
Computers/Workstations (Various mfg.)	2008-2021	100
Conductance Meter, Field/Laboratory Model (YSI)	1999, 2021	2
Conductivity Meter (YSI)	2007	1
Dessicator, Stainless Steel, 1 CF (Boekel)	1999	2
Dessicator, Stainless Steel, 3 CF (Boekel)	1997, 2016	3
Diazomethane generator, Wheaton/Aldrich DIAZALD KIT	2002, 2005	2
Dispensing Pipet, 1.0 mL (Eppendorf, Inc.)	2001-2013	10
Dispensing Pipet, 5 mL_100 L (Eppendorf, Inc.)	2005-2013	10
Distillation System, Ammonia (Wheaton)	1997	9
Extraction Apparatus, Liquid_Liquid (Supelco, Inc.)	1995	5
Extractors, Zero Headspace TCLP	2013, 2015, 2018	25
Extraction systems, Automated SPE-Promochrom Technologies	2018, 2020	2
Eye Wash Station, Portable (Bel_Art, Inc.)	2001	1
Eyewash System (Speakman Company)	2004	1
Flash Point Apparatus (Pensky_Martin, Closed Cup)	2012	1
Furnace (Thermolyne Type 1500)	2005	2
Furnace, Muffle Furnace, 1.5 CF , Thermolyne	2010	1
Gas Chromatograph (HP 5890 ECD,FID ALS7673,HP ChemSta.)	1999	1
Gas Chromatograph (HP 5890 dual ECD dual ALS7673,HP ChemSta.)	2004, 2006,2013	7
Gas Chromatograph (HP 5890II,G.S.V.FPD,TCD	1995	1
Gas Chromatographs (HP 6890 dual ECD dual ALS7673,HP ChemSta.)	2015-2020	5
Gas Chromatograph (HP 5890 Dual Inj/Dual FID, HP Chem Sta.)	2011-2014	3

Equipment & Instrumentation	*Year Acquired*	*Quantity*
EST PT2 VOA analysis interface modules	2006	3
Gas Chromatograph/Mass Spectrometer/Data System (HP 6890 II/5973 / HP Chemstation)	2006-2020	12
Gas Chromatograph/Mass Spectrometer/Data System (HP 6890 II/5973/w/ ALS 7673,7683)	2009, 2016, 2020	9
Gas Chromatograph/Mass Spectrometer/Data System (HP 7890/5975 / HP Chemstation) (1 TO15 Air))-Queens Lab	2011, 2016	2
Gas Concentration System/Interface TO-15-ENTECH 7200 with 7016 autosampler and 3100 canister cleaning systems-	2011, 2016	2
Gas Dilution Systems (Environics Model 2000); Entech 3150-	2005, 2016	2
Gas Leak Detector (GM 21_250)-Helium detector; Restek	2001, 2016	2
Gas Regulators, Brass (Airco, Inc.)	Various	45
Gas Regulators, SS (Airco,Inc.)	Various	7
Heater (Lab_Line Multi Boil Heater No. 2090)	1994	1
Hot Plate (Corning PC_100 1 SF)	2001-2012	6
Hot Plate (Thermolyne Type 2200)	2010	1
Hot Plate/Stirrer (Cimarec 3, Thermolyne)	2011	1
Hot Plate/Stirrer (Corning PC_351)	2010	1
Hot Plate/Stirrer (Nuova II, Sybron/Nalge)	2010	1
Hot Plate/Stirrer (Thermolyne Cimarec 2)	2010	1
Hot Plate/Stirrer (Thermolyne Cimarec 3)	2012	1
HPLC/MS-MS- Agilent 1260/6470A triple Quad system w/ autosampler	2018	1
HPLC/MS-MS- Agilent 1290/6460C triple Quad system w/autosampler	2020	1
HPLC –Agilent 1100 with DAD/UV detectors	2014	1
Incubator, 20C, BOD (VWR 2005)	2005	2
Inductively Coupled Plasma/Mass Spectrometer (PE Nexion 350)	2020	1
Inductively Coupled Plasma/Mass Spectrometer (PE Nexion 2000)	2018	1
Inductively Coupled Plasma (PE7300 DV_Axial/Radial)	2016	1
Inductively Coupled Plasma (PE Avio 500_Axial/Radial)	2020	1
Ion Chromatograph Dionex 1100 with AS40 ALS-PeakNet 7 software; Dionex ICS 1500/AS 50ALS system Chromeleon data system	2012, 2016	2
Laboratory Hoods (Labconco, others)	Various	12
LIMS System- Promium Element/instrument interfaces	2010	1
Mercury Analysis Systems-Milestone DMA-80 Tricell Direct systems	2012, 2015	2
Microwave Digestion Systems- Milestone Ethos UP	2016, 2020	2
Microwave Extraction Systems-Milestone Ethos EXII	2020	2
Microwave Extraction system-Milestone Ethos EX	2017	1
Nitrogen/TKN Digestor-Westco Smart Digest system	2015	1
Oven, 5 CF (OF-02 TDS forced air oven)	2016	1
Oven, 3 CF (Baxter S/P Tempcon)	2001	1
Oven, 5 CF (Blue M)-drying oven	2005	1

Equipment & Instrumentation	*Year Acquired*	*Quantity*
Oven, Radiant Heat (Lab_Line Imperial II)	2001	1
Oxygen Meter/BOD Probe (VWR 122372)	2005, 2011	2
pH/ISE Meter, Portable (Orion Serial)	1999	1
pH Meter (Corning Model 10)	2004	1
pH Meter (Orion EA 940)	2006	1
pH Meter/Specific Ion Meter (Orion SA_720)	2004	1
Photocopier/Scanner (Image runner 5055)	2011	1
Printers (HP2055dn)	2005-2012	6
Printer Brother HL diff. models	2006-2012	5
Printer (HP LaserJet 4000N)	2005	4
Printer (Okidata Microline 320)	2004	1
Printer, Xerox Phaser 6300	2006	1
Pump, Liquid, Peristaltic, 4 gpm (Cole Parmer)	1999	1
Pump, Vacuum (GE)	1998	1
Pump, Vacuum (GE)	2004	1
Pumps, Personal Sampling (SKC & Gilian)	2001	6
Purge & Trap (Tekmar LCS 3000)	2001-2012	3
Purge & Trap autosampler systems-Archon 51/81 position samplers	2004-2012	6
Purge & Trap autosamplers-Encon Evolution	2013, 2014, 2016	5
P/T autosamplers-Centurion-EST	2015-2016	3
Reflux/Distillation Systems-cyanide	2004	8
Refrigeration Freezer (Kenmore)	2001,2018	4
Refrigerator (Sanyo)	2002, 2018	4
Refrigerator (Summit)	2002	1
Refrigerator, Walk-in custom design-CCI-350 ft2	2016	1
Refrigerator (Welbilt 1.5 C.F.)	2003, 2010	3
Refrigerator (Westinghouse)	2005	4
Refrigerator, 10 CF (Sears)	2008	1
Refrigerator, 14 CF (Gibson)	2009	5
Refrigerator(Sanyo,1.5 C.F.)	2003	2
Sample Concentrator (Supelco, Inc. Mini_VAP_6) and tubes	2001	1
Sample Concentrator (Zymak Turbo VAP II ZW8001)	2003	2
Sample Concentrator (Zymark Tubro VAP II ZW8001)	2004	1
Sample Concentrators (Zymark Turbo VAP II)	2005, 2016	3
SKALAR Flow injection Analyzer-NO3, NO2, NH3, o-PO4, TN, TOC	2010	1
Sonic Cleaning System (Branson 1200)	2010	1
Sonic Disruptor (Tekmar)	1997	3
Sonic Disruptor & Sound Enclosure (Heat Systems, Inc.)	2004	3
Sonic Disruptor Sound Chambers	1997-2004	3
Soxhlet Extraction Apparati/hot plates	2010	24
Specific Ion Electrode, Chloride (Orion)	2001	1
Specific Ion Electrode, Chlorine (Orion)	2004	1

Equipment & Instrumentation	*Year Acquired*	*Quantity*
Specific Ion Electrode, Flouride (Orion)	2005	1
Spectrophotometer (Bausch & Lomb Spectronic 2D0)	1995	1
Spectrophotometer, Visible (Milton_Roy, SPEC_20D)	2012	1
Stirrer, Gang, 6 Position (Phipps & Bird)	1994	1
Storage Cabinet (ACIDS)	2004	2
Storage Cabinet, Solvent, Safety (Justrite, Inc.)	2004	2
Summa Canisters, Restek, Entech, 6 liter	2000-2021	230
Summa Canister Flow controllers, 1 hr, 4 hr, 8 hr, 24 hr adjustable, Entech	2005-2014	125
TCLP Extraction Pressure Filtration System (Millipore)	2001, 2004	2
TCLP Extraction System (Millipore, Inc.)	2001	4
TCLP Rotator, 12 Position (Assoc. Design & Mfg 12)	2001, 2010, 2013	3
TCLP_ZHE Volatile Extraction System	2001-2012	20
Thermometers, NIST Traceable (ASP, Inc.)	2001, 2012	2
Thermometers, Various Ranges (ASP, Inc.)	1999-2012	10
Total Organic Carbon Analyzer-SKALAR	2010	1
Turbidity Meter (Lamotte)	2012	1
Vortex _ Genie SI)	1995	1
Water Bath (25_100C, ASP, Inc.)	1996	1
Water Purification System (Hydro Inc. RO/DI/Carbon)	2004, 2012	2
Hydrogen Generator, Parker Hannifan H2-500	2013	1
Generator, 200 KVA for full facility, Cummins Diesel	2020	1

APPENDIX D – LISTING OF CONTROLLED DOCUMENTS

SOP#	Description	SOP Name	Effective Date
PFAS			
1	Preparation of Non-Potable Water and Soils for Target Per- and Polyfluorinated Alkyl Substances (PFAS) for analysis by LC-MS/MS	PFASExtr_AQ_S Rev 1.0	5/10/2019
2	Analysis of Target Per- and Polyfluorinated Alkyl Substances (PFAS) in Non-Potable Water and Soil by EPA Method 537 Modified using LC/MS-MS	PFAS_LCMSMS_MOD Rev. 1.1	2/13/2020
3	Analysis of Target Per- and Polyfluorinated Alkyl Substances (PFAS) in Potable Water by EPA Method 537.1 using HPLC/MS-MS	PFAS_ LCMSMS Rev 1.3	4/22/2021
GC/MS-TO-15			
1	VOCs in AIR by EPA TO-14A/TO-15	GCMS AIR 111692-Rev 9.7	1/15/2019
2	Cleaning of Summa Canisters	SummaClean111507 Rev 1.4	1/15/2019
3	Calibration of Flow Controllers	FLOWCONT011312 Rev 1.3	1/15/2019
GC/MS - Volatiles			
1	Volatile Organics using GC/MS	GCMS VOC 011700-Rev 3.6	1/21/2019
2	Volatile Organics in Drinking Water using GC/MS by EPA 524.2	GCMS VOC524.2 011700-Rev 2.0	12/7/2016
3	Soil Sampling Procedure by EPA method 5035A	GCMS VOC5035 060712-Rev 1.0	6/7/2012
4	Screening of Aqueous and Soil Samples for Volatile Compounds by Dynamic Headspace/GC/FID	VOASCREEN121615-Rev.1.1	11/17/2016
5	Determination of Gasoline Range Organics in Aqueous and Solid Samples by method 8015D	GC GROFID 022715-Rev. 1.2	3/27/2017

GC/MS - Semi-volatiles			
1	Semi-Volatiles using GC/MS by EPA 8270C and 8270D	GCMS SVOC-Rev 3.3	4/20/2017
1	Semi-Volatiles using GC/MS by EPA 8270E	GCMS SVOC-Rev 3.4	8/24/2020
1	Analysis of 1,4-Dioxane by GC/MS/SIM by EPA method 8270E SIM with Isotope Dilution	SVOC-1,4-DIOX_ALL-01 Rev 1.4	8/28/2020
1	Analysis of 1,4-Dioxane by GC/MS/SIM by EPA method 522	SVOC-1,4-DIOXPW-01 Rev 1.1	2/9/2021

Gas Chromatography			
1	PCBs using GC/ECD by EPA 8082	GC PCB-Rev 1.8	1/20/2021
2	TPH-DRO using GC/FID by EPA 8015D	GC TPHDRO 091009 Rev.1.7	6/28/2019
3	Pesticides (Chlorinated) using GC/ECD by EPA 8081	GC Pest 011799-Rev 1.9	12/11/2019
4	Herbicides using GC/ECD by EPA 8151A	GC Herb-Rev 1.7	1/21/2020
6	CT ETPH	GC ETPH 111704-Rev 1.7	11/9/2228
7	NJ EPH	GC NJEPH 031313-Rev 1.0	3/13/2013
8	EDB, DBCP	GC EDB,DBCP 102413-Rev 1.3	7/13/2019
Extractions			
1	Herbicide Extraction of Solids	EXT Herb-Rev 1.7	6/17/2019
1a	Extraction of Chlorinated Herbicides from Aqueous Samples and TCLP extracts by EPA SW-846 Method 8151A	EXT AQ TCLP Herb- Rev 1.5	6/17/2019
2	UltraSonic Extraction of Solids [EPA 3550]	EXT SSVOC-Rev 2.8	8/14/2019

3	ASE Extraction of Solids [EPA 3545]	EXT SVOCASE-Rev 2.4	2/10/2017

4	Aqueous Extraction [EPA 3510C]	EXT AqSVOC -Rev 2.9	5/24/2016
5	Extraction Laboratory Glassware Washing Procedure	EXTGP052600Rev1.1	4/3/2012
6	Soxhlet Extraction of Solids for PCBs [3540C]	EXT PCBSox-Rev 1.2	9/6/2020
7	MA EPH Extraction from Waters and Soils	EXTMAEPHAQASE121207Rev2.0	10/22/2009
8	Spike and Surrogate Standard Preparation for Extractable Organics	EXT SVOCStds-Rev 1.3	5/31/2016
9	NJEPH Extraction from Waters and Soils	EXT NJEPH-Rev 1.1	1/15/2014
10	Extraction of Herbicides [SM 6640B]	EXT HerbSM-Rev 1.1	12/3/2014
11	Glycols Extraction with SPE Tubes	EXT GlyLL-Rev 1.1	7/13/2015
12	Extraction of Semi-Volatile Organic Compounds from Solid Samples using Microwave Assisted Extraction by SW-846 3546	EXT SSVOCMAE-Rev1.1	5/24/2016
12	Extraction of 1,4-Dioxane from Aqueous Samples using SPE by EPA Method 3535A	EXT AQ_1,4-DIOXANE	9/9/2020
Metals			
1	ICP/MS Analysis of Sample Digestates by EPA 200.8 and SW-846 6020A and B	ICPMS 080106-Rev1.8	6/16/2018
2	Preparation of Samples for Metals Analysis by ICP and ICP/MS by SW-846 3010A and 3050B	M SPrep 030695-Rev1.8	10/25/2017
3	ICP Analysis of Sample Digestates by EPA 200.7 and SW-846 6010C	M ICP 031195-Rev1.8	11/20/2017

3	ICP Analysis of Sample Digestates by EPA 6010D	M ICP 031195-Rev1.2	7/10/2018
4	Mercury by Cold Vapor Technique EPA SW-846 7470 annd 7471	M Hg 120998-Rev 1.8	3/27/2017
5	Mercury by Direct Technique EPA SW-846 7473	M Hg2-Rev 1.4	3/29/2018
6	Preparation of Samples for Metals Analysis by ICP and ICP/MS by SW-846 3015	M PrepMAD071715-Rev 1.1	11/20/2017
Wet Chemistry			
1	Chemical Oxygen Demand	WC COD Rev 2.3	4/29/2014
2	TKN, Ammonia and TON	WC TKN-Rev. 1.8	5/4/2018
3	Reactivity-Cyanide	WC CNR-Rev 1.4	4/3/2018
4	Hexavalent Chromium	WC Cr+6-Rev 1.7	4/5/2018
5	Total Cyanide	WC CNT-Rev 1.9	1/10/2018
6	Reactivity-Sulfide	WC ReacSulf-Rev 1.5	4/3/2018
7	Alkalinity	WC T-Alk 022600-Rev 1.5	1/2/2015
8	Hexane Extactable Material (O&G)	WC HemGrav-Rev.1.8	6/8/2015
9	Ion Chromatography	WC IC-Rev2.2	4/4/2018
10	Biochemical Oxygen Demand (BOD)	WC BOD-Rev1.7	3/28/2017

11	TSS / VSS in Aqueous Samples	WC TSS-Rev1.7	5/10/2018
12	pH	WC pH-Rev1.9	4/3/2018
13	Total Phosphorous and Ortho-Phosphate	WC Phos 051000-Rev-1.7	7/3/2017
14	TCLP / SPLP Extraction	WC TCLPEX-Rev1.7	6/4/2018
15	Cyanide Amenable to Chlorination	WC CNA-Rev1.4	10/15/2014
16	Flash Point	WC FP-Rev1.5	1/5/2014
17	Methylene Blue Active Substances (MBAS)	WC MBAS-Rev1.4	7/18/2017
18	TS, VS, TDS in Aqueous Samples	WC TSTDS-Rev1.5	2/15/2016
19	Color	WC COLOR 04262010 Rev1.2	3/27/2017
20	Glassware Washing	WC GlassPrep 090299Rev2.1	12/16/2013
21	Total Phenols (low level)	WC PhenolsLL-Rev1.5	1/5/2014
22	Total Phenols	WC Phenols-Rev 1.6	5/18/2017
23	Conductivity	WCCond-Rev 1.3	1/5/2014
24	Turbidity	WC Turbidity-Rev 1.6	3/27/2017

25	TS, FS, VS and % Moisture in Solid Samples	WC TS%M 022912-Rev 1.2	4/5/2018
26	Extractable Organic Halogens (EOX) in Soil Samples	WC EOX 041112-Rev 1.2	11/9/2012
27	Total Organic Carbon (TOC) in Aqueous Samples	WC TOC Rev 1.3	10/7/2014
28	Oxidation-Reduction Potential (ORP)	WC ORP 031213-Rev 1.0	3/12/2013
29	Settleable Solids	WC SetSol-Rev 1.2	1/5/2014
30	Sulfide	WC Sulfide-Rev 1.1	1/5/2014
31	Chlorine Demand	WC Cl Demand-Rev 1.0	4/9/2014
32	TKN by Skalar	WC TKN SK- Rev 1.5	5/10/2018
33	Free Liquids	WC Free Liquids Rev 1.0	3/7/2016
General Laboratory			
1	MDL Studies, Organics	GL MDL 113005-Rev.1.4	3/9/2018
2	Chemical Expiration Dates	GL ExpDt 041812 Rev1.0	4/18/2012
3	LOQ/LOD Determination and Verification	GL LODLOQ 122812-Rev 1.4	1/27/2017
4	Balance Calibration Check Procedure	GL Balance 082514-Rev 1.0	8/25/2014
Sample Control			
1	Sample Control Procedures (Receipt, Log-in, Storage, Archival, Disposal)	SC Proc 011501-Rev 2.5	5/27/2015

2	Sample Handling and Chain-of-Custody for Sample Couriers	Couriers091207Rev1.1	3/25/2015
Administration			
1	Laboratory Safety and Health	ADMINSAFETY011600Rev1.1	11/13/2017
2	Purchasing	ADMIN Purchasing 043010-Rev1.2	4/11/2013
3	QC Review/Evaluation of Data	QC040202Rev1.2	9/28/2016
4	Education and Training in Ethics and Legal Responsibilities	ADMIN Ethics-Rev1.6	11/20/2017

5	Training of Personnel	ADMIN Training-Rev 1.4	9/4/2014
6	Manual Integration of Chromatographic Data	Admin Integration 091107 Rev. 2.3	9/27/2018
7	Laboratory Notebook Control and Use	ADMIN LabNote 091107-Rev 1.1	1/13/2013
8	Control of Records	ADMIN Records 043010-Rev 1.2	11/20/2017
9	Control of Nonconforming Work	QSP 4-9-1 Rev1.0	4/30/2010
10	Management Review	ADMINMGMTREVIEW043010Rev1.1	9/27/2016
11	Internal Quality Audit	ADMIN IntAudit 043010Rev 1.2	2/22/2017
12	Estimation of Uncertainty	ADMINESTUNCERT043010 rev 1.1	10/17/2014
13	Document Control	ADMINDOC043010Rev1.2	6/2/2012

14	Corrective/Preventive Action	ADMIN CorrAction 043010 Rev 1.2	6/15/2016
15	Complaints	COMPLAINTS043010 Rev. 1.1	9/12/2016
16	Review of Chromatographic Data for Detection of Manual Re-Integration Issues	SOP ADMINManINTReview04302010 Rev 1.0	4/30/2010
17	Additional Policies/Procedures	Additional Policies 05/07/10 Rev1.2	10/17/2014
18	EDDs and Reports for Client Connect	ADMIN REPORT100714 Rev1.0	9/16/2010
19	Preparation of CTDEP RCP Deliverables	ADMINRCPDELIVS Rev1.0	8/2/2010
19	Preparation , Documentation and Traceability of Standards within the Element LIMS	ADMIN_STDS031816 Rev 1.0	4/15/2016

END OF DOCUMENT

APPENDIX B – HEALTH AND SAFETY PLAN

GZA SITE-SPECIFIC HEALTH, SAFETY & ACCIDENT PREVENTION STANDARD-PLAN

1. CLIENT/SITE/PROJECT INFORMATION		
Client: Clay Properties, LLC		
Site Address: 29-37 Clay Street, Brooklyn, NY		
Site Description (be sure to list pertinent site features, chemicals used at the facility, and other potential hazard sources): The site is currently vacant. Remnants of the slab of the former building remain on-site. The site is gated to avoid any trespassers entering the premises.		
Work Environment (active manufacturing, office, vacant site, undeveloped property, etc.): Inactive open lot.		
Job/Project #: 41.0163305.00	Field Start Date: August 5, 2024	Field Finish Date: August 14, 2024
Site is Covered by the Following Regulations:	OSHA HAZWOPER Standard ☒	Mine Safety and Health Administration ☐
	OSHA Construction Regulations ☒	

2. EMERGENCY INFORMATION		
Hospital Name: NYU Langone		Hospital Phone: 646-929-7800
Hospital Address: 706 Broadway, Brooklyn, NY		Directions and Street Map Attached: ☒ Yes
Local Fire #: 911	Local Ambulance #: 911	Local Police #: 911
WorkCare Incident Intervention Services:	**For non-emergencies, if an employee becomes hurt or sick call 888-449-7787**	
Other Emergency Contact(s): Reinbill Maniquez	Phone #'s: 347-443-1059	
Site-Specific Emergency Preparedness/Response Procedures/Concerns: See Site Access Safety Addendum (attached)		

owning
ZERO
accidents – injuries - illnesses

LIFTING
Get help lifting or carrying anything over 50 pounds

SITE RECON
Walk your site before starting work to find and mark slips/trips/falls and insect nests

DRIVING
Don't use your mobile phone while driving

ERGONOMICS
Take a 5-minute break for every hour you work, whether it's in th office or the field

CUTS
Wear cut-resistant gloves when using knives or other sharp objects

PPE
At a minimum, always wear safety glasses and protective footwear in the field

HASP
Develop a HASP and have it with you in the field

WORKCARE
Without delay, call WorkCare immediately for any minor injury or illness at 888-449-7787

- All EHS Events must be reported immediately to the Project Manager and to the GZA People-Based Safety mobile app.
- In the event of a chemical release greater than 5 gallons, site personnel will evacuate the affected area and relocate to an upwind location. The GZA Field Safety Officer and client site representative shall be contacted immediately.
- Site work shall not be conducted during severe weather, including high winds and lightning. In the event of severe weather, stop work, lower any equipment (drill rigs), and evacuate the affected area.

3. SCOPE OF WORK

General project description, and phase(s) or work to which this H&S Plan applies.	Remedial Investigation, Field Sampling
Specific Tasks Performed by GZA:	Drilling Observation, soil sampling, groundwater sampling, soil vapor sampling, soil handling, and field logging
Concurrent Tasks to be Performed by GZA-hired Subcontractors (List Subcontractors by Name):	TBD Drillers - Drilling, soil sampling, groundwater sampling, soil vapor sampling, soil handling
Concurrent Tasks to be Performed by Others:	N/A

Any OSHA PERMIT-REQUIRED CONFINED SPACE entry? ☐ YES ☒ NO IF YES, ADD CONFINED SPACE ENTRY PERMIT FOR THAT PORTION OF THE WORK	Any INDOOR fieldwork? ☐ YES ☒ NO IF YES, EXPLAIN:

4. SUB-SURFACE WORK, UNDERGROUND UTILITY LOCATION

Will subsurface explorations be conducted as part of this work (drilling or excavation)?	☒ Yes ☐ No
Will GZA personnel be required to use a hand-auger as part of this work?	☐ Yes ☒ No
Site property ownership where underground explorations will be conducted on: Clay Properties, LLC	Public Access Property ☐ Yes ☒ No Private Property ☒ Yes ☐ No
Have Necessary Underground Utility Notifications for Subsurface Work Been Made?	☐ Yes ☒ Yet to be conducted

Specify Clearance Date & Time, Dig Safe Clearance I.D. #, And Other Relevant Information: GZA will review utility clearance with driller prior to field work.

IMPORTANT! For subsurface work, prior to the initiation of ground penetrating activities, GZA personnel to assess whether the underground utility clearance (UUC) process has been completed in an manner that appears acceptable, based on participation/ confirmation by other responsible parties (utility companies, subcontractor, client, owner, etc.), for the following:

Electric:	☒ Yes	☐ No	☐ NA	☐ Other________________
Fuel (gas, petroleum, steam):	☒ Yes	☐ No	☐ NA	☐ Other________________
Communication:	☒ Yes	☐ No	☐ NA	☐ Other________________
Water:	☒ Yes	☐ No	☐ NA	☐ Other________________
Sewer:	☒ Yes	☐ No	☐ NA	☐ Other________________
Other:________________	☐ Yes	☐ No	☐ NA	☐ Other________________

Comments: GZA to confirm mark outs prior to commencing work. Contractor to determine exact location of test boring.

5. HAZARD ASSESSMENT (CHECK ALL THAT APPLY AND ADDRESS EACH HAZARD IN SECTION 6)

A. GENERAL FIELDWORK HAZARDS

☐ Confined Space Entry (Add Confined Space Entry Permit)
☒ Abandoned or vacant building/Enclosed Spaces
☒ Significant Slip/Trip/Fall Hazards
☐ Unsanitary/Infectious Hazards
☐ Poisonous Plants
☒ Biting/Stinging Insects
☐ Feral Animal Hazards
☐ Water/Wetlands Hazards
☐ Remote Locations/Navigation/Orientation hazards
☐ Heavy Traffic or Work Alongside a Roadway
☒ Weather-Related Hazards
☒ Motor vehicle operation Hazards
☒ Heavy Equipment Hazards
☒ Structural Hazards (i.e. unsafe floors/stairways/roof)
☐ Demolition/Renovation
☐ Presence of Pedestrians or the General Public

☒ Overhead Hazards (i.e. falling objects, overhead power lines)
☒ Portable Hand Tools or Power Tools
☒ Significant Lifting or Ergonomic Hazards
☒ Electrical Hazards (i.e. Equipment 120 Volts or Greater, Work Inside Electrical Panels, or Maintenance of Electrical Equipment)
☐ Other Stored energy Hazards (i.e. Equipment with High Pressure or Stored Chemicals)
☐ Fire and/or Explosion Hazard
☒ Elevated Noise Levels
☐ Excavations/Test Pits
☐ Explosives or Unexploded Ordinance/MEC
☐ Long Distance or Overnight Travel
☐ Personal Security or High Crime Area Hazards
☐ Working Alone
☐ Ionizing Radiation or Non-Ionizing Radiation
☒ Chemical/Exposure Hazards (See Part B for Details)
☒ Other: COVID-19, Underground Utilities, Soil Handling

B. CHEMICAL/EXPOSURE HAZARDS (CONTAMINANTS ARE CONTAINED IN X SOIL, WATER, X GROUNDWATER)

☐ No chemical hazards anticipated
☐ Hydrogen Sulfide (H2S)
☐ Cyanides, Hydrogen Cyanide (HCN)
☐ Carbon Monoxide
☐ Herbicides, Pesticide, Fungicide, Animal Poisons
☒ Metals, Metal Compounds:
☐ Corrosives, Acids, Caustics, Strong Irritants
☐ Polychlorinated Biphenyls (PCBs)
☒ Polycyclic Aromatic Hydrocarbons (PAHs)
☐ Compressed Gases
☐ Flammable/Combustible Liquids
☐ Radiation Hazards (i.e. radioactive sealed/open source, x-rays, ultra violet, infrared, radio-frequency, etc.)

☐ Methane
☐ Chemicals Subject to OSHA Hazard Communication (attach Safety Data Sheet for each chemical GZA brings to the site)
☐ Containerized Waste, Chemicals in Piping & Process Equipment
☐ Emissions from Gasoline-, Diesel-, Propane-fired Engine, Heater, Similar Equipment
☐ General Work Site Airborne Dust Hazards
☒ Volatile Organic Compounds (VOCs), BTEX
☒ Chlorinated Organic Compounds
☒ Fuel Oil, Gasoline, Petroleum Products, Waste Oil
☐ Asbestos
☐ Oxygen Deficiency, Asphyxiation Hazards
☒ Other: Silica

6. SITE-SPECIFIC OVERVIEW OF H&S HAZARDS/MITIGATIONS (NOTE: Based on Hazard Assessment, Section 5)

Describe the major hazards expected to be present at the jobsite, and describe the safety measures to be implemented for worker protection (refer to items checked in Section 5 above). Use brief abstract statements or more detailed narrative as may be appropriate.

ON-SITE HAZARDS:	HAZARD MITIGATIONS:
Task Hazard Analyses	Task 21.1 – General Outdoor Field Work Task 4.1 – Drilling Observations Task 4.5 – Soil-Gas Sampling Task 20.11 – Field Sampling
Owning Zero	Ensure all GZA personnel on-site have downloaded the People Based Safety app to their mobile phones and are familiar with using it to report safety events. Prior to work each day, review Owning Zero rules with all onsite personnel during morning safety meeting.
Abandoned or vacant building/Enclosed Spaces	Ask the client to validate that the building is structurally safe to enter. Constantly scan surroundings for integrity of floors and stairs and stay alert to debris on the ground or unsafe objects. Do not walk under ceilings or structures showing signs of distress and wear hard hats at all times within structures. Be alert for other people and / or animals in the building. Bring flashlights in case of poor lighting and a charged cell phone for communication. Inform your PM to let her/him know your anticipated hours of work on the site, and call them when you leave the site for the day. Leave the site if it is unsafe for any reason.
Biting and Stinging Insects	Ticks carry risk of Lyme and other Diseases. Tick season is basically any field day above 40 degrees F. Tuck pants into long socks and apply DEET (or permethrin pre-treatment) to clothing in season to control exposure to ticks. Check clothing for ticks frequently. Check whole body immediately upon returning from field and shower. Be aware of intermittent seasonal reports of mosquito borne diseases, such as West Nile disease and Eastern Equine Encephalitis (EEE), and their locations relative to your field site. Use DEET or other mosquito repellant. Be aware of potential cavity, suspended or ground nesting bee/wasp/hornet nests. Avoid undue disturbance or approach with appropriate safety clothing protection and netting. See attached Policy - GZA policy 03-3019 Lyme Disease.
Slip, Trips, and Falls	Inspect work area prior to starting work. Mark out or remove any potential hazards. Be aware and inspect area for uneven surface. Wear sturdy shoes with ankle support and good tread. Look for potential natural depressions/holes/or other obstructions in the area of work and travel. Personnel will be wearing appropriate boots with good tread to prevent slips and falls. Maintain one free hand to break falls. Provide adequate space for each employee to work safely with sound footing. Watch for equipment on ground and slippery surfaces. Keep work area clean, no running, be mindful of changing weather conditions that may change footing conditions. Store any hand tools used for sampling in their proper storage location when not in use. Do not perform work if adequate lighting is not available. Maintain an exit pathway away from the rig at all times.
Weather-Related Hazards	Weather conditions will be assessed prior to on-site work and forecast examined for anticipated period of work. If weather permits fieldwork, then workers will dress appropriately. Should inclement weather be encountered, the project scope may be reduced or rescheduled. Breaks will be taken to reduce exposure to the elements. If conditions change and lightning or thunder is observed, work will be suspended immediately, and workers will seek shelter. Work may resume if thunder and/or lightning cease for 30 minutes. In the case of cold weather, proper warm gear should be worn to minimize cold exposure. Hand warmers (e.g. "Hot Hands") should be used when appropriate to keep extremities warm and multiple breaks within a warm area (vehicle with heat) should be taken. Review the signs of heat stress and dehydration before the start of fieldwork. Water, sunscreen, hardhat, tinted safety sunglasses, rain gear (if necessary) and periodic breaks should all be planned for. Be sure to consume plenty of liquids on hot summer days and stay out of direct sunlight for extended periods of time to the extent possible. Use protective ointments such as sunscreen and chap stick, and consult the OSHA Heat Safety App daily.

Motor Vehicle Operation Hazard	Check blind spots before backing up. Use a spotter when maneuvering vehicle in tight locations. Obey speed limits and wear seatbelts. No active hand-held or hands-free cell phone use while driving.
Underground Utilities	Confirm that underground utility clearance procedures have been completed in accordance with GZA Policy # 04-0301 Responsibility for Utility Clearance of Exploration Locations for clearing utility locations prior to breaking ground. Hand clear as necessary prior to commencement of drilling activities.
Heavy Equipment Hazards	All personnel working in proximity to heavy equipment will be familiarized with the locations and operations of emergency kill switches prior to equipment start-up. A first-aid kit and fire extinguisher (10 # Class B/C, minimum) will be available at all times. No loose clothing, jewelry, or unsecured long hair is permitted near the rig. Keep hands and feet away from all moving parts while drilling is in-progress. Persons shall not pass under or over a moving drill tools. Watch for moving vehicles and equipment. Stay out of equipment radius while drilling and excavation is in-progress. Maintain visibility and eye contact with operators when walking around trucks and excavators. Wear reflective vests to enhance visibility. Stay clear of drill rig or excavator (minimum of 6 feet) while operating and do not approach unless equipment has been stopped and eye contact/coordination is made with equipment operator for personnel to approach rig to make observations or collect samples. GZA personnel shall not climb onto or approach rig or excavator while operating or while drill rods are being attached or removed. GZA staff should verify that the onsite equipment has been routinely inspected. GZA staff should also maintain a safe working distance from the equipment while it is maneuvering around the site. GZA staff are not authorized to operate the drill rig or excavator, however, they should be familiar with the location and operation of the emergency shutoff in the event the main operator is unable to operate this control in the event of an emergency. Personnel are not allowed on a mast while drilling is in operation. While a drill rig or excavator is moved from one location to another, drill steel, tools, and other equipment shall be secured and the mast placed in a safe position. All borings and test pits will be adequately covered and/or barricaded if left unattended for any period of time to prevent injury. Working around heavy equipment, personnel shall be aware of pinch points, rotating equipment, and winch operated equipment. Maintain safe working distance and never walk underneath overhead projection of the equipment. Always maintain eye contact and communication with the operator. Follow GZA safe drilling and field work procedures.
Struck by, caught by, run over by equipment	Do not stand near or where equipment operators cannot see you. Always be in line of sight. Do not make sudden moves and always let the operator know of your intentions. Wear high-visibility safety vest, hard hat, eye protection, steel toe boots and use common sense and good housekeeping practices to avoid injury. Stay within sight of rig/excavator operator but at least 6-10 feet away from rig and excavator swing area. Maintain clear lines of communication (verbal and/or visual) with the operator. Stand clear of exhaust from operating equipment and stay out of the swing radius of heavy equipment. Be aware of overhead equipment and potential for falling objects (i.e. tree branches). Avoid any “pinch points” where one could become trapped between the equipment and other objects. Maintain awareness of general rig movement/operation and communication with drill crew. Do not conduct soil classification/sampling directly adjacent to the drill rig. Hearing protection shall be worn when working near operating equipment. Equipment should be situated so that at full extension of bucket arm, the equipment is at least 10 feet away from overhead lines.
Overhead Hazards (i.e. Falling Objects, Overhead Power Lines)	Mechanical raising and falling weights and equipment are typical around drill rig. Stand clear of drill rig when possible. Observe proposed exploration locations for possible overhead utility lines/tree branches and avoid these if applicable. Check for overhead lines at each work location and between locations and keep equipment at least 25 feet from overhead utilities. Wear steel toed boots, hardhat and safety glasses/goggles. If stacked materials appear unstable inform the site representative. Be aware while equipment is advancing into soil / sediment. Do not stand directly in immediate vicinity of equipment in case equipment malfunction occurs. Maintain safe working distance and maintain eye contact and communication with operator. Never stand under elevated loads or equipment.

Significant Lifting or Ergonomic Hazards	Proper lifting techniques (lifting with the legs, carrying the load at a reasonable height to allow for proper posture during the carry, and avoiding twisting while carrying loads) should be followed at all times. Caution should be used when lifting equipment. Be aware of hand position during all stages of the lift, transport and placement of equipment. Review equipment to be moved prior to lifting to prevent moving parts from crushing fingers or otherwise pinching skin. Do not stack items prior to carrying, but rather transport one item at a time to prevent shifting during carrying. Follow GZA Safe Lifting SOP.
Elevated Noise Levels	Always use ear protection when drill rig is in operation. In accordance with 29 CFR 1910.95(b)(1) When employees are subjected to sound exceeding those listed in Table G-16, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels within the levels of Table G-16, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table. TABLE G-16 - PERMISSIBLE NOISE EXPOSURES (1) Duration per day (hours) | Sound level dBA slow response 8...................................... | 90 6.......................................| 92 4.......................................| 95 3.......................................| 97 2.......................................| 100 1 1/2 ....| 102 1...| 105 1/2 ....| 110 1/4 or less........................| 115 Hearing protection in the form of disposable ear plugs will be worn during field work with sound levels anticpated above those listed in Table G-16. Use sound meter app on phone to assess required PPE. Be aware that hearing protection can diminish warning sounds - do not stand with back to operating equipment and be alert for changing conditions.
Soil Handling	Be aware that soil jars may have been broken during transport and properly cushion sample jars to prevent breakage. Do not eat, smoke or apply cosmetics (e.g. Chapstick, sunscreen) in the work area. Wear nitrile gloves during sampling to avoid common hazards associated with soil handling. Do not have skin contact with/ingest soils. Wash hands and face before eating or drinking.
Portable Hand Tools	Appropriate personal protective equipment (i.e.: safety glasses, face shield, safety goggles, gloves, etc.) shall be worn to protect from hazards that may be encountered while using portable power tools and hand tools
Silica Dust	Primary health effects of silica exposure include silicosis. raining will be provided to employees potentially exposed over the PEL for silica prior to them beginning work with silica, and will be updated on a regular basis. Depending on the levels of total and/or respirable dust in the employee's breathing zone, air monitoring will be performed for particulates. Ample ventilation will be provided to GZA workers.

7. AIR MONITORING ACTION LEVELS – Make sure air monitoring instruments are in working order, calibrated before use, and 'bump-checked' periodically throughout the day and/or over multiple days of use

Is air monitoring to be performed for this project? Yes ☒ No ☐

ACTION LEVELS FOR OXYGEN DEFICIENCY AND EXPLOSIVE ATMOSPHERIC HAZARDS (Action levels apply to occupied work space in general work area)

☐ Applicable, See Below. ☒ Not Applicable

Parameter	Response Actions for Elevated Airborne Hazards
Oxygen	At 19.5% or below – Exit area, provide adequate ventilation, or proceed to Level B, or discontinue activities Verify presence of adequate oxygen (approx. 12% or more) before taking readings with LEL meter. Note: If oxygen levels are below 12%, LEL meter readings are not valid.

LEL	Less than 10% LEL – Continue working, continue to monitor LEL levels Greater than or Equal to 10% LEL – Discontinue work operations and immediately withdraw from area. Resume work activities ONLY after LEL readings have been reduced to less than 10% through passive dissipation, or through active vapor control measures.

ACTION LEVELS FOR INHALATION OF TOXIC/HAZARDOUS SUBSTANCES (Action levels are for sustained breathing zone concentrations)

☒ Applicable, See Below. ☐ Not Applicable

Air Quality Parameters (Check all that apply)	**Remain in Level D or Modified D**	**Response Actions for Elevated Airborne Hazards**
☒ VOCs	0 to 5 ppm	From 5 ppm to 10 ppm: Proceed to Level C, or Ventilate, or Discontinue Activities If greater than 5 ppm: Discontinue Activities and consult EHS Team
☐ Carbon Monoxide	0 to 35 ppm	At greater than 35 ppm, exit area, provide adequate ventilation, proceed to Level B, or discontinue activities.
☐ Hydrogen Sulfide	0 to 10 ppm	At greater than 10 ppm, exit area, provide adequate ventilation, proceed to Level B, or discontinue activities
☒ Dust	0 to 150 ug/m^3	If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 ug/m3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 ug/m3 of the upwind level and in preventing visible dust migration
☐	0 to	

SPECIAL INSTRUCTIONS/COMMENTS REGARDING AIR MONITORING (IF APPLICABLE)

8. HEALTH AND SAFETY EQUIPMENT AND CONTROLS

AIR MONITORING INSTRUMENTS

- ☒ PID Type: Lamp Energy: 10.6 eV
- ☐ FID Type:
- ☐ Carbon Monoxide Meter
- ☐ Hydrogen Sulfide Meter
- ☐ O_2/LEL Meter
- ☒ Particulate (Dust) Meter
- ☒ Calibration Gas Type - Isobutylene
- ☐ Others:

OTHER H&S EQUIPMENT & GEAR

- ☒ Fire Extinguisher
- ☒ Caution Tape
- ☒ Traffic Cones or Stanchions
- ☐ Warning Signs or Placards
- ☐ Decon Buckets, Brushes, etc.
- ☐ Portable Ground Fault Interrupter (GFI)
- ☐ Lockout/Tagout Equipment
- ☐ Ventilation Equipment
- ☒ Others: First Aid Kit, Cell Phone, Water, Soap

PERSONAL PROTECTIVE EQUIPMENT

- ☐ Respirator – Type
- ☐ Respirator - Cartridge Type:
- ☒ Hardhat
- ☒ Outer Gloves Type: Nitrile
- ☒ Inner Gloves Type: nitrile
- ☒ Steel-toed boots/shoes
- ☐ Coveralls – Type
- ☐ Outer Boots – Type
- ☒ Eye Protection with side shields
- ☐ Face Shield
- ☒ Traffic Vest
- ☐ Personal Flotation Device (PFD)
- ☐ Fire Retardant Clothing
- ☐ EH (Electrical Hazard) Rated Boots, Gloves, etc.
- ☒ Noise/Hearing Protection
- ☒ Others: Face Covering (COVID—19)

Discuss/Clarify, as Appropriate: face mask covering when social distancing cannot be readiliy practiced

9. H&S TRAINING/QUALIFICATIONS FOR FIELD PERSONNEL

☒ Project-Specific H&S Orientation (Required for All Projects/Staff)
☒ OSHA 40-Hour HAZWOPER/8 Hour Refreshers
☐ Hazard Communication (for project-specific chemical products)
☒ First Aid/CPR (required for HAZWOPER for at least one individual on site)
☐ Current Medical Clearance Letter (required for HAZWOPER)
☒ OSHA 10-hour Construction Safety Training
☐ Fall Protection Training
☐ Trenching & Excavation

☐ Lockout/Tagout Training
☐ Electrical Safety Training
☐ Bloodborne Pathogen Training
☒ Safe Drilling SOP
☐
☐
☐
☐

Discuss/Clarify, as needed:

10. PERSONNEL AND EQUIPMENT DECONTAMINATION (SECTION ONLY REQUIRED FOR HAZWOPER SITES)

Describe personnel decontamination procedures for the project site, including "dry decon" (simple removal of PPE)	Dry Decon, wash hands and other exposed skin before taking breaks or leaving site. Change PPE before leaving site.

11. PROJECT PERSONNEL - ROLES AND RESPONSIBILITIES

GZA ON-SITE PERSONNEL:

Name(s)	Project Title/Assigned Role	Telephone Numbers
Jackson Bogach	Site Supervisor	Work: 646-929-8944 Cell: 332-215-6349
Jackson Bogach	Field Safety Officer	Work: 646-929-8944 Cell: 332-215-6349
Jackson Bogach	First Aid Personnel	Work: 646-929-8944 Cell: 332-215-6349
Yunmee Han	GZA Project Team Members	Work: 646-929-8941 Cell: 317-999-8432

Site Supervisors and Project Managers (SS/PM): Responsibility for compliance with GZA Health and Safety programs, policies, procedures and applicable laws and regulations is shared by all GZA management and supervisory personnel. This includes the need for effective oversight and supervision of project staff necessary to control the Health and Safety aspects of GZA on-site activities.

Field Safety Officer (FSO): The FSO is responsible for implementation of the Site Specific Health and Safety Plan.

First Aid Personnel: At least one individual designated by GZA who has current training and certification in basic first aid and cardiopulmonary resuscitation (CPR) must be present during on-site activities involving multiple GZA personnel at HAZWOPER sites.

GZA Project Team: Follow instructions relayed by the HASP and GZA manager on-site.

OTHER PROJECT PERSONNEL:

Name	Project Title/Assigned Role	Telephone Numbers
Victoria D. Whelan	Principal-in-Charge	Work: (212) 594-8140 Cell: (631) 793-8821
Mark Hutson	Project Manager	Work: (212) 594-8140 Cell: (332) 208-2260
Reinbill Maniquez	Office Safety Coordinator	Work: (212) 594-8140 Cell: (347) 443-1059
Richard Ecord	GZA EHS Director	Work: 781-278-3809 Cell: 404-234-2834

Principal-in-Charge: Responsible of overall project oversight, including responsibility for Health and Safety.

Project Manager: Responsible for day-to-day project management, including Health and Safety.

Health and Safety Coordinator: General Health and Safety guidance and assistance.

GZA EHS Director: H &S technical and regulatory guidance, assistance regarding GZA H&S policies and procedures.

12. PLAN ACKNOWLEDGEMENT AND APPROVALS

GZA Project Site Worker Plan Acknowledgement

I have read, understood, and agree to abide by the information set forth in this Safety and Accident Prevention Plan. I will follow guidance in this plan and in the GZA Health and Safety Program Manual. I understand the training and medical monitoring requirements covered by the work outlined in this plan and have met those requirements.

GZA Employee Name	GZA Employee Signature	Date
Jackson Bogach		
Yunmee Han		**7/29/2024**

Subcontractor Site Worker Plan Acknowledgement

GZA has prepared this plan solely for the purpose of protecting the health and safety of GZA employees. Subcontractors, visitors, and others at the site must refer to their organization's health and safety program or site-specific HASP for their protection. Subcontractor employees may use this plan for general informational purposes only. Subcontractor firms are obligated to comply with safety regulations applicable to their work, and understand this plan covers GZA activities only.

Subcontractor Employee Name	Subcontractor Employee Signatures	Date

GZA HASP Approval Signatures

The following individuals indicate their acknowledgement and/or approval of the contents of this Site Specific H&S Plan based on their understanding of project work activities, associated hazards and the appropriateness of health and safety measures to be implemented. A signed copy of this document must be present at the project site at all times work is being performed.

GZA Author/Reviewer Role	Signature	Date
Yunmee Han **HASP Preparer**		**7/29/2024**
TBD **EHS Reviewer**		
Victoria D. Whelan **Principal in Charge**		**7/29/2024**

ATTACHMENT - A
HEALTH AND SAFETY BRIEFING

Health and Safety Briefing/Site Orientation Record/Hazard Communication

This is to verify that I, the undersigned, have been provided with a site (orientation) briefing, including hazard communication, regarding the safety and health considerations at the 1701 Purdy Street, Bronx, New York (Site). I agree to abide by my employer's Site-specific safety and health plan and other safety or health requirements applicable to the Site.

Name (Print)	Signature	Company	Date

Site (orientation) briefing conducted by: ___________________________________

Date:___________

Health and Safety Briefing/Site Orientation Record

TAILGATE SAFETY MEETING

CHECK ONE: ______ **Initial H&S Orientation** _______**Periodic "Toolbox" Safety Meeting**

Project Site/Location____

Date________________________ **Time**_______________________________ **Job No.**__________________

PM____ **PIC**____

The undersigned have attended a Health and Safety briefing, consisting of a review of the provisions of the Site Specific H&S Plan, and/or appropriate prior H&S events or concerns, and/or review of anticipated H&S concerns and safety measures for the project.

SUMMARY OF HEALTH AND SAFETY TOPICS COVERED (required topics are listed below to be covered in addition to regular site-specific topics)
1. Pausing and Stopping Work
2. Review Site-Specific Safety Guidelines
3. Uneven and/or Unstable Terrain in Work Area(s)
4. How GZA People-Based Safety will be implemented on the site

NAME (printed)	SIGNATURE	COMPANY

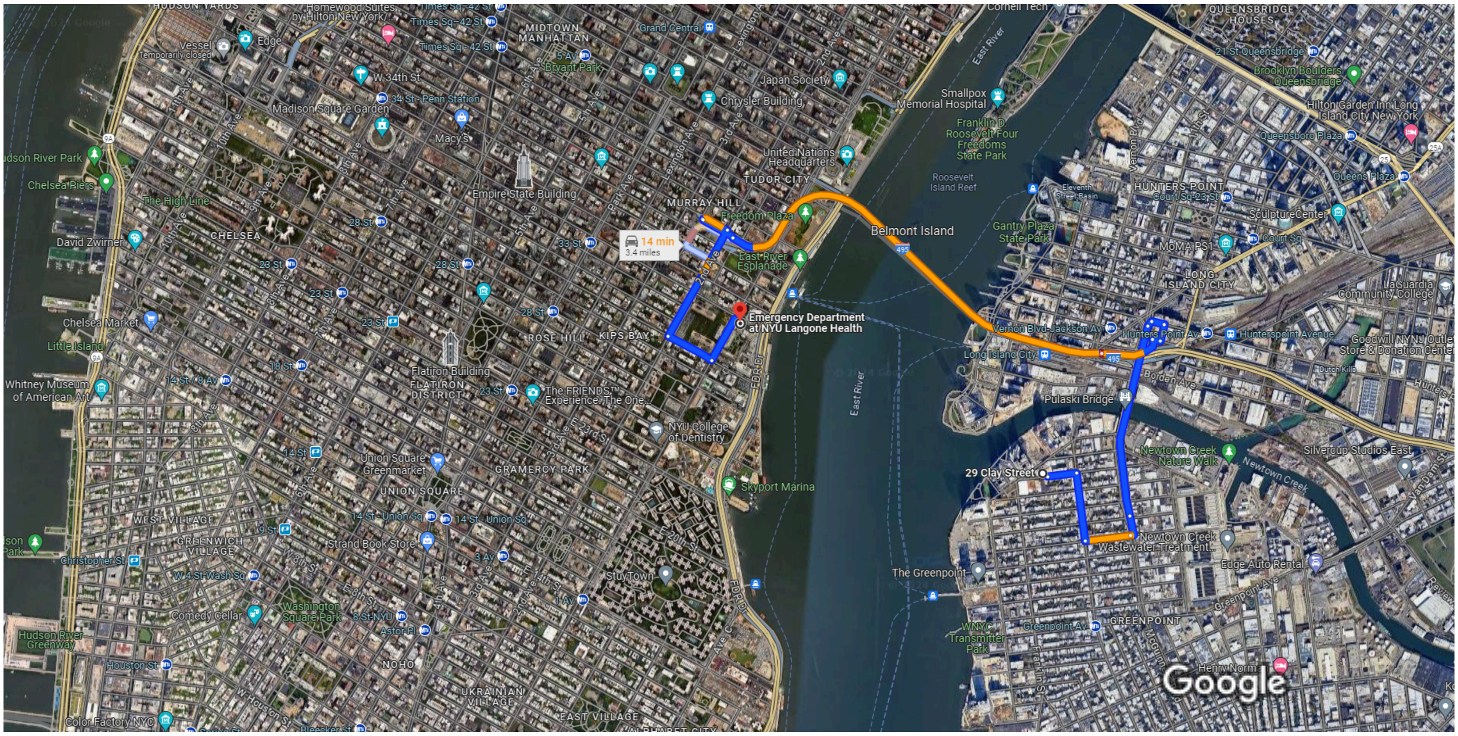
Conducted by: ____ Date:________________________

ATTACHMENT - B
ROUTE TO HOSPITAL

Google Maps

29 Clay St, Brooklyn, NY 11222 to Emergency Department at NYU Langone Health, 570 1st Ave., New York, NY 10016

Drive 3.4 miles, 14 min



Map data ©2024 , Map data ©2024 Google   1000 ft

29 Clay St
Brooklyn, NY 11222

⚠ This route has tolls.

Take Manhattan Ave to McGuinness Blvd

3 min (0.4 mi)

↑ 1. Head east on Clay St toward Manhattan Ave

443 ft

↱ 2. Turn right at the 1st cross street onto Manhattan Ave

0.2 mi

↰ 3. Turn left onto Green St

0.1 mi

Take Pulaski Brg, I-495 W and 2nd Ave to 1st Ave. in Manhattan

10 min (3.0 mi)

↰ 4. Turn left at the 1st cross street onto McGuinness Blvd

348 ft

↰ 5. Use the right lane to continue on Pulaski Brg

0.6 mi

↗ 6. Slight right toward 49th Ave

95 ft

7. Turn right onto 49th Ave

200 ft

8. Turn right onto 11th Pl

266 ft

9. Turn right onto 50th Ave

121 ft

10. Turn left to merge onto I-495 W
⚠ Toll road

0.2 mi

11. Keep right to stay on I-495 W
⚠ Toll road

1.3 mi

12. Take the 3 Ave/41 St exit toward Uptown/38 St
⚠ Toll road

0.1 mi

13. Take the ramp to 39th St
⚠ Toll road

16 ft

14. Turn right onto E 37th St

430 ft

15. Turn right onto 2nd Ave

0.3 mi

16. Turn left onto E 30th St

0.1 mi

17. Use the middle lane to turn left onto 1st Ave.
ℹ Destination will be on the right

0.1 mi

Emergency Department at NYU Langone Health
570 1st Ave., New York, NY 10016

ATTACHMENT - C
JOB HAZARD ANALYSES

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: Drilling Observations, Monitoring Well Installation Observation and Soil Sampling		
Analysis By: Andrew Whitsitt	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: October 2, 2011 **Revised: June 14, 2012**	**Date: June 14, 2012**	**Date: June 26, 2012**

Task 4.1
DRILLING OBSERVATIONS, MONITORING WELL INSTALLATION OBSERVATIONS, SOIL SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
<u>Review Related THA's</u> – 21.1 – General Outdoor Field Work		
Observation of Deploying of Traffic Protection Equipment by Drilling Contractor (e.g., cones, signs, etc.)	Personal injury due to vehicle traffic, Collisions, injuries	Wear high visibility vest at all times when out of vehicle.
		Park in designated parking locations or select off-road areas that are firm and free of hazards. Directly inspect parking location on foot if necessary.
		Use emergency flashers or other appropriate vehicle warning system as appropriate to local conditions when parking personal or GZA vehicle and/or equipment.
		If parking outside of a designated parking area, demarcate vehicle with traffic cones or equivalent.
		Use emergency flashers or other appropriate vehicle warning system when placing equipment.
		Observe if police detail or other required traffic control system (if necessary) is in place.
		Stay within the confines of the work area and do not venture outside of the demarcated work area into traffic.
		If you observe that contractor may back into structures, vehicles, fences, etc., notify contractor immediately with pre-determined signals. Do not cross the path of the heavy equipment.
		Stand clear of moving Drill Rig.
Observation of Mobilizing Drill Rig To Job Site and positioning at borehole by Drilling Contractor	Struck by drill rig	Before drilling begins, confirm that drill rig has been parked properly and securely by the drilling contractor.
		Wear high visibility vests. Make sure that the driver can see you and is aware of your location at all times.
		Inform the driller if it is observed that the rig is being moved with the mast raised and/or tools and other equipment on the rig are not secured and can fall over and potentially hurt personnel.

Job: Drilling Observations, Monitoring Well Installation Observation and Soil Sampling		
Analysis By: Andrew Whitsitt	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: October 2, 2011 **Revised: June 14, 2012**	**Date: June 14, 2012**	**Date: June 26, 2012**

Task 4.1

DRILLING OBSERVATIONS, MONITORING WELL INSTALLATION OBSERVATIONS, SOIL SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
	Overhead utility	Look overhead to assess if any utilities are present and confirm with driller that they are aware of the overhead utility location and to take appropriate actions to prevent contact with the overhead utilities and to minimize any arc flash hazards. Review GZA's Electrical Safe Work Practices Program 03-3003.
Observation of drilling operations and monitoring well installations	Underground utilities	Confirm that underground utility clearance procedures have been completed in accordance with GZA Policy # 04-0301 *Responsibility for Utility Clearance of Exploration Locations* for clearing utility locations prior
	Moving machinery, rotating parts, cables, ropes, etc.	Do not wear loose fitting clothing.
		All GZA personnel working in proximity to a drill rig will be familiarized with the location and operation of emergency kill switches prior to equipment start-up. Maintain safe distance from rotating auger, drill casing, rods and cathead at all times. Observe operations from a safe distance. Persons shall not pass under or over a moving stem or auger Check that "kill" switches are present and working. Confirm with driller that daily inspection of rig has been performed prior to commencing work and no conditions were noted with the rig that would affect its proper operation.
		Do not touch or operate or assist with any rig operations and maintenance work.
		Make eye contact with operator before approaching equipment.
		Be alert and take proper precautions regarding slippery ground surfaces and similar hazards near rotating auger.
		Do not engage the driller or helper when drill is in operation. Work out prearranged signals to get their attention before approaching them.
		Confirm prior to drilling operations that driller and helper communicate and coordinate their actions and movements.
		GZA personnel are not allowed to be on the drill rig or operate a rig.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: Drilling Observations, Monitoring Well Installation Observation and Soil Sampling		
Analysis By: Andrew Whitsitt	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: October 2, 2011 **Revised: June 14, 2012**	**Date: June 14, 2012**	**Date: June 26, 2012**

Task 4.1

DRILLING OBSERVATIONS, MONITORING WELL INSTALLATION OBSERVATIONS, SOIL SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Wear steel toed boots, hardhat and side-shielding safety glasses/goggles.
	Falling objects, debris	Stand clear of stacked drill rods. If stack appears unstable inform driller.
	Noise	Wear appropriate hearing protection.
	Roadway/traffic hazards	Be alert at all times; never step outside traffic cones.
		Wear high visibility vests at all times.
		Be familiar with escape routes at each location.
		Follow project Traffic Control Plan. Be alert at all times and never step outside the traffic cones. Use a Police detail when necessary.
	Slips, trips and falls	Maintain clean and sanitary work area free of tripping/slipping hazards.
		All borings, excavations, or partially completed groundwater monitoring wells will be adequately covered and/or barricaded if left unattended for any period of time to prevent injury.
		Store any hand tools used for sampling in their proper storage location when not in use.
		Provide adequate space for each employee to work safely with sound footing.
		Do not perform work if adequate lighting is not available.
		Maintain an exit pathway away from the rig at all times.
	Cuts, bruises, shocks, lacerations, sprains and strains during tool use	When working with a driller, do not assist the drilling crew with their work.
		Use properly maintained tools; do not use damaged tools.
		Wear the proper Personal Protective Equipment based on the task being performed.
		Store and carry tools correctly.
		Use the correct tool for the job.
		Do not use electrical tools with damaged cords or other electrical components.
		Observe proper electrical safety practices. Do not use electrical tools in wet areas.

Job: Drilling Observations, Monitoring Well Installation Observation and Soil Sampling		
Analysis By: Andrew Whitsitt	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: October 2, 2011 **Revised: June 14, 2012**	**Date: June 14, 2012**	**Date: June 26, 2012**

Task 4.1

DRILLING OBSERVATIONS, MONITORING WELL INSTALLATION OBSERVATIONS, SOIL SAMPLING

HAZARD CONTROLS

GZA Job Tasks	**Potential Hazards**	**Controls**
		Coordinate activities with driller. Allow driller to open sampling equipment (i.e., split spoons, Geoprobe sleeves, etc.)
	Fire hazards	Be familiar with emergency procedures and where fire extinguishers are present on site.
		Inform GZA subcontractor if you observe improper storage of used rags and unsafe storage of flammable/combustible liquids brought on site.
		GZA and its subcontractors, suppliers and vendors shall not smoke in the work area in GZA project sites. Smoking can only be in designated smoking areas away from work areas and potential fire hazard locations.
		Confirm with driller that a fire extinguisher present with rig and will be available at all times and that inspection tag is not expired.
		If driller is welding or cutting on site confirm there are no flammables or combustible materials near the vicinity of welding machines or torches (such as debris, fuels, grass/weeds, etc.). Review Site requirements for obtaining “Hot Work Permit”.
		Stand well clear of welding/cutting/burning areas.
		When drilling activities encounter the presence of gas or electric, the drill crew shall immediately curtail drilling activity, shut down the drill rig and contact the Project Manager.
	Exposure to Hazardous Substances/Chemicals	Become familiar with hazards associated with hazardous commercial products used in drilling (fuels, silica sand, grout, cement, bentonite, etc.). Review Safety Data Sheets (SDSs) for such products and participate in daily safety tailgate meetings.
		Do not handle drilling chemicals.
		Wear appropriate personal protective equipment.
		Review hazards of chemicals that may have been used or currently are being used on site.
		Refer to the site specific HASP for chemical hazards and the necessary precautions required for sampling.

Job: Drilling Observations, Monitoring Well Installation Observation and Soil Sampling		
Analysis By: Andrew Whitsitt	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: October 2, 2011 **Revised: June 14, 2012**	**Date: June 14, 2012**	**Date: June 26, 2012**

Task 4.1
DRILLING OBSERVATIONS, MONITORING WELL INSTALLATION OBSERVATIONS, SOIL SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Be alert for hazardous site contaminants (as indicated by odor, visual characteristics, location, and site history). Assess whether procedures and contingencies are in place for characterizing hazards and protecting workers by use of appropriate air monitoring, personal protective clothing and respiratory protection, as needed. If contamination is identified at the Site only personnel trained and medically qualified to work on hazardous sites will be permitted to proceed with the work.
Sampling Soil	Exposure to chemicals	Refer to the site specific HASP for chemical hazards and the necessary precautions required for sampling.
		Understand potential hazards associated with handling sample collection preservatives.
		Review and have SDS available for chemicals being brought on site, including that of sample preservatives.
		Wear appropriate PPE identified in the HASP
		Wash hands before eating and drinking. Eating and drinking are prohibited in areas of soil contamination/work area.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: Groundwater Sampling		
Analysis By: Andrew Whitsitt	**Reviewed By: Michael McCoy, CIH, CHMM**	**Approved By: Kim Anderson, Ph.D.** **Jayanti Chatterjee, CIH**
Date: September 30, 2011	**Date: November 9, 2011**	**Date: December 9, 2011**

TASK 4.2
GROUNDWATER SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
Deploying Traffic Protection Equipment	Personal injury due to vehicle traffic; Collisions, injuries	All drivers shall be properly licensed. Abide by driving safety procedures. Inspect vehicle to ensure it is in safe operating condition.
		Park in designated parking locations, or select off-road area that is firm, and without hazards. Directly inspect parking location on foot if necessary.
		Use emergency flashers or other appropriate vehicle warning system as appropriate to local conditions.
		Utilize police detail (if present) to direct traffic while entering traffic safety zone, if applicable.
Working outdoors	Unescorted or vacant site /Working Alone	Do not assume that Site has been maintained for safety.
		Coordinate site visit with other personnel not present, so that your failure to return would be noticed. Sign out or call into the office to leave site specific information where you are working, the anticipated duration/hours of work on site. Do this for each site if multiple in one day. See GZA working alone policy.
	Hunters, Abutters, and Property Owners	Always wear high visibility safety vest and hat. Make deliberate noise
		Permission for field work on private and public lands must almost always be obtained in advance. When possible, contact the local landowners when on site. Leave the site immediately if threatened or made to feel uncomfortable.
		Always announce yourself and your business at the site.
		Leave the site immediately if threatened or made to feel uncomfortable.
		Understand local hunting seasons and requirements.
	Insect Bites; Plant toxins; Poisonous Snakes. Incidental contact	Ticks carry risk of Lyme's and other Diseases. Tick season is basically any field day above 40 degrees F. • Tuck pants into long socks and apply DEET (or permethrin pre-treatment) to clothing in season to control exposure to ticks. • Check clothing for ticks frequently • Check whole body immediately upon returning from field and shower.
		Know the appearance of poison ivy and poison sumac in all seasons, and if sensitive to these toxins, carry and use special cleaning soaps/solutions when thought to be exposed. Stock first aid kit with poison ivy/sumac cleaning soaps/solutions.
		Be aware of intermittent seasonal reports of mosquito borne diseases, such as West Nile disease and Eastern Equine Encephalitis (EEE), and their locations relative to your field site. Use DEET or other mosquito repellant.

TASK 4.2
GROUNDWATER SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Be aware of potential cavity, suspended or ground nesting bee/wasp/hornet nests. Avoid undue disturbance or approach with appropriate safety clothing protection and netting.
		Be aware of terrain likelihood of harboring poisonous snakes in your work zone. Avoid reaching or stepping into hidden areas (such as into wood pile, rock pile, debris pile, stone wall, etc.) without pre-inspection.
	Exposure to Hazardous Substances	Become familiar with the hazards associated with hazardous commercial products used while groundwater sampling (laboratory preservatives, decontamination solutions, etc.). Review MSDS for such products.
		Wear proper personal protective equipment (PPE)) as specified in the Health and Safety Plan (HASP) to avoid direct contact with Site contaminants, calibration solutions, decontamination supplies, and laboratory preservatives.
		Assure proper respiratory protection is available as specified by the HASP.
		Assure decontamination procedures are in place per the HASP.
	Emergency conditions	Ensure that all site workers are familiar with emergency contact procedures route to nearest hospital.
		Ensure a first aid kit is present in field vehicle.
		It is required that at least one individual in the field has had first aid training.
	Adverse Weather Conditions	Assess weather conditions prior to on-site work and examine forecast for anticipated period of work.
		Dress appropriately for weather conditions (e.g., precipitation, temperature ranges over anticipated duration of field work).
		Use protective ointments such as sunscreen and chap stick, as appropriate to the field conditions.
		Be aware of the anticipated weather conditions prior to mobilization to the site. Unacceptable field work conditions are not precise, but may include site specific conditions, general location, extreme weather conditions (e.g., icing, lightening, excessive cold or wind), travel conditions, and other factors. Professional judgment is required, and personal assessment of safety must always be individually assessed.
Handling Flammable Liquids	Fire Hazards	Use only approved fuel containers for fuel, heavy duty metal cans with stable base and self closing nozzle is recommended.
		Store flammable liquids in an appropriate area when not in use.
		Provide proper fire extinguisher with the sampling equipment.
		Observe GZA's "no smoking" policy at all work sites.
Mobilizing Equipment	Collision; struck by	Perform a pre-operation check of the vehicle, ensuring service brakes, parking brake, steering, lights, tires, horn, wipers mirrors, and glass are in good condition. Ensure that the vehicle is roadworthy.
		All vehicle occupants shall wear seat belts.
		Secure loose materials in the cab or bed of the vehicle.
		Keep the windows and lights clean.
		Do not operate the vehicle if it is in an unsafe condition.
		Abide by driving safety procedures and laws.
Positioning vehicle at monitoring well	Unstable, uneven terrain and ground obstacles	Locate the vehicle on stable ground.
		Avoid wet areas/mud when possible.
	Backing Collisions	If possible, avoid backing by using a route that allows you to pull through.
		If you must back, do a quality 360^0 walk around.
		Use a spotter to help guide the backing safely.
		Look over the right shoulder and glance back to make sure fenders are clearing objects.

TASK 4.2
GROUNDWATER SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Block/chock wheels.
Well Sampling	Hazardous material contact	Identify wells with hazardous concentrations of contaminants.
		Sample wells in order from least to most impacted.
		Wear proper gloves (nitrile, etc.) when handling jars, preservatives could leak during shipment from the laboratory.
	Cuts and bruises from Sample jar	Do not over-tighten glass jars (especially VOAs); they can break, causing a cut.
Sampling Equipment Operation	Splashes, electrical shocks, fires, caught by	Perform an equipment inspection before use; ensure that pumps, flow meters, and water quality meters are calibrated and are in good working condition.
		Use GFCI with all cords.
		Be sure all equipment (especially generators) is properly grounded.
		Completely shut down all equipment prior to conducting maintenance activities, fueling, servicing or repairs.
	Manual lifting, equipment handling	Use proper lifting techniques when lifting equipment (generators, pumps, air compressors, tubing, etc.). Seek assistance with heavy loads.
		Use work gloves where appropriate to prevent hand injuries.
		Wear steel toed boots.
	Noise	Wear appropriate hearing protection during activities that produce noise (running generators, pumps, air compressors, etc.).
	Slips, trips and falls	Maintain a clean and sanitary work area free of tripping/slipping hazards.
		Store hand tools in their proper storage location when not in use.
		Provide ample space for each employee to work safely with sound footing.
		Provide ample lighting.
		Provide adequate facilities/equipment/hand sanitizers for hand washing prior to eating.
	Tool-related hazards	Do not use electrical tools with damaged cords or other electrical components.
		Observe proper electrical safety practices.
		Ensure tools are properly maintained; do not use damaged tools.
		Wear eye protection.
		Store and carry tools correctly.
		Use the correct tool for the job.
		Protect from gouges, hammer blows, cutting tools, etc. Position your hands to prevent injury in case the tool slips while in use.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: Surface Water and Sediment Sampling		
Analysis By: Kim Cichon	**Reviewed By: Michael McCoy, CIH, CHMM**	**Approved By: Kim Anderson, Ph.D.** **Jayanti Chatterjee, CIH**
Date: October 14, 2011	**Date: November 9, 2011**	**Date: November 9, 2011**

TASK 4.3
SURFACE WATER AND SEDIMENT SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
Surface Water Sampling and/or Sediment Sampling – (lakes, ponds, streams)	Unescorted or vacant site /Working Alone	Do not assume that Site has been maintained for safety.
		Coordinate site visit with other personnel not present, so that your failure to return would be noticed. Sign out or call into the office to leave site specific information where you are working, the anticipated duration/hours of work on site. Do this for each site if multiple in one day. See GZA working alone policy.
	Hunters, Abutters, and Property Owners	Always wear high visibility safety vest and hat. Make deliberate noise
		Permission for field work on private and public lands must almost always be obtained in advance. When possible, contact the local landowners when on site. Leave the site immediately if threatened or made to feel uncomfortable.
		Always announce yourself and your business at the site.
		Leave the site immediately if threatened or made to feel uncomfortable.
		Understand local hunting seasons and requirements.
	Insect Bites; Plant toxins; Poisonous Snakes. Incidental contact	Ticks carry risk of Lyme's and other Diseases. Tick season is basically any field day above 40 degrees F. • Tuck pants into long socks and apply DEET (or permethrin pre-treatment) to clothing in season to control exposure to ticks. • Check clothing for ticks frequently Check whole body immediately upon returning from field and shower.
		Know the appearance of poison ivy and poison sumac in all seasons, and if sensitive to these toxins, carry and use special cleaning soaps/solutions when thought to be exposed. Stock first aid kit with poison ivy/sumac cleaning soaps/solutions.
		Be aware of intermittent seasonal reports of mosquito borne diseases, such as West Nile disease and Eastern Equine Encephalitis (EEE), and their locations relative to your field site. Use DEET or other mosquito repellant.
		Be aware of potential cavity, suspended or ground nesting bee/wasp/hornet nests. Avoid undue disturbance or approach with appropriate safety clothing protection and netting. Avoid areas with tall grasses, rocks/stone walls, wood piles/down trees.
	Water Hazards	Use sampler with extension/telescoping pole.
		Use proper equipment (boots and waders, life jacket) if necessary to enter water.
		Do not reach over water.
		Use "buddy system."
		Review emergency plan prior to start of work.

TASK 4.3
SURFACE WATER AND SEDIMENT SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
	Boat Hazards	Use U.S. Coast Guard-approved life jacket/vest.
		Take boaters safety course.
		Have emergency ring buoys.
		Use "buddy system" at all times.
		Keep boat clean work area to avoid slips, trips, and falls.
		Use anchors to secure boat from drifting before sampling.
		Secure items in boat before moving boat.
		Avoid loose fitting clothing that may get caught on sampling equipment.
	Adverse weather	Assess weather conditions prior to on-site work and examine forecast for anticipated period of work.
		Dress appropriately for weather conditions (e.g., precipitation, temperature ranges over anticipated duration of field work).
		Use protective ointments such as sunscreen and chap stick, as appropriate to the field conditions.
		Be aware of the anticipated weather conditions prior to mobilization to the site. Unacceptable field work conditions are not precise, but may include site specific conditions, general location, extreme weather conditions (e.g., icing, lightening, excessive cold or wind), travel conditions, and other factors. Professional judgment is required, and personal assessment of safety must always be individually assessed.
		Stop work during lightening storms.
	Chemical Hazards	Wear appropriate PPE as specified in Site Specific Health and Safety Plan.
		Follow safe work practices identified in the plan and in accordance with training and review with all employees during tailgate meetings.
		Be alert for site contaminants (odors, visual observations).
	Traffic Hazards	Use safety vests and safety cones when sampling at bridges or other access points near roads/parking areas.
	Slips, trips and falls – uneven Terrain	Ensure stable footing before collecting sample.
		Avoid areas along stream beds/shoreline that are "soft" or where slump may occur.
	Working Alone	Sign out or call into the office to leave site specific information where you are working, the anticipated duration/hours of work on site. Do this for each site if multiple in one day. Review GZA's working alone policy.
		Call office when off site.
	Emergency Conditions	Ensure that all site workers are familiar with emergency contact procedures route to nearest hospital.
		Ensure a first aid kit is present in field vehicle.
		It is required that at least one individual in the field has had first aid training.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: Excavation and Trenching (Heavy Equipment)		
Analysis By: Andrew Whitsitt	**Reviewed By: Michael McCoy, CIH, CHMM**	**Approved By: Kim Anderson, Ph.D.** **Jayanti Chatterjee, CIH**
Date: September 30, 2011	**Date: November 10, 2011**	**Date: December 9, 2011**

TASK 4.4A
EXCAVATION AND TRENCHING (HEAVY EQUIPMENT)

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
Observation of Mobilizing Equipment by contractor	Collisions, struck by injuries	Wear high visibility vest at all times when out of personal or GZA vehicle.
		Park personal or GZA vehicle in designated parking locations, or select off-road area that is firm, and without hazards. Directly inspect parking location on foot if necessary.
		Use emergency flashers or other appropriate vehicle warning system as appropriate to local conditions when parking personal or GZA vehicle.
		Confirm with contractor that police detail (if necessary) has been arranged to direct traffic while entering traffic safety zone.
		Stand clear of moving heavy equipment and away from any overhead utility lines until equipment is safely in position and parked properly and securely by the contractor.
		If the equipment contacts an overhead power line, inform any occupant and/or operator to remain in/on the rig until the line is de-energized. Summon help immediately.
		If possible, avoid backing by using a route that allows you to pull through.
		If you must back, do a quality 360° walkover.
		Use a spotter to help guide the backing safely.
		If you observe that contractor may back into structures, vehicles, fences, etc. notify contractor immediately.
		When backing own or GZA vehicle conduct a quality 360° walkover.
		If necessary, use a spotter to help guide the backing safely.
		Look over the right shoulder and glance back to make sure fenders are clearing objects.
	Overhead electrical lines	Confirm with contractor that overhead lines are cleared so that equipment, truck beds, etc. does not strike overhead utility. Stand clear of overhead lines while equipment is being mobilized.
Unloading equipment and materials	Strains and sprains	Use proper lifting techniques when lifting equipment. Seek assistance with heavy loads. GZA personnel **are not to** assist contractor with contractor's work.
		Use work gloves where appropriate to prevent hand injuries. Wear steel toed boots.
		Use heavy equipment whenever possible to avoid heavy lifting.
	Trip and Fall Hazards	Inspect site for uneven terrain or tripping hazards; plan travel route to avoid these areas or improve the site to eliminate the hazard.
		Clear brush from work area and clear vegetation that could cause trip hazards, eye injury or obstruct sight lines.
	Unstable equipment	Ensure trailers are counter weighted properly before unloading equipment.

TASK 4.4A
EXCAVATION AND TRENCHING (HEAVY EQUIPMENT)

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
Excavation operations	Struck by	Stay clear of equipment at all times. . Assure that operators are aware of your position on the site at all times. Wear high visibility reflective vests at all times while on site. Heed back up alarms of all equipment.
		Do not approach operating heavy equipment until eye contact is made with operator and equipment operation is stopped.
		Consult with contractor to properly maintain Site access roads to assure vehicles can safely leave and enter the Site.
		Confirm with contractor that excavating equipment are properly staged and stabilized to avoid roll overs and accidents.
		Be especially aware of and clear of the swing radius of all heavy equipment.
		Equipment buckets cannot be used to transport personnel from/into excavation.
	Underground utilities; above ground piping and appurtenances	Confirm with contractor that proper utility location/clearance has been conducted prior to breaking ground.
		Confirm with contractor that safe distance from utilities, above ground piping and equipment are being maintained.
		Have contractor hand excavate where required to expose utilities.
		Where possible have contractor lockout and purge active utilities.
		If excavation exposes utilities, have the contractor assure that lines are properly supported.
		Require the contractor to use non-sparking tools around active gas lines and implement safe work practices.
		If any damage is caused during excavation to utility lines notify utility owner.
		Make sure extinguishers are present in the work area, charged and currently inspected.
		Notify utility owner if cathodic protection (coatings, groundbeds, etc.) has been exposed.
	Collisions with workers using shovels and hand tools	Ensure that workers communicate and coordinate their actions and movements.
	Falling objects, debris	Wear hardhat and safety glasses/goggles.
		Do not work under raised loads
	Falls into Open Excavation	Secure work zone using barricades, caution tape, etc.
		DO NOT stand near edges of excavations.
		Keep non-essential personnel away from the work zone.
	Hazardous Liquid Spills	Maintain spill control kit, including sorbents, pad booms and shovels.
		Line waste loading areas with polyethylene sheeting.
		Immediately report any spill to the project manager.
	Exposure to Hazardous Substances	Be alert for hazardous site contaminants (as indicated by odor, visual characteristics, location, and site history). Ensure that procedures and contingencies are in place for characterizing hazards and protecting workers by use of appropriate personal protective clothing and respiratory protection, as needed; notify project manager if such conditions are encountered.
	Noise	Wear appropriate hearing protection.
	Cave-In Hazards	Ensure that excavation is monitored by a Competent Person.
		Confirm with contractors that operators are properly trained for excavating.
		Ensure proper sloping/shoring for soil type.
		Ensure no standing water in excavation
		Place Spoils away from the edge of excavation as appropriate for the soil type.

TASK 4.4A
EXCAVATION AND TRENCHING (HEAVY EQUIPMENT)

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Excavations greater than 20 feet in depth must be designed by a registered professional engineer.
		Inspect excavations at the beginning of each shift and following rain events
		DO NOT enter excavations unless absolutely necessary. Ensure that excavation is safe to enter before entering.
	Hazardous Atmosphere	Identify possible contaminants.
		Set action levels for exposure.
		Monitor air quality.
		Ensure air monitoring equipment is properly calibrated.
		Refer to the site specific Health and Safety Plan for the use of proper personal protective equipment (PPE) and respiratory protection.
		Provide adequate means of entering and exiting manned excavations at intervals of no more than 25 feet
		Ladders should extend above the ground surface at the edge of an excavation
Soil Transport	Roadway/traffic hazards	Provide signage at blind intersections.
		Be alert at all times; never step outside traffic cones.
		Wear high visibility vests at all times.
		Be familiar with escape routes at each location.
		Regularly inspect cone pattern to ensure proper setup.
		Modify traffic protection pattern as needed in response to “close call incidents.”
		Loads must be of proper weight for designated road routes.
	Hazardous Material Contamination	Materials should be properly covered, including use of tarping trucks.
		Be sure equipment and truck wheels, running boards, etc. are free of loose materials before leaving Site.
		Ensure proper waste manifestation for loads.
Handling Flammable Liquids	Fire Hazards	Use only approved fuel containers for fuel, heavy duty metal cans with stable base and self closing nozzle is recommended.
		Store flammable liquids in appropriate flammable storage cabinet.
Tool Operation	Cuts, bruises, shocks, lacerations, sprains and strains	Do not use electrical tools with damaged cords or other electrical components.
		Observe proper electrical safety practices.
		Ensure tools are properly maintained; do not use damaged tools.
		Wear eye and hearing protection.
		Store and carry tools correctly.
		Use the correct tool for the job.
		Support the work piece (using clamps, vise, sawhorse, or other device). Do not hold the work piece with your hand.
		Unplug tools or remove batteries when servicing or changing bit, blades, abrasive wheels or other components.
		Protect your “off hand” from gouges, hammer blows, cutting tools, etc. Position your “of hand” to prevent injury in case of slip of the tool.
General site work	Slips, trips and falls	Maintain clean and sanitary work area free of tripping/slipping hazards.
		Store hand tools in their proper storage location when not in use.
		Ensure ample space for each employee to work safely with sound footing.

TASK 4.4A
EXCAVATION AND TRENCHING (HEAVY EQUIPMENT)

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
	Insect Bites; Plant toxins; Poisonous Snakes. Incidental contact	Ticks carry risk of Lyme's and other Diseases. Tick season is basically any field day above 40 degrees F. • Tuck pants into long socks and apply DEET (or permethrin pre-treatment) to clothing in season to control exposure to ticks. • Check clothing for ticks frequently • Check whole body immediately upon returning from field and shower.
		Know the appearance of poison ivy and poison sumac in all seasons, and if sensitive to these toxins, carry and use special cleaning soaps/solutions when thought to be exposed. Stock first aid kit with poison ivy/sumac cleaning soaps/solutions.
		Be aware of intermittent seasonal reports of mosquito borne diseases, such as West Nile disease and Eastern Equine Encephalitis (EEE), and their locations relative to your field site. Use DEET or other mosquito repellant.
		Be aware of potential cavity, suspended or ground nesting bee/wasp/hornet nests. Avoid undue disturbance or approach with appropriate safety clothing protection and netting.
		Be aware of terrain likelihood of harboring poisonous snakes in your work zone. Avoid reaching or stepping into hidden areas (such as into wood pile, rock pile, debris pile, stone wall, etc.) without pre-inspection.
	Adverse Weather Conditions	Assess weather conditions prior to on-site work and examine forecast for anticipated period of work.
		Dress appropriately for weather conditions (e.g., precipitation, temperature ranges over anticipated duration of field work).
		Use protective ointments such as sunscreen and chap stick, as appropriate to the field conditions.
		Be aware of the anticipated weather conditions prior to mobilization to the site. Unacceptable field work conditions are not precise, but may include site specific conditions, general location, extreme weather conditions (e.g., icing, lightening, excessive cold or wind), travel conditions, and other factors. Professional judgment is required, and personal assessment of safety must always be individually assessed.
	Emergency Conditions	Ensure that all site workers are familiar with emergency contact procedures route to nearest hospital.
		Ensure a first aid kit is present in field vehicle.
		It is required that at least one individual in the field has had first aid training.
		Discuss any worker physical conditions that may require medical attention.
		Carry a cell phone during all field work for emergency purposes, and confirm that a cell phone signal is available at the site.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: Manual Excavation and Trenching		
Analysis By: Andrew Whitsitt	**Reviewed By: Michael McCoy, CIH, CHMM**	**Approved By: Kim Anderson, Ph.D.** **Jayanti Chatterjee, CIH**
Date: September 30, 2011	**Date: November 10, 2011**	**Date: November 10, 2011**

TASK 4.4B
MANUAL EXCAVATION AND TRENCHING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
Vehicle Safety Moving Vehicle and Trailer To Job Site	Collisions, injuries	All drivers shall be properly licensed.
		Perform pre-operation check of vehicle, ensuring service brakes, parking brake, steering, lights, tires, horn, wipers, mirrors and glass are in good condition. Ensure that the rig is roadworthy.
		Occupants shall wear seat belts.
		Secure loose materials in cab or bed of vehicle.
		Keep windows, lights clean.
		Do not operate vehicle if in an unsafe condition.
		Abide by driving safety procedures.
		Inspect trailer hitch and make sure securely fastened.
		Attach safety chains.
		Check trailer light connections and make sure lights are in good operating order.
		Locate trailers and parked vehicles out of right-of-ways, clear of facility traffic and in a manner the egress is not blocked.
		Use emergency flashers if necessary to stop in right-of-ways.
	Backing Collisions	If possible, avoid backing by using a route that allows you to pull through.
		If you must back, do a quality 360° walkover.
		Use a spotter to help guide the backing safely.
		Look over the right shoulder and glance back to make sure fenders are clearing objects.
	Unstable, uneven terrain	Locate trailer on stable ground.
		Level trailer with jacks, if necessary.
		Ensure jacks are on stable footing.
		Block/chock wheels
	Overhead electrical lines	Confirm with contractor that overhead lines are cleared so that equipment, truck beds, etc. does not strike overhead utility. Stand clear of overhead lines while equipment is being mobilized.
Unloading equipment and materials	Insect Bites; Plant toxins; Poisonous Snakes. Incidental contact	Ticks carry risk of Lyme's and other Diseases. Tick season is basically any field day above 40 degrees F. • Tuck pants into long socks and apply DEET (or permethrin pre-treatment) to clothing in season to control exposure to ticks. • Check clothing for ticks frequently • Check whole body immediately upon returning from field and shower.

TASK 4.4B
MANUAL EXCAVATION AND TRENCHING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
Unloading equipment and materials	Insect Bites; Plant toxins; Poisonous Snakes. Incidental contact	Know the appearance of poison ivy and poison sumac in all seasons, and if sensitive to these toxins, carry and use special cleaning soaps/solutions when thought to be exposed. Stock first aid kit with poison ivy/sumac cleaning soaps/solutions.
		Be aware of intermittent seasonal reports of mosquito borne diseases, such as West Nile disease and Eastern Equine Encephalitis (EEE), and their locations relative to your field site. Use DEET or other mosquito repellant.
		Be aware of potential cavity, suspended or ground nesting bee/wasp/hornet nests. Avoid undue disturbance or approach with appropriate safety clothing protection and netting.
		Be aware of terrain likelihood of harboring poisonous snakes in your work zone. Avoid reaching or stepping into hidden areas (such as into wood pile, rock pile, debris pile, stone wall, etc.) without pre-inspection.
Site Setup Manual lifting, equipment handling	Sprains and strains	Use proper lifting techniques when lifting equipment. Seek assistance with heavy loads. GZA personnel **are not to** assist contractor with contractor's work.
		Use work gloves where appropriate to prevent hand injuries. Wear steel toed boots.
		Use heavy equipment whenever possible to avoid heavy lifting.
	Trip and Fall Hazards	Inspect site for uneven terrain or tripping hazards; plan transportation route to avoid these areas or improve the site to eliminate the hazard.
		Clear brush from work area and clear vegetation that could cause trip hazards, eye injury or obstruct sight lines.
Excavation Operations	Underground utilities; above ground piping and appurtenances	Confirm with contractor that proper utility location/clearance has been conducted prior to breaking ground.
		Confirm with contractor that safe distance from utilities, above ground piping and equipment are being maintained.
		Have contractor hand excavate where required to expose utilities.
		Where possible have contractor lockout and purge active utilities.
		If excavation exposes utilities, have the contractor assure that lines are properly supported.
		Require the contractor to use non-sparking tools around active gas lines and implement safe work practices.
		If any damage is caused during excavation to utility lines notify utility owner.
	Collisions with workers using shovels and hand tools	Ensure that workers communicate and coordinate their actions and movements
	Falling objects, debris	Wear hardhat and safety glasses/goggles.
	Falls into Open Excavation	Secure work zone using barricades, caution tape, etc.
		DO NOT near edges of excavations
		Keep non-essential personnel away from the work zone.
	Hazardous Spills	Maintain spill control kit, including sorbents, pad booms and shovels.
		Line waste loading areas with polyethylene sheeting.
		Make timely notification of any spill.
	Noise	Wear appropriate hearing protection.
	Adverse weather	Assess weather conditions prior to on-site work and examine forecast for anticipated period of work.

TASK 4.4B
MANUAL EXCAVATION AND TRENCHING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
Excavation Operations	Adverse weather	Dress appropriately for weather conditions (e.g., precipitation, temperature ranges over anticipated duration of field work).
		Use protective ointments such as sunscreen and chap stick, as appropriate to the field conditions.
		Be aware of the anticipated weather conditions prior to mobilization to the site. Unacceptable field work conditions are not precise, but may include site specific conditions, general location, extreme weather conditions (e.g., icing, lightening, excessive cold or wind), travel conditions, and other factors. Professional judgment is required, and personal assessment of safety must always be individually assessed.
	Slips, trips and falls	Maintain clean and sanitary work area free of tripping/slipping hazards.
		Store hand tools in their proper storage location when not in use.
		Ensure ample space for each employee to work safely with sound footing.
	Cuts, bruises, shocks, lacerations, sprains and strains	Do not use electrical tools with damaged cords or other electrical components. Observe proper electrical safety practices.
		Ensure tools are properly maintained; do not use damaged tools.
		Wear eye and hearing protection.
		Store and carry tools correctly.
		Use the correct tool for the job.
		Support the work piece (using clamps, vise, sawhorse, or other device). Do not hold the work piece with your hand.
		Unplug tools or remove batteries when servicing or changing bit, blades, abrasive wheels or other components.
		Protect your "off hand" from gouges, hammer blows, cutting tools, etc. Position your "of hand" to prevent injury in case of slip of the tool.
		Do not use electrical tools with damaged cords or other electrical components.
	Exposure to Hazardous Substances	Be alert for hazardous site contaminants (as indicated by odor, visual characteristics, location, and site history). Ensure that procedures and contingencies are in place for characterizing hazards and protecting workers by use of appropriate personal protective clothing and respiratory protection, as needed; notify project manager if such conditions are encountered. Refer to Site Specific Health and Safety Plan for work practices, air monitoring and decontamination procedures.
	Emergency Conditions	Ensure that all site workers are familiar with emergency contact procedures route to nearest hospital.
		Ensure a first aid kit is present in field vehicle.
		It is required that at least one individual in the field has had first aid training.
		Discuss any worker physical conditions that may require medical attention.
		Carry a cell phone during all field work for emergency purposes, and confirm that a cell phone signal is available at the site.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: Soil-Gas Sampling		
Analysis By: **Joseph DiAntonio**	**Reviewed By: Michael McCoy, CIH, CHMM**	**Approved By: Kim Anderson, Ph.D.** **Jayanti Chatterjee, CIH**
Date: September 30, 2011	**Date: November 10, 2011**	**Date: December 10, 2011**

TASK 4.5
SOIL-GAS SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
Collection of Soil-Gas for Sampling	Exposure to Hazardous Substances	Become familiar with hazards through review of Task Hazard Analysis and participate in daily safety tailgate meetings.
		Communicate Task Hazard Analysis and Lessons Learned information to field crew prior to initiating work and throughout the project as needed.
		Be alert for hazardous site contaminants (as indicated by odor, visual characteristics, location, and site history). Wear appropriate safety equipment as required by the Site Specific Health and Safety Plan (HASP) work area (hard hat, steel toe boots, work clothes, high visibility vest, eye and hearing protection, etc.). Implement work practices identified in the HASP.
		Ensure that workers are familiar with hazards associated with products used where samples will be collected. Ensure that workers are familiar with potential compounds of concern during the remedial investigation. Ensure that MSDSs are available-
	Emergency Conditions	Ensure that all site workers are familiar with emergency contact procedures route to nearest hospital.
		Ensure a first aid kit is present in field vehicle.
		It is required that at least one individual in the field has had first aid training.
		Discuss any worker physical conditions that may require medical attention.
	Underground Utilities	Verify that proper utility locations/clearance has been performed and check area for evidence of underground features prior to breaking ground.
Sampling Near or In Roadways:	Personal injury due to vehicle traffic	Wear high visibility vest at all times when out of personal or GZA vehicle.
		Park personal or GZA vehicle in designated parking locations, or select off-road area that is firm, and without hazards. Directly inspect parking location on foot if necessary.
		Use emergency flashers or other appropriate vehicle warning system as appropriate to local conditions when parking personal or GZA vehicle.
		Use police detail (if necessary) to direct traffic while entering traffic safety zone.
Sampling in outdoor environment	Insect Bites; Plant toxins; Poisonous Snakes. Incidental contact	Ticks carry risk of Lyme's and other Diseases. Tick season is basically any field day above 40 degrees F. • Tuck pants into long socks and apply DEET (or

TASK 4.5
SOIL-GAS SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		permethrin pre-treatment) to clothing in season to control exposure to ticks. • Check clothing for ticks frequently • Check whole body immediately upon returning from field and shower.
		Know the appearance of poison ivy and poison sumac in all seasons, and if sensitive to these toxins, carry and use special cleaning soaps/solutions when thought to be exposed. Stock first aid kit with poison ivy/sumac cleaning soaps/solutions.
		Be aware of intermittent seasonal reports of mosquito borne diseases, such as West Nile disease and Eastern Equine Encephalitis (EEE), and their locations relative to your field site. Use DEET or other mosquito repellant.
		Be aware of potential cavity, suspended or ground nesting bee/wasp/hornet nests. Avoid undue disturbance or approach with appropriate safety clothing protection and netting.
		Be aware of terrain likelihood of harboring poisonous snakes in your work zone. Avoid reaching or stepping into hidden areas (such as into wood pile, rock pile, debris pile, stone wall, etc.) without pre-inspection.
		Be aware of any site worker allergies, know where their epi-pen is if applicable.
Manual Installation of Sample Points	Cuts, bruises, shocks, lacerations, sprains and strains	Do not use electrical tools with damaged cords or other electrical components. Observe proper electrical safety practices.
		Ensure tools are properly maintained; do not use damaged tools.
		Wear eye and hearing protection.
		Store and carry tools correctly.
		Use the correct tool for the job.
		Support the work piece (using clamps, vise, sawhorse, or other device). Do not hold the work piece with your hand.
		Unplug tools or remove batteries when servicing or changing bit, blades, abrasive wheels or other components.
		Protect your "off hand" from gouges, hammer blows, cutting tools, etc. Position your "of hand" to prevent injury in case of slip of the tool.
		Do not use electrical tools with damaged cords or other electrical components.
Generator Use	Fire / burn hazards from generator used to power, rotary drill, hammer drill, lighting etc.	Ensure that all flammable/combustible liquids are stored in proper containers.
		Ensure that a fire extinguisher is present on site.
		Ensure generator is placed on level, stable ground. Be sure to keep exhaust port/pipe away from potential flammable materials (i.e. dry brush, oily rags etc).
		Use careful around hot exhaust port/pipe

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: AST/UST Inspection and Sampling		
Analysis By:	**Reviewed By: Michael McCoy, CIH, CHMM**	**Approved By: Kim Anderson, Ph.D.**
Date:	**Date: November 17, 2011**	**Date: November 17, 2011**

TASK 4.6
AST/UST INSPECTION AND SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
Observation of Excavation Operations	Various Physical hazards	Review THA for Excavation 4.4a Excavation and Trenching (Heavy Equipment).
Inspection of AST/UST (only after removal)	Traffic Hazards	Be alert for moving vehicles, equipment, pedestrians.
		Wear high visibility safety vest.
		Maintain eye contact with equipment operator when moving around excavation area.
	Struck by/crushed by	Verify that the tank is stable ground and properly chocked and braced before approaching to inspect.
		DO NOT stand within swing radius of the equipment or underneath tank when it is being removed from underground or from its above ground location to observe cracks/holes on the tanks.
		DO NOT enter excavations to inspect USTs.
	Cuts and lacerations	Be aware of sharp edges from saw cut made for cleaning on the tanks. Use gloves and approach with caution.
	Slips, trips and falls	Stand away from edge of excavations.
		Be aware of excavation stability.
		DO NOT enter excavation unless absolutely necessary. Never enter excavation that is not properly sloped/shored and has adequate egress means (ladders every 25 ft).
	Insect Bites; Plant toxins; Poisonous Snakes. Incidental contact	Ticks carry risk of Lyme's and other Diseases. Tick season is basically any field day above 40 degrees F. • Tuck pants into long socks and apply DEET (or permethrin pre-treatment) to clothing in season to control exposure to ticks. • Check clothing for ticks frequently • Check whole body immediately upon returning from field and shower.
		Know the appearance of poison ivy and poison sumac in all seasons, and if sensitive to these toxins, carry and use special cleaning soaps/solutions when thought to be exposed. Stock first aid kit with poison ivy/sumac cleaning soaps/solutions.
		Be aware of intermittent seasonal reports of mosquito borne diseases, such as West Nile disease and Eastern Equine Encephalitis (EEE), and their locations relative to your field site. Use DEET or other mosquito repellant.
		Be aware of potential cavity, suspended or ground nesting bee/wasp/hornet nests. Avoid undue disturbance or approach with appropriate safety clothing protection and netting.
	Adverse weather	Assess weather conditions prior to on-site work and examine forecast for anticipated period of work.
		Dress appropriately for weather conditions (e.g., precipitation, temperature ranges over anticipated duration of field work).
		Use protective ointments such as sunscreen and chap stick, as appropriate to the field conditions.

TASK 4.6
AST/UST INSPECTION AND SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Be aware of the anticipated weather conditions prior to mobilization to the site. Unacceptable field work conditions are not precise, but may include site specific conditions, general location, extreme weather conditions (e.g., icing, lightening, excessive cold or wind), travel conditions, and other factors. Professional judgment is required, and personal assessment of safety must always be individually assessed.
Sample Collection from excavation	Slips, trips, falls, struck by	Ensure stable footing before collecting sample.
		Carefully coordinate sample locations with operator and laborers.
		Wait for operator to signal before approaching bucket to collect sample.
	Chemical Hazards Excavation Equipment	Prepare H&S Plan and review with all employees during daily tailgate meeting.
		Wear appropriate PPE as specified in the Site Health and Safety Plan (HASP).
		Be alert for site contaminants (odors, visual observations).
		Implement work practices and monitoring identified in the HASP.
General site work	Emergency Conditions	Ensure that all site workers are familiar with emergency contact procedures route to nearest hospital.
		Ensure a first aid kit is present in field vehicle.
		It is required that at least one individual in the field has had first aid training.
		Discuss any worker physical conditions that may require medical attention.
		Carry a cell phone during all field work for emergency purposes, and confirm that a cell phone signal is available at the site.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: Temporary/Permanent Sampling Equipment Operation		
Analysis By: James Wieck	**Reviewed By: Michael McCoy, CIH, CHMM**	**Approved By: Kim Anderson, Ph.D.** **Jayanti Chatterjee, CIH**
Date: September 30, 2011	**Date: November 17, 2011**	**Date: December 10, 2011**

TASK 4.7
TEMPORARY/PERMANENT SAMPLING EQUIPMENT OPERATION

HAZARD CONTROLS

GZA Job Tasks	**Potential Hazards**	**Controls**
Installation of equipment within monitoring wells by GZA (transducers, probes and multiparameter sonds, pumps, solid and pneumatic slugs, and borehole logging equipment)	Cuts, lacerations, bruises, pinch points, electrical shocks.	Become familiar with equipment installation procedures and related hazards through review of Job Hazard Analysis and participate in daily safety tailgate meetings.
		Review potential pinch, trip, abrasion/cut, and entanglement hazards. Wear gloves to limit potential pinch, cut, and abrasion hazards.
		Wear appropriate safety equipment as required by the Site Specific Health and Safety Plan when in general work area (steel toe boots, work clothes, gloves, high visibility vest, eye and hearing protection, etc.).
		Keep cables, electrical lines, tubing organized and within view when installing or retrieving from well.
		Review weight of equipment being installed or retrieved and select methods sufficient to insure control of deployment/retrieval rate with equipment suspended in well.
		If tripods and winches are needed to control the deployment or retrieval of equipment, review related safety procedures and manufacturers recommendations; consider hazards associated with electrical or fuel power sources and exhaust as applicable and consider entanglement and overhead hazards.
		Use a dedicated cable or cord secured to the equipment and the well casing or secure object at the ground surface for deployment and retrieval. Do not deploy or retrieve equipment using data cables or sample tubing to carry the weight of the equipment.
	Insect Bites; Plant toxins; Poisonous Snakes. Incidental contact	Use caution when opening monitoring wells for the presence of insects and vermin. Wear gloves to protect against unanticipated stinging insects or biting vermin.
		Ticks carry risk of Lyme's and other Diseases. Tick season is basically any field day above 40 degrees F. • Tuck pants into long socks and apply DEET (or permethrin pre-treatment) to clothing in season to control exposure to ticks. • Check clothing for ticks frequently • Check whole body immediately upon returning from field and shower.
		Know the appearance of poison ivy and poison sumac in all seasons, and if sensitive to these toxins, carry and use special cleaning soaps/solutions when thought to be exposed. Stock first aid kit with poison ivy/sumac cleaning soaps/solutions.

TASK 4.7
TEMPORARY/PERMANENT SAMPLING EQUIPMENT OPERATION

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Be aware of intermittent seasonal reports of mosquito borne diseases, such as West Nile disease and Eastern Equine Encephalitis (EEE), and their locations relative to your field site. Use DEET or other mosquito repellant.
		Be aware of potential cavity, suspended or ground nesting bee/wasp/hornet nests. Avoid undue disturbance or approach with appropriate safety clothing protection and netting.
		Be aware of terrain likelihood of harboring poisonous snakes in your work zone. Avoid reaching or stepping into hidden areas (such as into wood pile, rock pile, debris pile, stone wall, etc.) without pre-inspection.
	Exposure to Hazardous Substances	Ensure that workers are familiar with hazards associated with hazardous commercial products used in drilling (fuels, calibration solutions, etc.). Ensure that MSDSs for such products are available, and that workers wear appropriate personal protective equipment.
		Be alert for hazardous site contaminants (as indicated by odor, visual characteristics, location, and site history). Ensure that procedures and contingencies are in place for characterizing hazards and protecting workers by use of appropriate personal protective clothing and respiratory protection, as needed.
		Implement work practices and procedures identified in the HASP.
	Adverse Weather Conditions	Assess weather conditions prior to on-site work and examine forecast for anticipated period of work.
		Dress appropriately for weather conditions (e.g., precipitation, temperature ranges over anticipated duration of field work).
		Use protective ointments such as sunscreen and chap stick, as appropriate to the field conditions.
	Emergency Procedures	Ensure that all site workers are familiar with emergency contact procedures route to nearest hospital.
		Ensure a first aid kit is present in field vehicle.
		It is required that at least one individual in the field has had first aid training.
		Discuss any worker physical conditions that may require medical attention.
		Carry a cell phone during all field work for emergency purposes, and confirm that a cell phone signal is available at the site.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: Subsurface Vapor Sampling		
Analysis By: Guy Dalton	**Reviewed By: Michael McCoy, CIH, CHMM**	**Approved By: Kim Anderson, Ph.D.**
Date: September 29, 2011	**Date: November 17, 2011**	**Date: December 10, 2011**

TASK 4.8
SUBSURFACE VAPOR SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
Review Related THA's – 4.1 Drilling Observations, Monitoring Well Installation Observations and Soil Sampling 4.5 Soil-Gas Sampling 4.7 Temporary/Permanent Sampling Equipment Operation NOTE - As a sampling THA, this THA assumes the subsurface vapor sampling well(s) or port(s) have already been installed.		
Pre-work tasks	Emergency Conditions	Ensure that all site workers are familiar with emergency contact procedures route to nearest hospital.
		Ensure a first aid kit is present in field vehicle.
		It is required that at least one individual in the field has had first aid training.
		Discuss any worker physical conditions that may require medical attention.
		Carry a cell phone during all field work for emergency purposes, and confirm that a cell phone signal is available at the site.
Screening Work Zone Atmosphere	Exposure to Hazardous Substances	Review site specific Health and Safety Plan and implement work practices and procedures specified.
		Monitor breathing air in work zone for hazardous atmospheres (e.g., low oxygen, elevated VOCs, H_2S, CO, etc.) and do not proceed unless it is determined that no hazardous conditions exist.
		Be alert for hazardous site contaminants (as indicated by odor, visual characteristics, location, and site history). Assure that procedures and contingencies are in place for characterizing hazards and protecting workers by use of appropriate personal protective clothing and respiratory protection, as needed.
		Assure adequate facilities/equipment for hand washing prior to eating.
All Site related work Work	Insect Bites; Plant toxins; Poisonous Snakes. Incidental contact	Ticks carry risk of Lyme's and other Diseases. Tick season is basically any field day above 40 degrees F. • Tuck pants into long socks and apply DEET (or permethrin pre-treatment) to clothing in season to control exposure to ticks. • Check clothing for ticks frequently • Check whole body immediately upon returning from field and shower.
		Know the appearance of poison ivy and poison sumac in all seasons, and if sensitive to these toxins, carry and use special cleaning soaps/solutions when thought to be exposed. Stock first aid kit with poison ivy/sumac cleaning soaps/solutions.

TASK 4.8
SUBSURFACE VAPOR SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Be aware of intermittent seasonal reports of mosquito borne diseases, such as West Nile disease and Eastern Equine Encephalitis (EEE), and their locations relative to your field site. Use DEET or other mosquito repellant.
		Be aware of potential cavity, suspended or ground nesting bee/wasp/hornet nests. Avoid undue disturbance or approach with appropriate safety clothing protection and netting.
		Be aware of terrain likelihood of harboring poisonous snakes in your work zone. Avoid reaching or stepping into hidden areas (such as into wood pile, rock pile, debris pile, stone wall, etc.) without pre-inspection.
	Adverse weather	Assess weather conditions prior to on-site work and examine forecast for anticipated period of work.
		Dress appropriately for weather conditions (e.g., precipitation, temperature ranges over anticipated duration of field work).
		Use protective ointments such as sunscreen and chap stick, as appropriate to the field conditions.
		Be aware of the anticipated weather conditions prior to mobilization to the site. Unacceptable field work conditions are not precise, but may include site specific conditions, general location, extreme weather conditions (e.g., icing, lightening, excessive cold or wind), travel conditions, and other factors. Professional judgment is required, and personal assessment of safety must always be individually assessed.
	Working Alone	Sign out or call into the office to leave site specific information where you are working, the anticipated duration/hours of work on site. Do this for each site if multiple in one day. Review GZA's working alone policy.
		Call office when off site.
Constructing Sampling Train	Slips, trips and falls	Store hand tools in their proper storage location when not in use.
		Assure ample space for each employee to work safely with sound footing is provided.
		Assure ample lighting is provided.
	Electrical shocks, cuts, bruises, from Tool-Related use	Do not use electrical tools with damaged cords or other electrical components.
		Observe proper electrical safety practices.
		Assure tools are properly maintained; do not use damaged tools.
		Wear eye protection.
		Store and carry tools correctly.
		Use the correct tool for the job.
		Protect "off hand" from gouges, hammer blows, cutting tools, etc. Position your "off hand" to prevent injury in case of slip of the tool.
Evaluating Leaks in Sampling Train	Working with Pressurized Cylinders (Helium)	Use caution when screwing in pressure regulator and valve (if this wasn't already done by the helium vendor). Take care not to hit the regulator and valve once it is installed and do not drop the cylinder. Cylinder should remain on the ground surface at all times or (ideally) fixed to a cylinder dolly.
Purging the Sampling Train	Working with Electrical Equipment	If using 12-volt DC pump to purge sampling train, inspect power cord and battery terminal connectors to assure they are free of defects or damage.
		If using 120-volt AC pump to purge sampling train, verify that the ground fault circuit interrupter (GFCI) is functioning properly.
	Electrical shocks, cuts, bruises, from Tool-Related use	See above.
Sample Collection	Electrical shocks, cuts,	See above.

TASK 4.8
SUBSURFACE VAPOR SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
	bruises, from Tool-Related use	

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: Landfill Sampling		
Analysis By: Mark Dalpe	**Reviewed By: Michael McCoy, CIH, CHMM**	**Approved By: Kim Anderson, Ph.D.** **Jayanti Chatterjee, CIH**
Date: September 29, 2011	**Date: November 8, 2011**	**Date: December 10, 2011**

TASK 4.9
LANDFILL SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
Review Related THA's – 4.1 Drilling Observations, Monitoring Well Installation Observations and Soil Sampling 4.2 Groundwater Sampling 4.3 Surface Water and Sediment Sampling		
Surface Water /Groundwater Sample Collection	Slips, Trips, Falls, Drowning	Become familiar with surface water and landfill topography related hazards through review of Task Hazard Analysis and site reconnaissance.
		Communicate Task Hazard Analysis and Lessons Learned information to sampling crews prior to initiating work and throughout the project as needed.
		Maintain safe distance from dams, weirs, ice bridges, and steep slopes during sampling operations.
		Be cognizant of slip/trip/fall hazards associated with wooded areas, mud flats, rip-rap banks and shorelines, refuse, and pits/holes during water/monitoring well access. Coordinate all required sampling/logging activities with supervisor/project manager prior to initiating sampling operations. Those sampling locations that are not safely accessible may be sampled via remote sampling methods (i.e. dip poles, and sampling pumps with drop tubing). Sharp objects in refuse are common in landfill areas. Appropriate puncture resistant steel-toed safety shoes shall be worn at all times.
		Wear appropriate safety equipment as required by the Site Specific Health and Safety Plan (HASP) when in the vicinity of surface water bodies, and monitoring wells (hard hat, steel toe boots, work clothes, high visibility vest, eye protection, personal floatation devices, etc.).
		Implement work practices and procedures specified in the HASP.
	Exposure to Hazardous Substances	LEL and H_2S monitoring devices shall be employed for screening purposes prior to collecting samples from landfill monitoring wells. Refer to HASP for action levels for air monitoring and implement as specified.
		Ensure that workers are familiar with hazards associated with hazardous commercial/laboratory products used in sampling operations (acid containing batteries, preservatives decontamination products, etc.). Ensure that MSDSs for such products are available, and that workers wear appropriate personal protective equipment.

TASK 4.9
LANDFILL SAMPLING

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Be alert for hazardous site contaminants (as indicated by odor, visual characteristics, location, and site history). Leachate break-outs are common at active landfills. Use caution when in the vicinity of leachate pools and avoid contact. Be aware of staining and precipitate on wellhead standpipes of monitoring wells indicating flowing landfill gas effluent. Ensure that procedures and contingencies are in place for characterizing hazards and protecting workers by use of appropriate personal protective clothing and respiratory protection, as specified in the HASP. Be aware of dust levels that may contain various contaminants in landfill areas.
All site work	Emergency Procedures	Ensure that all site workers are familiar with emergency contact procedures route to nearest hospital.
		Ensure a first aid kit is present in field vehicle.
		It is required that at least one individual in the field has had first aid training.
		Discuss any worker physical conditions that may require medical attention.
		Carry a cell phone during all field work for emergency purposes, and confirm that a cell phone signal is available at the site.
	Adverse Weather Conditions	Assess weather conditions prior to on-site work and examine forecast for anticipated period of work.
		Dress appropriately for weather conditions (e.g., precipitation, temperature ranges over anticipated duration of field work).
		Use protective ointments such as sunscreen and chap stick, as appropriate to the field conditions.
		Be aware of the anticipated weather conditions prior to mobilization to the site. Unacceptable field work conditions are not precise, but may include site specific conditions, general location, extreme weather conditions (e.g., icing, lightening, excessive cold or wind), travel conditions, and other factors. Professional judgment is required, and personal assessment of safety must always be individually assessed.
Landfill Gas Sample Collection	Landfill Gas Exposure	LEL/O$_2$, H$_2$S, and PID monitoring devices are imperative during landfill gas sampling operations. Refer to HASP for air monitoring requirements for H$_2$S, and other contaminants.
	Noise	Hearing protection is imperative at sampling points in the vicinity of operating power plants, booster blowers etc.
	Slips, trips and falls	Maintain clean and sanitary work area free of tripping/slipping hazards.
		Store hand tools in their proper storage location when not in use.
		Ensure ample space for each employee to work safely with sound footing.
		Ensure ample lighting.
		Ensure adequate facilities/equipment for hand washing prior to eating.
	Electrical shocks, cuts, bruises, fires, burns from Tool-Related use	Do not use electrical tools with damaged cords or other electrical components.
		Observe proper electrical safety practices
		Ensure tools are properly maintained; do not use damaged tools
		Wear eye protection.
		Store and carry tools correctly.
		Use the correct tool for the job.
		Ensure that all flammable/combustible liquids are stored in proper containers.
		Dispose of oily rags properly.

TASK 4.9
LANDFILL SAMPLING

HAZARD CONTROLS

GZA Job Tasks	**Potential Hazards**	**Controls**
Generator/Gas Powered Equipment Operation	Fire hazards	Ensure that a fire extinguisher is present with crew.
		Observe “no smoking” policies.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: Field Sampling

Analysis By: Christie Wagner	**Reviewed By: Jayanti Chatterjee, CIH**	**Approved By: Jayanti Chatterjee, CIH**
Date: November 4, 2011 **Revised: July 12, 2012**	**Date: July 12, 2012**	**Date: July 12, 2012**

Task 20.11
Field Sampling

HAZARD CONTROLS

GZA Job Tasks	**Potential Hazards**	**Controls**
Review Related THA's – 21.1 General Outdoor Field Work		
Pre work task for site visit	Adverse Weather Conditions	Assess weather conditions prior to on-site work and examine forecast for anticipated period of work.
		Dress appropriately for weather conditions (e.g., precipitation, temperature ranges over anticipated duration of field work).
		Use protective ointments such as sunscreen and chap stick, as appropriate to the field conditions.
		Be aware of the anticipated weather conditions prior to mobilization to the site. Unacceptable field work conditions are not precise, but may include site specific conditions, general location, extreme weather conditions (e.g., icing, lightening, excessive cold or wind), travel conditions, and other factors. Professional judgment is required, and personal assessment of safety must always be individually assessed.
Conduct visual inspection of site	Dangerous Terrain	Be aware of the site terrain, watch for holes and rocks that can be tripping hazards
		Learn to identify and watch for plants such as thorn bushes and poision ivy that can either scratch you or give you a rash.
Collecting sample	Muscle strain from lifting heavy objects	Use proper lifting techniques. Use appropriate mechanical assistance and tools when possible. Wear work gloves and steel toed boots.
	Exposure to unknown sample	Be sure to treat effluent samples as unknowns and wear the proper PPE.
		If there are any unusual odors/fumes coming from a sample, especially those that cause reactions in the eyes or nose, leave the area and inform a supervisor immediately.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: General Outdoor Field Work		
Analysis By: Anthony Zemba, CHMM	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: June 25, 2012	**Date: June 25, 2012**	**Date: July 12, 2012**

Task 21.1
General Outdoor Field Work

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
Pre-work preparation	Overlooking of potential hazards	Become familiar with project area and job site by reviewing available on-line mapping (USGS Topographic, NWI Wetland, NRCS Soil, etc.; and aerial photographs before visiting site. Understand related hazards through review of this and other Task Hazard Analyses and participate in daily safety tailgate meetings (where applicable).
		Communicate Task Hazard Analysis and Lessons Learned information to operator(s) prior to initiating work and throughout the project as needed.
Driving to site	Vehicle accidents/collisions/injuries	Perform pre-operation check of vehicle, verifying service brakes, parking brake, steering, lights, tires, horn, wipers mirrors and glass are in good condition. verify that the rig is roadworthy.
		Wear seat belts always when driving even on site.
		Secure loose materials in cab or bed of vehicle.
		Keep windshields, windows and lights cleans.
		Abide by safe driving procedures.
	Backing collisions	If possible avoid backing by using a route that allows you to pull through.
		If backing up from a parked area do a quality 360 walker.
Working within transportation corridors or active construction sites	Collisions injuries	Wear high visibility safety vest on site when out of personal or GZA vehicle.
		Park vehicle in designated parking locations, or select off-road area that is firm, and without hazards. Directly inspect parking location on foot if necessary.
		Use emergency flashers or other appropriate vehicle warning system as appropriate to local conditions when parking vehicle.
		Use emergency flashers or other appropriate vehicle warning system when parking outside of standard parking spaces, or to stop in right-of-
		Be alert at all times; never step outside traffic cones.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: General Outdoor Field Work		
Analysis By: Anthony Zemba, CHMM	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: June 25, 2012	**Date: June 25, 2012**	**Date: July 12, 2012**

Task 21.1
General Outdoor Field Work

HAZARD CONTROLS

GZA Job Tasks	**Potential Hazards**	**Controls**
		Stand clear of moving heavy equipment and away from any overhead utility lines until equipment is safely in position and parked properly and securely by the contractor.
		Do not wear headphones or earbuds, or listen to music or talk on the phone, which may distract from work hazards.
	Crossing Automobile traffic lanes	Wear high visibility safety vests at all times when out of vehicle and working within or adjacent to the roadway.
	Crossing Airport Movement Areas (e.g., Runways, taxiways, approaches)	Learn, know, and conform to project site Airport's, Airfield's, or Airbase's protocol for crossing movement areas (whether on foot or in vehicle).
		Work within airport movement areas or safety zones must be coordinated with the Air Traffic Control Tower.
		Vehicles to have blinking or flashing lights or beacons; pedestrians to wear high visibility safety vests.
		Using protocol, maintain communication with airport security and air traffic controllers.
	Crossing Railways	Work within active railroad ROWs requires railroad safety training. No work can be done within the railroad traffic envelope without the permission of a railroad flagman.
		No equipment or vehicles can cross without the permission of a railroad flagman.
		Expect any train on any track coming from either direction at any time.
Working in Natural or Remote Areas	Slips, trips, fall	Be aware of loose ground materials such as talus, unconsolidated rock, soil, sediment, ice and other media that could cause slips, trips or falls.
		Be careful when walking in heavily vegetated areas. Mind tangles of vines, thorny branches, and slippery logs and rock surfaces. Dense vegetation and especially entangled vines present trip hazards, or can mask voids, sharp objects, or other hazards beneath.

Job: General Outdoor Field Work		
Analysis By: Anthony Zemba, CHMM	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: June 25, 2012	**Date: June 25, 2012**	**Date: July 12, 2012**

Task 21.1
General Outdoor Field Work

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Be vigilant for signs of cracking, shifting, fracturing, and evidence of past movement.
		Use wood mats or other stabilizing materials for equipment if soft ground conditions are present.
		Use walking stick, auger, or ski poles to steady yourself when traversing loose material or slopes.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: General Outdoor Field Work		
Analysis By: Anthony Zemba, CHMM	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: June 25, 2012	**Date: June 25, 2012**	**Date: July 12, 2012**

Task 21.1
General Outdoor Field Work

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Wear proper footwear for conditions. Store tools in their proper storage location when not in use. Provide adequate lighting when necessary.
	Falls into excavations/ voids	Stand away from edges of excavations and voids. Do not attempt access without proper equipment / training. Remember that some excavations or voids may constitute a confined space and may present structural stability issues.
	Cave-ins and engulfment	DO NOT enter caves, sinkholes, excavations, and other voids or concavities that are not sloped or shored properly and have not been evaluated by a competent person to be safe. Stand away from edges of excavations, cliffs, dug wells, and other voids. Watch for cracks/fissures in the ground surface in the immediate vicinity of a pit or void, which indicate imminent sidewall failure/cave-in. Assess if confined space entry procedures need to be implemented. Before entering void (if required to do so and with proper training) be aware of any hazards at the surface (boulders, equipment) which may fall into the void.
Working among hazardous biota	Plant toxins Incidental contact	Know the appearance of poison ivy and poison sumac in all seasons, and if sensitive to these toxins, carry and use special cleaning soaps/solutions when thought to be exposed. Stock first aid kit with poison ivy/sumac cleaning soaps/solutions.
	Ticks	Ticks carry risk of Lyme's and other Diseases. Tick season is basically any field day above 40 degrees F. Tuck pants into long socks. The application of DEET (or permethrin pre-treatment) to clothing in season to control exposure to ticks is recommended. Check clothing for ticks frequently.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: General Outdoor Field Work		
Analysis By: Anthony Zemba, CHMM	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: June 25, 2012	**Date: June 25, 2012**	**Date: July 12, 2012**

Task 21.1
General Outdoor Field Work

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Check whole body immediately upon returning from field and shower.
	Mosquitoes	Be aware of intermittent seasonal reports of mosquito borne diseases, such as West Nile disease and Eastern Equine Encephalitis (EEE), and their locations relative to your field site. Use of DEET or other mosquito repellant is recommended.
	Stinging bees and wasps	Be aware of potential cavity, suspended or ground nesting bee/wasp/hornet nests. Avoid undue disturbance or approach with appropriate safety clothing, protection and netting.
		Take appropriate precautions if allergic to bees. Carry at least two epi-pens in first aid kit as well as anti-histamines (oral and inhalers).
		Avoid areas of heavy bee activity if allergic. Avoid perfumed soaps, shampoos, deodorants, colognes, etc. that may attract bees.
	Poisonous Snakes	Be aware of terrain likelihood of harboring poisonous snakes in your work zone. Avoid reaching or stepping into hidden areas (such as into wood pile, rock pile, debris pile, stone wall, etc.) without pre-inspection.
		Coordinate with local hospitals to verify they have proper anti-venom in stock.
		Learn first aid procedures in case of poisonous snake bite.
		Devise an action plan and include in the site-specific HASP.
	Wild Animals	Do NOT handle wildlife unless properly trained to do so.
		Beware of any wild animal that shows no sign of wariness of humans.
		Do NOT attempt to feed wild animals or to help apparently injured wild animals.
		Be aware of domestic animals that may also pose a threat such as dogs off leash, bulls out to pasture, etc.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: General Outdoor Field Work		
Analysis By: Anthony Zemba, CHMM	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: June 25, 2012	**Date: June 25, 2012**	**Date: July 12, 2012**

Task 21.1
General Outdoor Field Work

HAZARD CONTROLS

GZA Job Tasks	**Potential Hazards**	**Controls**
Working in Adverse Weather Conditions	Heat / cold stress and other weather related hazards	Assess weather conditions prior to on-site work and examine forecast for anticipated period of work.
		Dress appropriately for weather conditions (e.g., precipitation, temperature ranges over anticipated duration of field work). Include clothing and the presence / absence of shade when calculating a heat index.
		Schedule work day to avoid working during hottest or coldest parts of the day, to the extent practicable.
		Keep exposed skin covered in extremely cold weather.
		Recognize signs of frostbite; use warming packs and layer clothing to maintain warmth.
		Use a wicking layer of clothing against your body to keep moisture away from skin.
		Wool clothing will continue to keep you warm after it becomes wet; cotton will not.
		Use protective ointments such as sunscreen and chap stick, as appropriate to the field conditions.
		Stay hydrated in hot weather; drink fluids regularly throughout the day, even if not thirsty.
		Recognize signs of heat stress; take frequent breaks in shade when working in direct sunlight for prolonged periods.
		Be familiar with Heat index chart - add 20 degrees to chart if fully clothed and if working in direct sunlight.
		NOTE: Unacceptable field work conditions are not precise, but may include site specific conditions, general location, extreme weather conditions (e.g., icing, lightning, excessive cold or wind), travel conditions, and other factors. Professional judgment is required, and personal assessment of safety must always be individually assessed.
	Working on Ice	Assess relative load bearing capacity of ice on lakes, ponds and other waterways. If unsure do not venture onto the ice.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: General Outdoor Field Work		
Analysis By: Anthony Zemba, CHMM	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: June 25, 2012	**Date: June 25, 2012**	**Date: July 12, 2012**

Task 21.1
General Outdoor Field Work

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Wear proper footwear modified for traction on ice.
	Electrical storms	If lightning is observed during drilling activities, work shall be suspended immediately and employees shall find suitable shelter (building or vehicle at minimum). Work will commence no sooner than 30 minutes after the last indications of lightning have been observed
		Seek shelter inside a walled building or your vehicle.
		Open picnic pavilions and under trees are not adequate shelters.
		Assess vulnerability to lightning strikes as soon as thunder is heard on the horizon. Open areas and higher elevations are more susceptible to strikes.
		Tall objects such as metal towers and flag poles may attract lightning.
		Consult internet weather radar tracking devices to learn of impending storm patterns proximal to your work area.
	High Winds	Avoid working at high elevations, elevated platforms, and other exposed areas during high wind conditions.
		Assess work area for equipment that may be blown down, over, or carried aloft by high winds.
Working in areas without sanitary facilities	Hygiene related hazards	Provide hand washing kits (e.g., baby wipes, hand sanitizers, paper towels, bottled water, etc.) to be used prior to eating and drinking.
		Have garbage bags handy to collect trash.
Working in remote areas	Emergency Conditions	Be familiar with onsite emergency procedures and route to nearest hospital.
		Have a first aid kit available; know its contents and how to use them.
		Carry a cell phone during all field work for emergency purposes, and confirm the nearest location of cell phone signal on site prior to start of worksite.
	Disorientation	Plan your route and anticipated progress prior to field work.

GZA GEOENVIRONMENTAL, INC.
JOB HAZARD ANALYSIS WORKSHEET

Job: General Outdoor Field Work		
Analysis By: Anthony Zemba, CHMM	**Reviewed By: Guy Dalton**	**Approved By: Jayanti Chatterjee , CIH**
Date: June 25, 2012	**Date: June 25, 2012**	**Date: July 12, 2012**

Task 21.1
General Outdoor Field Work

HAZARD CONTROLS

GZA Job Tasks	Potential Hazards	Controls
		Have multiple navigation aids (e.g., USGS Map, compass, GPS, etc.) and know how to use them before entering field. Remember to have charged batteries and battery back-ups for electronic devices.
		Share your progress plan with office staff prior to entering the field.
		Check in with office personnel periodically to update progress.
		Review and comply with GZA's Working Alone Policy 03-1009 in advance of working alone on a project site.
	Hunting	Be familiar with the various game hunting seasons. Follow rules and guidelines for remaining visible to hunters.
		Try to plan work around active hunting seasons or daily peak hunting hours as warranted.

ATTACHMENT - D
ACCIDENT AND INJURY REPORT FORM

SUPERVISOR'S ACCIDENT INVESTIGATION REPORT

Injured Employee ______________________________ Job Title ____________________________

Home Office __________________________ Division/Department __________________________________

Date/Time of Accident ____

Location of Accident ____

Witnesses to the Accident ____

Injury Incurred? _________ Nature of Injury ____

____

Engaged in What Task When Injured? ____

____

Will Lost Time Occur? ____ How Long? ___________ Date Lost Time Began _________________________

Were Other Persons Involved/Injured? ____

____

How Did the Accident Occur? ____

____

____

____

____

What Could Be Done to Prevent Recurrence of the Accident? _____________________________________

____

____

What Actions Have You Taken Thus Far to Prevent Recurrence? ___________________________________

____

____

Supervisor's Signature ___________________________ Title ________________________ Date _________

Reviewer's Signature ____________________________ Title ________________________ Date _________

Note: If the space provided on this form is insufficient, provide additional information on a separate page and attach. The completed accident investigation report must be submitted to the Health and Safety Manager within two days of the occurrence of the accident.

ATTACHMENT - E
SAFETY DATA SHEETS

SAFETY DATA SHEET

Acetone

Section 1. Identification

GHS product identifier : Acetone

Chemical name : acetone

Other means of identification : propan-2-one; propanone; 2-Propanone; dimethyl ketone

Product use : Synthetic/Analytical chemistry.

Synonym : propan-2-one; propanone; 2-Propanone; dimethyl ketone

SDS # : 001088

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Emergency telephone number (with hours of operation) : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Highly flammable liquid and vapor.
May form explosive mixtures with air.
Causes serious eye irritation.
May cause drowsiness and dizziness.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Wear protective gloves. Wear eye or face protection. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Avoid breathing vapor. Wash hands thoroughly after handling.

Section 2. Hazards identification

Response	: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or physician if you feel unwell. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.
Storage	: Store locked up. Store in a well-ventilated place. Keep cool.
Disposal	: Dispose of contents and container in accordance with all local, regional, national and international regulations.
Hazards not otherwise classified	: None known.

Section 3. Composition/information on ingredients

Substance/mixture	: Substance
Chemical name	: acetone
Other means of identification	: propan-2-one; propanone; 2-Propanone; dimethyl ketone

CAS number/other identifiers

CAS number	: 67-64-1
Product code	: 001088

Ingredient name	%	CAS number
acetone	100	67-64-1

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact	: Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.
Inhalation	: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If necessary, call a poison center or physician. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
Skin contact	: Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.
Ingestion	: Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention

Section 4. First aid measures

immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness and dizziness.

Skin contact : No known significant effects or critical hazards.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : Can cause central nervous system (CNS) depression. Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Highly flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard. This material is toxic to aquatic life. This material is harmful to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any

Section 5. Fire-fighting measures

waterway, sewer or drain.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Avoid release to the environment. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking

Section 7. Handling and storage

tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
acetone	**ACGIH TLV (United States, 3/2012).** STEL: 1782 mg/m³ 15 minutes. STEL: 750 ppm 15 minutes. TWA: 1188 mg/m³ 8 hours. TWA: 500 ppm 8 hours. **NIOSH REL (United States, 1/2013).** TWA: 590 mg/m³ 10 hours. TWA: 250 ppm 10 hours. **OSHA PEL (United States, 6/2010).** TWA: 2400 mg/m³ 8 hours. TWA: 1000 ppm 8 hours. **OSHA PEL 1989 (United States, 3/1989).** STEL: 2400 mg/m³ 15 minutes. STEL: 1000 ppm 15 minutes. TWA: 1800 mg/m³ 8 hours. TWA: 750 ppm 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Section 8. Exposure controls/personal protection

Hygiene measures	Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
Eye/face protection	Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.
Skin protection	
Hand protection	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
Body protection	Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.
Other skin protection	Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory protection	Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance	
Physical state	Liquid. [COLORLESS LIQUID WITH A FRAGRANT, MINT-LIKE ODOR]
Color	Colorless.
Molecular weight	58.09 g/mole
Molecular formula	C3-H6-O
Boiling/condensation point	56.05°C (132.9°F)
Melting/freezing point	-94.7°C (-138.5°F)
Critical temperature	234.85°C (454.7°F)
Odor	Characteristic.
Odor threshold	Not available.
pH	Not available.
Flash point	Closed cup: -20°C (-4°F)
Burning time	Not applicable.
Burning rate	Not applicable.
Evaporation rate	6.06 (butyl acetate = 1)
Flammability (solid, gas)	Not available.
Lower and upper explosive (flammable) limits	Lower: 2.5% Upper: 13%
Vapor pressure	24 kPa (180.014626188 mm Hg) [room temperature]

Section 9. Physical and chemical properties

Vapor density	: 2 (Air = 1)
Specific Volume (ft ^{3}/lb)	: 1.2642
Gas Density (lb/ft ^{3})	: 0.791
Relative density	: 0.8
Solubility	: Not available.
Solubility in water	: Not available.
Partition coefficient: n-octanol/water	: -0.23
Auto-ignition temperature	: 465°C (869°F)
Decomposition temperature	: Not available.
SADT	: Not available.
Viscosity	: Not available.

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	: Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.
Incompatibility with various substances	: Extremely reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	: Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
acetone	LC50 Inhalation Vapor LD50 Oral	Rat Rat	59528 ppm 5800 mg/kg	1 hours -

Irritation/Corrosion

Section 11. Toxicological information

Product/ingredient name	Result	Species	Score	Exposure	Observation
acetone	Eyes - Mild irritant	Human	-	186300 parts per million	-
	Eyes - Mild irritant	Rabbit	-	10 microliters	-
	Eyes - Moderate irritant	Rabbit	-	24 hours 20 milligrams	-
	Eyes - Severe irritant	Rabbit	-	20 milligrams	-
	Skin - Mild irritant	Rabbit	-	24 hours 500 milligrams	-
	Skin - Mild irritant	Rabbit	-	395 milligrams	-

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
acetone	Category 3	Not applicable.	Narcotic effects

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness and dizziness.

Skin contact : No known significant effects or critical hazards.

Ingestion : Can cause central nervous system (CNS) depression. Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Section 11. Toxicological information

Inhalation : Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
acetone	Acute EC50 20.565 mg/l Marine water	Algae - Ulva pertusa	96 hours
	Acute LC50 6000000 µg/l Fresh water	Crustaceans - Gammarus pulex	48 hours
	Acute LC50 10000 µg/l Fresh water	Daphnia - Daphnia magna	48 hours
	Acute LC50 100 mg/l Fresh water	Fish - Pimephales promelas - Juvenile (Fledgling, Hatchling, Weanling)	96 hours
	Chronic NOEC 4.95 mg/l Marine water	Algae - Ulva pertusa	96 hours
	Chronic NOEC 0.1 ml/L Fresh water	Daphnia - Daphnia magna - Neonate	21 days

Persistence and degradability

Not available.

Section 12. Ecological information

Bioaccumulative potential

Product/ingredient name	**LogP_{ow}**	**BCF**	**Potential**
acetone	-0.23	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	**CAS #**	**Status**	**Reference number**
Acetone (I); 2-Propanone (I)	67-64-1	Listed	U002

Section 14. Transport information

	DOT	**TDG**	**Mexico**	**IMDG**	**IATA**
UN number	UN1090	UN1090	UN1090	UN1090	UN1090
UN proper shipping name	ACETONE	ACETONE	ACETONE	ACETONE (ACETONE SOLUTIONS)	ACETONE
Transport hazard class(es)	3 	3 	3 	3 	3 
Packing group	II	II	-	II	II
Environment	No.	No.	No.	No.	No.

Section 14. Transport information

Additional information	**Reportable quantity** 5000 lbs / 2270 kg [758.12 gal / 2869.8 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements. **Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: 5 L **Cargo aircraft** Quantity limitation: 60 L **Special provisions** IB2, T4, TP1	**Explosive Limit and Limited Quantity Index** 1 **Passenger Carrying Ship Index** Forbidden **Passenger Carrying Road or Rail Index** 5	-	-	**Passenger and Cargo Aircraft**Quantity limitation: 5 L **Cargo Aircraft Only** Quantity limitation: 60 L **Limited Quantities - Passenger Aircraft** Quantity limitation: 1 L

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Special precautions for user : **Transport within user’s premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

United States inventory (TSCA 8b): This material is listed or exempted.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Section 15. Regulatory information

Classification : Fire hazard
Immediate (acute) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
acetone	100	Yes.	No.	No.	Yes.	No.

State regulations

Massachusetts : This material is listed.
New York : This material is listed.
New Jersey : This material is listed.
Pennsylvania : This material is listed.
Canada inventory : This material is listed or exempted.

International regulations

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: This material is listed or exempted.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

WHMIS (Canada) : Class B-2: Flammable liquid
Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class B-2: Flammable liquid
Class D-2B: Material causing other toxic effects (Toxic).

Hazardous Material Information System (U.S.A.)

Health	*	2
Flammability		3

Section 16. Other information

Physical hazards	0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of printing : 4/26/2015.
Date of issue/Date of revision : 4/26/2015.
Date of previous issue : 10/21/2014.
Version : 0.02

Key to abbreviations :
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United NationsACGIH – American Conference of Governmental Industrial Hygienists
AIHA – American Industrial Hygiene Association
CAS – Chemical Abstract Services
CEPA – Canadian Environmental Protection Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)
CFR – United States Code of Federal Regulations
CPR – Controlled Products Regulations
DSL – Domestic Substances List
GWP – Global Warming Potential
IARC – International Agency for Research on Cancer
ICAO – International Civil Aviation Organisation
Inh – Inhalation
LC – Lethal concentration

Section 16. Other information

LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health
TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References : Not available.

◤ **Indicates information that has changed from previously issued version.**

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

SAFETY DATA SHEET

Ethanol

Section 1. Identification

GHS product identifier : Ethanol

Chemical name : ethanol

Other means of identification : ethyl alcohol; Denatured Alcohol; ALCOHOL; Ethyl alcohol (Ethanol)

Product use : Synthetic/Analytical chemistry.

Synonym : ethyl alcohol; Denatured Alcohol; ALCOHOL; Ethyl alcohol (Ethanol)

SDS # : 001114

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Emergency telephone number (with hours of operation) : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 2

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Highly flammable liquid and vapor.
May form explosive mixtures with air.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Wear protective gloves. Wear eye or face protection. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Use and store only outdoors or in a well ventilated place.

Response : IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower.

Storage : Store in a well-ventilated place. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture	:	Substance
Chemical name	:	ethanol
Other means of identification	:	ethyl alcohol; Denatured Alcohol; ALCOHOL; Ethyl alcohol (Ethanol)

CAS number/other identifiers

CAS number	:	64-17-5
Product code	:	001114

Ingredient name	%	CAS number
ethanol	100	64-17-5

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact	:	Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.
Inhalation	:	Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
Skin contact	:	Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.
Ingestion	:	Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention if adverse health effects persist or are severe. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact	:	No known significant effects or critical hazards.
Inhalation	:	No known significant effects or critical hazards.
Skin contact	:	No known significant effects or critical hazards.
Frostbite	:	Try to warm up the frozen tissues and seek medical attention.
Ingestion	:	No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact	:	No specific data.

Section 4. First aid measures

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Highly flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Section 6. Accidental release measures

Methods and materials for containment and cleaning up

Small spill	Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.
Large spill	Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures	Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.
Advice on general occupational hygiene	Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.
Conditions for safe storage, including any incompatibilities	Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
ethanol	**ACGIH TLV (United States, 3/2012).** STEL: 1000 ppm 15 minutes. **OSHA PEL 1989 (United States, 3/1989).** TWA: 1000 ppm 8 hours. TWA: 1900 mg/m³ 8 hours. **NIOSH REL (United States, 1/2013).** TWA: 1000 ppm 10 hours. TWA: 1900 mg/m³ 10 hours.

Section 8. Exposure controls/personal protection

	OSHA PEL (United States, 6/2010). TWA: 1000 ppm 8 hours. TWA: 1900 mg/m³ 8 hours.

Appropriate engineering controls	: Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
Environmental exposure controls	: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures	: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
Eye/face protection	: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection	: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
Body protection	: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.
Other skin protection	: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory protection	: Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state	: Liquid. [CLEAR, COLORLESS LIQUID WITH A WEAK, ETHEREAL, VINOUS ODOR]
Color	: Colorless. Clear.
Molecular weight	: 46.08 g/mole
Molecular formula	: C2-H6-O
Boiling/condensation point	: 78.29°C (172.9°F)

Section 9. Physical and chemical properties

Melting/freezing point	: -114°C (-173.2°F)
Critical temperature	: Not available.
Odor	: Characteristic.
Odor threshold	: Not available.
pH	: Not available.
Flash point	: Closed cup: 9.7°C (49.5°F)
Burning time	: Not applicable.
Burning rate	: Not applicable.
Evaporation rate	: 1.7 (butyl acetate = 1)
Flammability (solid, gas)	: Not available.
Lower and upper explosive (flammable) limits	: Lower: 3.3% Upper: 19%
Vapor pressure	: 5.7 kPa (42.948650611 mm Hg) [room temperature]
Vapor density	: 1.6 (Air = 1)
Specific Volume (ft ^{3}/lb)	: 1.2716
Gas Density (lb/ft ^{3})	: 0.7864 (25°C / 77 to °F)
Relative density	: 0.8
Solubility	: Not available.
Solubility in water	: 1000 g/l
Partition coefficient: n-octanol/water	: -0.35
Auto-ignition temperature	: 455°C (851°F)
Decomposition temperature	: Not available.
SADT	: Not available.
Viscosity	: Dynamic (room temperature): 0.544 to 0.59 mPa·s (0.544 to 0.59 cP)

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	: Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.
Incompatibility with various substances	: Highly reactive or incompatible with the following materials: oxidizing materials and alkalis.
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	: Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.
Inhalation : No known significant effects or critical hazards.
Skin contact : No known significant effects or critical hazards.
Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.
Inhalation : No specific data.
Skin contact : No specific data.
Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.
Potential delayed effects : Not available.

Long term exposure

Section 11. Toxicological information

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	LogP$_{ow}$	BCF	Potential
ethanol	-0.35	-	low

Mobility in soil

Soil/water partition coefficient (K$_{OC}$) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere

Section 13. Disposal considerations

inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1170	UN1170	UN1170	UN1170	UN1170
UN proper shipping name	ETHANOL OR ETHYL ALCOHOL OR ETHANOL SOLUTIONS OR ETHYL ALCOHOL SOLUTIONS	ETHANOL MORE THAN 24 PER CENT ETHANOL, BY VOLUME; ETHANOL SOLUTION MORE THAN 24 PER CENT ETHANOL, BY VOLUME; ETHYL ALCOHOL MORE THAN 24 PER CENT ETHANOL, BY VOLUME; OR ETHYL ALCOHOL SOLUTION MORE THAN 24 PER CENT ETHANOL, BY VOLUME	ETHANOL OR ETHYL ALCOHOL OR ETHANOL SOLUTIONS OR ETHYL ALCOHOL SOLUTIONS	ETHANOL (ETHYL ALCOHOL) OR ETHANOL SOLUTION (ETHYL ALCOHOL SOLUTION)	ETHANOL
Transport hazard class(es)	3 	3 	3 	3 	3 
Packing group	II	II	II	II	II
Environment	No.	No.	No.	No.	No.
Additional information	**Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: 5 L **Cargo aircraft** Quantity limitation: 60 L **Special provisions** 24, IB2, T4, TP1	**Explosive Limit and Limited Quantity Index** 5 **Passenger Carrying Road or Rail Index** 60	-	-	**Passenger and Cargo Aircraft**Quantity limitation: 5 L **Cargo Aircraft Only** Quantity limitation: 60 L **Limited Quantities - Passenger Aircraft** Quantity limitation: 1 L

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Special precautions for user	**Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

United States inventory (TSCA 8b): This material is listed or exempted.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
ethanol	100	Yes.	No.	No.	No.	No.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

Canada inventory : This material is listed or exempted.

International regulations

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: This material is listed or exempted.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Section 15. Regulatory information

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

WHMIS (Canada) : Class B-2: Flammable liquid
Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class B-2: Flammable liquid
Class D-2B: Material causing other toxic effects (Toxic).

Hazardous Material Information System (U.S.A.)

Health	2
Flammability	3
Physical hazards	0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of printing : 5/18/2015.
Date of issue/Date of revision : 5/18/2015.
Date of previous issue : 10/28/2014.
Version : 0.02

Section 16. Other information

Key to abbreviations :

ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United NationsACGIH – American Conference of Governmental Industrial Hygienists
AIHA – American Industrial Hygiene Association
CAS – Chemical Abstract Services
CEPA – Canadian Environmental Protection Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)
CFR – United States Code of Federal Regulations
CPR – Controlled Products Regulations
DSL – Domestic Substances List
GWP – Global Warming Potential
IARC – International Agency for Research on Cancer
ICAO – International Civil Aviation Organisation
Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health
TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References : Not available.

◤ **Indicates information that has changed from previously issued version.**

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

SAFETY DATA SHEET

N-Hexane

Section 1. Identification

GHS product identifier : N-Hexane

Chemical name : n-hexane

Other means of identification : Hexane; Hexane (n-Hexane)

Product use : Synthetic/Analytical chemistry.

Synonym : Hexane; Hexane (n-Hexane)

SDS # : 001060

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Emergency telephone number (with hours of operation) : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 2
TOXIC TO REPRODUCTION (Fertility) - Category 2
TOXIC TO REPRODUCTION (Unborn child) - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 2
AQUATIC HAZARD (LONG-TERM) - Category 2

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Highly flammable liquid and vapor.
May form explosive mixtures with air.
Suspected of damaging fertility or the unborn child.
May cause drowsiness and dizziness.
May cause damage to organs through prolonged or repeated exposure.
Toxic to aquatic life with long lasting effects.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Section 2. Hazards identification

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Wear protective gloves. Wear eye or face protection. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Do not breathe vapor. Wash hands thoroughly after handling.

Response : Collect spillage. Get medical attention if you feel unwell. IF exposed or concerned: Get medical attention. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or physician if you feel unwell. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Store locked up. Store in a well-ventilated place. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : n-hexane

Other means of identification : Hexane; Hexane (n-Hexane)

CAS number/other identifiers

CAS number : 110-54-3

Product code : 001060

Ingredient name	%	CAS number
n-hexane	100	110-54-3

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention following exposure or if feeling unwell.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If necessary, call a poison center or physician. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Section 4. First aid measures

Skin contact : Wash contaminated skin with soap and water. Remove contaminated clothing and shoes. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness and dizziness.

Skin contact : No known significant effects or critical hazards.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : Can cause central nervous system (CNS) depression. May be irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Ingestion : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Highly flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard. This material is toxic to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities. Collect spillage.

Methods and materials for containment and cleaning up

Section 6. Accidental release measures

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Avoid exposure during pregnancy. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Avoid release to the environment. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Section 8. Exposure controls/personal protection

Ingredient name	**Exposure limits**
n-hexane	**ACGIH TLV (United States, 3/2012).** **Absorbed through skin.** TWA: 50 ppm 8 hours. **NIOSH REL (United States, 1/2013).** TWA: 180 mg/m³ 10 hours. TWA: 50 ppm 10 hours. **OSHA PEL (United States, 6/2010).** TWA: 1800 mg/m³ 8 hours. TWA: 500 ppm 8 hours. **OSHA PEL 1989 (United States, 3/1989).** TWA: 180 mg/m³ 8 hours. TWA: 50 ppm 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid. [COLORLESS LIQUID WITH A MILD GASOLINE-LIKE ODOR]

Color : Colorless.

Molecular weight : 86.18 g/mole

Molecular formula : C6-H14

Boiling/condensation point : 68.73°C (155.7°F)

Melting/freezing point : -95.35°C (-139.6°F)

Critical temperature : 234.25°C (453.6°F)

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Flash point : Closed cup: -22°C (-7.6°F)

Burning time : Not applicable.

Burning rate : Not applicable.

Evaporation rate : 6.82 (butyl acetate = 1)

Flammability (solid, gas) : Extremely flammable in the presence of the following materials or conditions: oxidizing materials.

Lower and upper explosive (flammable) limits : Lower: 1.1%
Upper: 7.5%

Vapor pressure : 17 kPa (127.510360216 mm Hg) [room temperature]

Vapor density : 3 (Air = 1)

Specific Volume (ft^3/lb) : 1.5138

Gas Density (lb/ft^3) : 0.6606 (25°C / 77 to °F)

Relative density : 0.7

Solubility : Not available.

Solubility in water : 0.0098 g/l

Partition coefficient: n-octanol/water : 4

Auto-ignition temperature : 225°C (437°F)

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Dynamic (room temperature): 0.3 mPa·s (0.3 cP)

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.

Section 10. Stability and reactivity

Incompatibility with various substances : Extremely reactive or incompatible with the following materials: oxidizing materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
n-hexane	LC50 Inhalation Gas. LC50 Inhalation Vapor LD50 Oral	Rat Rat Rat	48000 ppm 96000 ppm 15840 mg/kg	4 hours 1 hours -

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
n-hexane	Eyes - Mild irritant	Rabbit	-	10 milligrams	-

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
n-hexane	Category 3	Not applicable.	Narcotic effects

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
n-hexane	Category 2	Not determined	Not determined

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Section 11. Toxicological information

Eye contact : Causes eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness and dizziness.

Skin contact : No known significant effects or critical hazards.

Ingestion : Can cause central nervous system (CNS) depression. May be irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Ingestion : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : May cause damage to organs through prolonged or repeated exposure.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : Suspected of damaging fertility.

Numerical measures of toxicity

Acute toxicity estimates

Section 11. Toxicological information

Not available.

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
n-hexane	Acute LC50 113000 µg/l Fresh water	Fish - Oreochromis mossambicus	96 hours

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	LogP$_{ow}$	BCF	Potential
n-hexane	4	501.187	high

Mobility in soil

Soil/water partition coefficient (K$_{OC}$) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1208	UN1208	UN1208	UN1208	UN1208
UN proper shipping name	Hexanes	Hexanes	Hexanes	Hexanes	Hexanes
Transport hazard class(es)	3 	3 	3 	3  	3 

Section 14. Transport information

Packing group	II	II	II	II	II
Environment	No.	No.	No.	Yes.	No.
Additional information	**Reportable quantity** 5000 lbs / 2270 kg [907.77 gal / 3436.3 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.	**Explosive Limit and Limited Quantity Index** 1 **Passenger Carrying Ship Index** Forbidden **Passenger Carrying Road or Rail Index** 5	-	The marine pollutant mark is not required when transported in sizes of ≤5 L or ≤5 kg.	The environmentally hazardous substance mark may appear if required by other transportation regulations.

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

United States inventory (TSCA 8b): This material is listed or exempted.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients

Section 15. Regulatory information

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
n-hexane	100	Yes.	No.	No.	Yes.	Yes.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	n-hexane	110-54-3	100
Supplier notification	n-hexane	110-54-3	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

Canada inventory : This material is listed or exempted.

International regulations

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: This material is listed or exempted.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

WHMIS (Canada) : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

Hazardous Material Information System (U.S.A.)

Health	*	2
Flammability		3
Physical hazards		0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of printing : 5/20/2015.
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Date of previous issue : 10/16/2014.
Version : 0.03

Key to abbreviations :
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United NationsACGIH – American Conference of Governmental Industrial Hygienists
AIHA – American Industrial Hygiene Association
CAS – Chemical Abstract Services
CEPA – Canadian Environmental Protection Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)

Section 16. Other information

CFR – United States Code of Federal Regulations
CPR – Controlled Products Regulations
DSL – Domestic Substances List
GWP – Global Warming Potential
IARC – International Agency for Research on Cancer
ICAO – International Civil Aviation Organisation
Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health
TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References : Not available.

◤ **Indicates information that has changed from previously issued version.**

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

SAFETY DATA SHEET

Isopropyl Alcohol (Isopropanol)

Section 1. Identification

GHS product identifier : Isopropyl Alcohol (Isopropanol)

Chemical name : Isopropyl alcohol

Other means of identification : propan-2-ol; 2-Propanol; isopropanol; isopropyl alcohol

Product use : Synthetic/Analytical chemistry.

Synonym : propan-2-ol; 2-Propanol; isopropanol; isopropyl alcohol

SDS # : 001105

Supplier's details :
Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Emergency telephone number (with hours of operation) : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture :
FLAMMABLE LIQUIDS - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements :
Highly flammable liquid and vapor.
May form explosive mixtures with air.
Causes serious eye irritation.
May cause drowsiness and dizziness.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Wear protective gloves. Wear eye or face protection. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Use only outdoors or in a well-ventilated area. Avoid breathing vapor. Wash hands thoroughly after handling. Use and store only outdoors or in a well ventilated place.

Section 2. Hazards identification

Response : IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or physician if you feel unwell. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Store locked up. Store in a well-ventilated place. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : Isopropyl alcohol

Other means of identification : propan-2-ol; 2-Propanol; isopropanol; isopropyl alcohol

CAS number/other identifiers

CAS number : 67-63-0

Product code : 001105

Ingredient name	%	CAS number
propan-2-ol	100	67-63-0

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If necessary, call a poison center or physician. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention

Section 4. First aid measures

immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact	Causes serious eye irritation.
Inhalation	Can cause central nervous system (CNS) depression. May cause drowsiness and dizziness.
Skin contact	No known significant effects or critical hazards.
Frostbite	Try to warm up the frozen tissues and seek medical attention.
Ingestion	Can cause central nervous system (CNS) depression. Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact	Adverse symptoms may include the following: pain or irritation watering redness
Inhalation	Adverse symptoms may include the following: nausea or vomiting headache drowsiness/fatigue dizziness/vertigo unconsciousness
Skin contact	No specific data.
Ingestion	No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician	Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
Specific treatments	No specific treatment.
Protection of first-aiders	No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media	Use dry chemical, CO_2, water spray (fog) or foam.
Unsuitable extinguishing media	Do not use water jet.

Specific hazards arising from the chemical	Highly flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

Section 5. Firefighting measures

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for firefighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for firefighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Section 7. Handling and storage

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
propan-2-ol	**ACGIH TLV (United States, 3/2012).** TWA: 200 ppm 8 hours. STEL: 400 ppm 15 minutes. **OSHA PEL 1989 (United States, 3/1989).** TWA: 400 ppm 8 hours. TWA: 980 mg/m³ 8 hours. STEL: 500 ppm 15 minutes. STEL: 1225 mg/m³ 15 minutes. **NIOSH REL (United States, 1/2013).** TWA: 400 ppm 10 hours. TWA: 980 mg/m³ 10 hours. STEL: 500 ppm 15 minutes. STEL: 1225 mg/m³ 15 minutes. **OSHA PEL (United States, 6/2010).** TWA: 400 ppm 8 hours. TWA: 980 mg/m³ 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Section 8. Exposure controls/personal protection

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid. [COLORLESS LIQUID WITH THE ODOR OF RUBBING ALCOHOL]

Color : Colorless.

Molecular weight : 60.11 g/mole

Molecular formula : C3-H8-O

Boiling/condensation point : 83°C (181.4°F)

Melting/freezing point : -90°C (-130°F)

Critical temperature : Not available.

Odor : Alcohol-like.

Odor threshold : Not available.

pH : Not available.

Flash point : Closed cup: 11.7°C (53.1°F)

Burning time : Not applicable.

Burning rate : Not applicable.

Evaporation rate : 1.7 (butyl acetate = 1)

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Lower: 2%
Upper: 12%

Vapor pressure : 4.4 kPa (33.002681467 mm Hg) [room temperature]

Vapor density : 2.1 (Air = 1)

Specific Volume (ft^3/lb) : 1.2739

Gas Density (lb/ft^3) : 0.785

Relative density : 0.79

Section 9. Physical and chemical properties

Solubility : Not available.

Solubility in water : Not available.

Partition coefficient: n-octanol/water : 0.05

Auto-ignition temperature : 456°C (852.8°F)

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.

Incompatibility with various substances : Highly reactive or incompatible with the following materials: acids and moisture.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
propan-2-ol	LC50 Inhalation Gas.	Rat	45248 ppm	1 hours
	LD50 Dermal	Rabbit	12800 mg/kg	-
	LD50 Oral	Rat	5000 mg/kg	-

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
propan-2-ol	Eyes - Moderate irritant	Rabbit	-	24 hours 100 milligrams	-
	Eyes - Moderate irritant	Rabbit	-	10 milligrams	-
	Eyes - Severe irritant	Rabbit	-	100 milligrams	-
	Skin - Mild irritant	Rabbit	-	500 milligrams	-

Sensitization

Not available.

Section 11. Toxicological information

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
propan-2-ol	-	3	-

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
propan-2-ol	Category 3	Not applicable.	Narcotic effects

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness and dizziness.

Skin contact : No known significant effects or critical hazards.

Ingestion : Can cause central nervous system (CNS) depression. Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Section 11. Toxicological information

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
propan-2-ol	Acute LC50 1400000 to 1950000 µg/l Marine water Acute LC50 4200 mg/l Fresh water	Crustaceans - Crangon crangon Fish - Rasbora heteromorpha	48 hours 96 hours

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$\mathrm{LogP_{ow}}$	BCF	Potential
propan-2-ol	0.05	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1219	UN1219	UN1219	UN1219	UN1219
UN proper shipping name	ISOPROPANOL OR ISOPROPYL ALCOHOL	ISOPROPANOL; OR ISOPROPYL ALCOHOL	ISOPROPANOL OR ISOPROPYL ALCOHOL	ISOPROPANOL (ISOPROPYL ALCOHOL)	ISOPROPANOL
Transport hazard class(es)	3  	3  	3  	3  	3 
Packing group	II	II	II	II	II
Environment	No.	No.	No.	No.	No.
Additional information	**Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: 5 L **Cargo aircraft** Quantity limitation: 60 L **Special provisions** IB2, T4, TP1	**Explosive Limit and Limited Quantity Index** 1 **Passenger Carrying Road or Rail Index** 5	-	-	**Passenger and Cargo Aircraft**Quantity limitation: 5 L **Cargo Aircraft Only** Quantity limitation: 60 L **Limited Quantities M Passenger Aircraft** Quantity limitation: 1 L

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

United States inventory (TSCA 8b): This material is listed or exempted.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard
Immediate (acute) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
propan-2-ol	100	Yes.	No.	No.	Yes.	No.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	Isopropyl alcohol	67-63-0	100
Supplier notification	Isopropyl alcohol	67-63-0	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

Canada inventory : This material is listed or exempted.

International regulations

Section 15. Regulatory information

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: This material is listed or exempted.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

WHMIS (Canada) : Class B-2: Flammable liquid
Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class B-2: Flammable liquid
Class D-2B: Material causing other toxic effects (Toxic).

Hazardous Material Information System (U.S.A.)

Health	*	2
Flammability		3
Physical hazards		0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

Section 16. Other information

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of printing : 5/20/2015.

Date of issue/Date of revision : 5/20/2015.

Date of previous issue : 10/28/2014.

Version : 0.02

Key to abbreviations :

ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United NationsACGIH – American Conference of Governmental Industrial Hygienists
AIHA – American Industrial Hygiene Association
CAS – Chemical Abstract Services
CEPA – Canadian Environmental Protection Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)
CFR – United States Code of Federal Regulations
CPR – Controlled Products Regulations
DSL – Domestic Substances List
GWP – Global Warming Potential
IARC – International Agency for Research on Cancer
ICAO – International Civil Aviation Organisation
Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health
TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References : Not available.

◤ **Indicates information that has changed from previously issued version.**

Notice to reader

Section 16. Other information

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

GZA GeoEnvironmental of New York.

APPENDIX C – COMMUNITY AIR MONITORING PLAN (CAMP)

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F: 212.279.8180
www.gza.com

Appendix E
New York State Department of Health
Generic Community Air Monitoring Plan
Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. A periodic monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well bailing/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of 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 must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the

source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

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

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m_3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m_3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

1. If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring should occur within the occupied structure(s). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.

2. If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m3, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mcg/m3 or less at the monitoring point.

3. Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions should be pre-determined, as necessary, for each site.

Special Requirements for Indoor Work with Co-Located Residences or Facilities

Unless a self-contained, negative-pressure enclosure with proper emission controls will encompass the work area, all individuals not directly involved with the planned work must be absent from the room in which the work will occur. Monitoring requirements shall be as stated above under “Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures” except that in this instance “nearby/occupied structures” would be adjacent occupied rooms. Additionally, the location of all exhaust vents in the room and their discharge points, as well as potential vapor pathways (openings conduits, etc.) relative to adjoining rooms, should be understood and the monitoring locations established accordingly. In these situations, it is strongly recommended that exhaust fans or other engineering controls be used to create negative air pressure within the work area during remedial activities. Additionally, it is strongly recommended that the planned work be implemented during hours (e.g. weekends or evenings) when building occupancy is at a minimum.

APPENDIX D – HISTORICAL DATA TABLES (MARCH 2023)

Table 1
Summary of Samples Collected and Analytical Suites

Sample ID	Sample Interval (and/or Depth to Water)	Sample Collection Date	Associated Soil Boring Location	Property Location	Analytical Suite
Soil Samples					
SB-1 (0-2 ft bgs)	0- 2 +/- ft bgs	2/10/2023	SB-1	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-1 (4-6 ft bgs)	4-6 +/- ft bgs	2/10/2023	SB-1	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-2 (0-2 ft bgs)	0-2 +/- ft bgs	2/10/2023	SB-2	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-2 (4-6 ft bgs)	4-6 +/- ft bgs	2/10/2023	SB-2	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-3 (0-2 ft bgs)	0-2 +/- ft bgs	2/10/2023	SB-3	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-3 (4-6 ft bgs)	4-6 +/- ft bgs	2/10/2023	SB-3	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-4 (0-2 ft bgs)	0-2 +/- ft bgs	2/10/2023	SB-4	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved), PFAS, 1,4 Dioxane
SB-4 (4-6 ft bgs)	4-6 +/- ft bgs	2/10/2023	SB-4	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved), PFAS, 1,4 Dioxane
SB-5 (0-2 ft bgs)	0-2 +/- ft bgs	2/10/2023	SB-5	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-5 (4-6 ft bgs)	4-6 +/- ft bgs	2/10/2023	SB-5	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-6 (0-2 ft bgs)	0-2 +/- ft bgs	2/10/2023	SB-6	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-6 (4-6 ft bgs)	4-6 +/- ft bgs	2/10/2023	SB-6	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved), PFAS, 1,4 Dioxane
SB-7 (0-2 ft bgs)	0-2 +/- ft bgs	2/10/2023	SB-7	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-7 (4-6 ft bgs)	4-6 +/- ft bgs	2/10/2023	SB-7	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-8 (0-2 ft bgs)	0-2 +/- ft bgs	2/13/2023	SB-8	60-62 Commercial Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-8 (4-6 ft bgs)	4-6 +/- ft bgs	2/13/2023	SB-8	60-62 Commercial Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-X (Duplicate of SB-8 (4-6 ft))	4-6 +/- ft bgs	2/13/2023	SB-8	60-62 Commercial Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-9 (0-2 ft bgs)	0-2 +/- ft bgs	2/13/2023	SB-9	60-62 Commercial Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-9 (4-6 ft bgs)	4-6 +/- ft bgs	2/13/2023	SB-9	60-62 Commercial Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-10 (0-2 ft bgs)	0-2 +/- ft bgs	2/13/2023	SB-10	60-62 Commercial Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
SB-10 (4-6 ft bgs)	4-6 +/- ft bgs	2/13/2023	SB-10	60-62 Commercial Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
MS/MSD - SB-10 (4-6 ft bgs)	4-6 +/- ft bgs	2/13/2023	SB-10	60-62 Commercial Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (dissolved/undissolved)
Soil Vapor Samples					
SV-1	5 +/- in bgs	2/14/2023	North of SB-2	29 Clay Street, Brooklyn, NY	TO-15
SV-2	5 +/- in bgs	2/14/2023	Adjacent to SB-3	29 Clay Street, Brooklyn, NY	TO-15
SV-3	5 +/- ft bgs	2/14/2023	In SB-4	29 Clay Street, Brooklyn, NY	TO-15
SV-4	5 +/- ft bgs	2/14/2023	North of SB-4	29 Clay Street, Brooklyn, NY	TO-15
SV-5	5 +/- ft bgs	2/14/2023	In SB-6	29 Clay Street, Brooklyn, NY	TO-15
SV-6	5 +/- ft bgs	2/14/2023	Adjacent to SB-7	29 Clay Street, Brooklyn, NY	TO-15
SV-7	5 +/- ft bgs	2/14/2023	Adjacent to SB-8	60-62 Commercial Street, Brooklyn, NY	TO-15
SV-8	5 +/- ft bgs	2/14/2023	Adjacent to SB-9	60-62 Commercial Street, Brooklyn, NY	TO-15
SV-9	5 +/- ft bgs	2/14/2023	Adjacent to SB-10	60-62 Commercial Street, Brooklyn, NY	TO-15
OA-1	4-5 +/- ft ags	2/14/2023	SB-2	29 Clay Street, Brooklyn, NY	TO-15
OA-2	4-5 +/- ft ags	2/14/2023	SB-8	60-62 Commercial Street, Brooklyn, NY	TO-15
Groundwater Samples					
GW-1	15 +/- ft bgs	2/14/2023	SB-1	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (Total and Dissolved), PFAS, 1,4 Dioxane
MS/MSD - GW-1	15 +/- ft bgs	2/14/2023	SB-1	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (Total and Dissolved), PFAS, 1,4 Dioxane
GW-2	15 +/- ft bgs	2/14/2023	SB-7	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (Total and Dissolved), PFAS, 1,4 Dioxane
GW- X (Duplicate of GW-3)	15 +/- ft bgs	2/14/2023	SB-3	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (Total and Dissolved), PFAS, 1,4 Dioxane
GW-3	15 +/- ft bgs	2/14/2023	SB-3	29 Clay Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (Total and Dissolved), PFAS, 1,4 Dioxane
GW-4	15 +/- ft bgs	2/13/2023	SB-9	60-62 Commercial Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (Total and Dissolved), PFAS, 1,4 Dioxane
GW-5	15 +/- ft bgs	2/13/2023	SB-10	60-62 Commercial Street, Brooklyn, NY	VOCs, SVOCs, Pesticides, PCBs, TAL Metals (Total and Dissolved), PFAS, 1,4 Dioxane

ft bgs- Feet Below Grade Surface

ft ags- Feet Above Grade Surface

Table 2
Volatile Organic Compounds In Soil Samples
Clay Street, Brooklyn NY

Sample ID York ID Client Matrix	UUSCO	RRUSCO	Protection of GW	SB-1 (0-2) 23B0662-01 Soil		SB-1 (4-6) 23B0662-02 Soil		SB-2 (0-2) 23B0662-03 Soil		SB-2 (4-6) 23B0662-04 Soil		SB-3 (0-2) 23B0662-13 Soil		SB-3 (4-6) 23B0662-14 Soil		SB-4 (0-2) 23B0662-11 Soil		SB-4 (4-6) 23B0662-12 Soil		SB-5 (0-2) 23B0662-09 Soil		SB-5 (4-6) 23B0662-10 Soil		SB-6 (0-2) 23B0662-05 Soil		SB-6 (4-6) 23B0662-06 Soil		SB-7 (0-2) 23B0662-07 Soil		SB-7 (4-6) 23B0662-08 Soil	
Compound				Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
VOA, 8260 MASTER	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Dilution Factor				1		1		1		1		1		1		100		1		1		1		100		1		1		1	
1,1,1,2-Tetrachloroethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,1,1-Trichloroethane	0.68	100	0.68	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,1,2,2-Tetrachloroethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,1,2-Trichloroethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,1-Dichloroethane	0.27	26	0.27	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,1-Dichloroethylene	0.33	100	0.33	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,1-Dichloropropylene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,2,3-Trichlorobenzene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,2,3-Trichloropropane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,2,4,5-Tetramethylbenzene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,2,4-Trichlorobenzene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,2,4-Trimethylbenzene	3.6	52	3.6	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,2-Dibromo-3-chloropropane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,2-Dibromoethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,2-Dichlorobenzene	1.1	100	1.1	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,2-Dichloroethane	0.02	3.1	0.02	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,2-Dichloropropane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,3,5-Trimethylbenzene	8.4	52	8.4	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,3-Dichlorobenzene	2.4	49	2.4	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,3-Dichloropropane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,4-Dichlorobenzene	1.8	13	1.8	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
1,4-Dioxane	0.1	13	0.1	0.0700	U	0.0470	U	0.0610	U	0.0440	U	0.0450	U	0.0470	U	0.0510	U	0.0470	U	0.0600	U	0.0440	U	0.0710	U	0.0520	U	0.0610	U	0.0430	U
2,2-Dichloropropane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
2-Butanone	0.12	100	0.12	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
2-Chloroethylvinyl ether	~	~	~	0.0140	U	0.00940	U	0.0120	U	0.00880	U	0.00900	U	0.00950	U	0.0100	U	0.00950	U	0.0120	U	0.00890	U	0.0140	U	0.0100	U	0.0120	U	0.00860	U
2-Chlorotoluene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
2-Hexanone	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
4-Chlorotoluene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
4-Methyl-2-pentanone	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Acetone	0.05	100	0.05	0.00700	U	0.00470	U	0.00610	U	0.00440	U	0.00450	U	0.00470	U	0.00510	U	0.00640	J	0.00600	U	0.00440	U	0.00710	U	0.0200		0.0110	J	0.00430	U
Acrolein	~	~	~	0.00700	U	0.00470	U	0.00610	U	0.00440	U	0.00450	U	0.00470	U	0.00510	U	0.00470	U	0.00600	U	0.00440	U	0.00710	U	0.00520	U	0.00610	U	0.00430	U
Acrylonitrile	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Benzene	0.06	4.8	0.06	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Bromobenzene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Bromochloromethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Bromodichloromethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Bromoform	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Bromomethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Carbon disulfide	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Carbon tetrachloride	0.76	2.4	0.76	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Chlorobenzene	1.1	100	1.1	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Chloroethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Chloroform	0.37	49	0.37	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00270	J	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Chloromethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
cis-1,2-Dichloroethylene	0.25	100	0.25	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
cis-1,3-Dichloropropylene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Cyclohexane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Dibromochloromethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Dibromomethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Dichlorodifluoromethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Diisopropyl ether (DIPE)	~	~	~	0.00560	U	0.00370	U	0.00490	U	0.00350	U	0.00360	U	0.00380	U	0.00410	U	0.00380	U	0.00480	U	0.00350	U	0.00570	U	0.00410	U	0.00490	U	0.00340	U
Ethanol	~	~	~	0.0560	U	0.0370	U	0.0490	U	0.0350	U	0.0360	U	0.0380	U	0.0410	U	0.0380	U	0.0480	U	0.0350	U	0.0570	U	0.0410	U	0.0490	U	0.0340	U
Ethyl Benzene	1	41	1	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Ethyl tert-butyl ether (ETBE)	~	~	~	0.00560	U	0.00370	U	0.00490	U	0.00350	U	0.00360	U	0.00380	U	0.00410	U	0.00380	U	0.00480	U	0.00350	U	0.00570	U	0.00410	U	0.00490	U	0.00340	U
Hexachlorobutadiene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Iodomethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Isopropylbenzene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Methyl acetate	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Methyl Methacrylate	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Methyl tert-butyl ether (MTBE)	0.93	100	0.93	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Methylcyclohexane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Methylene chloride	0.05	100	0.05	0.00700	U	0.00470	U	0.00610	U	0.00440	U	0.00450	U	0.00470	U	0.00510	U	0.00470	U	0.00600	U	0.00440	U	0.00710	U	0.00520	U	0.00610	U	0.00430	U
Naphthalene	12	100	12	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
n-Butylbenzene	12	100	12	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
n-Propylbenzene	3.9	100	3.9	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
o-Xylene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
p- & m- Xylenes	~	~	~	0.00700	U	0.00470	U	0.00610	U	0.00440	U	0.00450	U	0.00470	U	0.00510	U	0.00470	U	0.00600	U	0.00440	U	0.00710	U	0.00520	U	0.00610	U	0.00430	U
p-Diethylbenzene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
p-Ethyltoluene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
p-Isopropyltoluene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
sec-Butylbenzene	11	100	11	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Styrene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
tert-Amyl alcohol (TAA)	~	~	~	0.0560	U	0.0370	U	0.0490	U	0.0350	U	0.0360	U	0.0380	U	0.0410	U	0.0380	U	0.0480	U	0.0350	U	0.0570	U	0.0410	U	0.0490	U	0.0340	U
tert-Amyl methyl ether (TAME)	~	~	~	0.00560	U	0.00370	U	0.00490	U	0.00350	U	0.00360	U	0.00380	U	0.00410	U	0.00380	U	0.00480	U	0.00350	U	0.00570	U	0.00410	U	0.00490	U	0.00340	U
tert-Butyl alcohol (TBA)	~	~	~	0.00880		0.00720		0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
tert-Butylbenzene	5.9	100	5.9	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Tetrachloroethylene	1.3	19	1.3	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.0380		0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Tetrahydrofuran	~	~	~	0.00700	U	0.00470	U	0.00610	U	0.00440	U	0.00450	U	0.00470	U	0.00510	U	0.00470	U	0.00600	U	0.00440	U	0.00710	U	0.00520	U	0.00610	U	0.00430	U
Toluene	0.7	100	0.7	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
trans-1,2-Dichloroethylene	0.19	100	0.19	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
trans-1,3-Dichloropropylene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
trans-1,4-dichloro-2-butene	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Trichloroethylene	0.47	21	0.47	0.420		0.0210		0.0240		0.0110		0.00570		0.00240	U	**10**	D	0.250		0.00750		0.00220	U	**21**	D	0.0940		0.00610		0.00220	U
Trichlorofluoromethane	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Vinyl acetate	~	~	~	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Vinyl Chloride	0.02	0.9	0.02	0.00350	U	0.00230	U	0.00310	U	0.00220	U	0.00230	U	0.00240	U	0.00260	U	0.00240	U	0.00300	U	0.00220	U	0.00350	U	0.00260	U	0.00310	U	0.00220	U
Xylenes, Total	0.26	100	1.6	0.0110	U	0.00700	U	0.00920	U	0.00660	U	0.00680	U	0.00710	U	0.00770	U	0.00710	U	0.00910	U	0.00660	U	0.0110	U	0.00770	U	0.00920	U	0.00650	U

NOTES:

Q is the Qualifier Column with definitions as follows:

D=result is from an analysis that required a dilution
J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated
U=analyte not detected at or above the level indicated
B=analyte found in the analysis batch blank
E=result is estimated and cannot be accurately reported due to levels encountered or interferences
P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis
NT=this indicates the analyte was not a target for this sample
~=this indicates that no regulatory limit has been established for this analyte

Table 3
Semi-Volatile Organic Compounds In Soil Samples
Clay Street, Brooklyn NY

Sample ID York ID Client Matrix	UUSCO	RRUSCO	Protection of GW	SB-1 (0-2) 23B0662-01 Soil		SB-1 (4-6) 23B0662-02 Soil		SB-2 (0-2) 23B0662-03 Soil		SB-2 (4-6) 23B0662-04 Soil		SB-3 (0-2) 23B0662-13 Soil		SB-3 (4-6) 23B0662-14 Soil		SB-4 (0-2) 23B0662-11 Soil		SB-4 (4-6) 23B0662-12 Soil		SB-5 (0-2) 23B0662-09 Soil		SB-5 (4-6) 23B0662-10 Soil		SB-6 (0-2) 23B0662-05 Soil		SB-6 (4-6) 23B0662-06 Soil		SB-7 (0-2) 23B0662-07 Soil		SB-7 (4-6) 23B0662-08 Soil	
Compound				Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Semi-Volatiles, 1,4-Dioxane 8270 SIM-S	mg/Kg	mg/Kg	mg/Kg													mg/Kg										mg/Kg					
Dilution Factor																1										1					
1,4-Dioxane	0.1	13	0.1	NT		NT		NT		NT		NT		NT		0.0194	U	NT		NT		NT		NT		0.0194	U	NT		NT	
SVOA, 8270 MASTER	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Dilution Factor				2		2		2		2		2		2		2		2		10		2		2		2		20		2	
1,1-Biphenyl	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.121	D	0.0485	U	0.0470	U	0.0726	U	0.0681	JD	0.0512	U
1,2,4,5-Tetrachlorobenzene	~	~	~	0.0937	U	0.0952	U	0.101	U	0.0967	U	0.0914	U	0.0914	U	0.0999	U	0.0930	U	0.0967	U	0.0967	U	0.0937	U	0.145	U	0.104	U	0.102	U
1,2,4-Trichlorobenzene	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
1,2-Dichlorobenzene	1.1	100	1.1	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
1,2-Diphenylhydrazine (as Azobenzene)	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
1,3-Dichlorobenzene	2.4	49	2.4	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
1,4-Dichlorobenzene	1.8	13	1.8	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
2,3,4,6-Tetrachlorophenol	~	~	~	0.0937	U	0.0952	U	0.101	U	0.0967	U	0.0914	U	0.0914	U	0.0999	U	0.0930	U	0.0967	U	0.0967	U	0.0937	U	0.145	U	0.104	U	0.102	U
2,4,5-Trichlorophenol	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
2,4,6-Trichlorophenol	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
2,4-Dichlorophenol	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
2,4-Dimethylphenol	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.103	JD	0.0512	U
2,4-Dinitrophenol	~	~	~	0.0937	U	0.0952	U	0.101	U	0.0967	U	0.0914	U	0.0914	U	0.0999	U	0.0930	U	0.0967	U	0.0967	U	0.0937	U	0.145	U	0.104	U	0.102	U
2,4-Dinitrotoluene	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
2,6-Dinitrotoluene	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
2-Chloronaphthalene	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
2-Chlorophenol	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
2-Methylnaphthalene	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.526	D	0.0485	U	0.0470	U	0.0726	U	0.245	D	0.0512	U
2-Methylphenol	0.33	100	0.33	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
2-Nitroaniline	~	~	~	0.0937	U	0.0952	U	0.101	U	0.0967	U	0.0914	U	0.0914	U	0.0999	U	0.0930	U	0.0967	U	0.0967	U	0.0937	U	0.145	U	0.104	U	0.102	U
2-Nitrophenol	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
3- & 4-Methylphenols	0.33	100	0.33	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.186	D	0.0512	U
3,3-Dichlorobenzidine	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
3-Nitroaniline	~	~	~	0.0937	U	0.0952	U	0.101	U	0.0967	U	0.0914	U	0.0914	U	0.0999	U	0.0930	U	0.0967	U	0.0967	U	0.0937	U	0.145	U	0.104	U	0.102	U
4,6-Dinitro-2-methylphenol	~	~	~	0.0937	U	0.0952	U	0.101	U	0.0967	U	0.0914	U	0.0914	U	0.0999	U	0.0930	U	0.0967	U	0.0967	U	0.0937	U	0.145	U	0.104	U	0.102	U
4-Bromophenyl phenyl ether	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
4-Chloro-3-methylphenol	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
4-Chloroaniline	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
4-Chlorophenyl phenyl ether	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
4-Nitroaniline	~	~	~	0.0937	U	0.0952	U	0.101	U	0.0967	U	0.0914	U	0.0914	U	0.0999	U	0.0930	U	0.0967	U	0.0967	U	0.0937	U	0.145	U	0.104	U	0.102	U
4-Nitrophenol	~	~	~	0.0937	U	0.0952	U	0.101	U	0.0967	U	0.0914	U	0.0914	U	0.0999	U	0.0930	U	0.0967	U	0.0967	U	0.0937	U	0.145	U	0.104	U	0.102	U
Acenaphthene	20	100	98	0.0470	U	0.0477	U	0.0518	JD	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	1.020	D	0.0485	U	0.0532	JD	0.0726	U	0.774	D	0.0512	U
Acenaphthylene	100	100	107	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.209	D	0.0485	U	0.0472	JD	0.0726	U	2.600	D	0.0512	U
Acetophenone	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Aniline	~	~	~	0.188	U	0.191	U	0.203	U	0.194	U	0.183	U	0.183	U	0.200	U	0.186	U	0.194	U	0.194	U	0.188	U	0.290	U	0.208	U	0.205	U
Anthracene	100	100	1000	0.0470	U	0.0477	U	0.113	D	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	1.800	D	0.0485	U	0.158	D	0.0726	U	4.040	D	0.0512	U
Atrazine	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Benzaldehyde	~	~	~	0.0470	U	0.0477	U	0.0558	JD	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Benzidine	~	~	~	0.188	U	0.191	U	0.203	U	0.194	U	0.183	U	0.183	U	0.200	U	0.186	U	0.194	U	0.194	U	0.188	U	0.290	U	0.208	U	0.205	U
Benzo(a)anthracene	1	1	1	0.0794	JD	0.0477	U	0.411	D	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	**4**	D	0.0485	U	0.611	D	0.191	D	**15**	D	0.0512	U
Benzo(a)pyrene	1	1	22	0.0554	JD	0.0477	U	0.263	D	0.0485	U	0.0458	U	0.0458	U	0.0719	JD	0.0466	U	**3.020**	D	0.0485	U	0.565	D	0.158	D	**13.100**	D	0.0512	U
Benzo(b)fluoranthene	1	1	1.7	0.0622	JD	0.0477	U	0.306	D	0.0485	U	0.0458	U	0.0458	U	0.0607	JD	0.0466	U	**2.670**	D	0.0485	U	0.597	D	0.136	JD	**12**	D	0.0512	U
Benzo(g,h,i)perylene	100	100	1000	0.0470	U	0.0477	U	0.226	D	0.0485	U	0.0458	U	0.0458	U	0.0727	JD	0.0466	U	1.690	D	0.0485	U	0.377	D	0.0834	JD	8.070	D	0.0512	U
Benzo(k)fluoranthene	0.8	3.9	1.7	0.0487	JD	0.0477	U	0.220	D	0.0485	U	0.0458	U	0.0458	U	0.0607	JD	0.0466	U	**2.800**	D	0.0485	U	0.385	D	0.130	JD	**10.900**	D	0.0512	U
Benzoic acid	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Benzyl alcohol	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Benzyl butyl phthalate	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Bis(2-chloroethoxy)methane	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Bis(2-chloroethyl)ether	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Bis(2-chloroisopropyl)ether	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Bis(2-ethylhexyl)phthalate	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Caprolactam	~	~	~	0.0937	U	0.0952	U	0.101	U	0.0967	U	0.0914	U	0.0914	U	0.0999	U	0.0930	U	0.0967	U	0.0967	U	0.0937	U	0.145	U	0.104	U	0.102	U
Carbazole	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	1.100	D	0.0485	U	0.0786	JD	0.0726	U	1.340	D	0.0512	U
Chrysene	1	3.9	1	0.0914	JD	0.0477	U	0.432	D	0.0485	U	0.0458	U	0.0458	U	0.0607	JD	0.0466	U	**3.900**	D	0.0485	U	0.602	D	0.181	D	**13.900**	D	0.0512	U
Dibenzo(a,h)anthracene	0.33	0.33	1000	0.0470	U	0.0477	U	0.0753	JD	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	**0.672**	D	0.0485	U	0.106	D	0.0726	U	**1.590**	D	0.0512	U
Dibenzofuran	7	59	210	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	1.040	D	0.0485	U	0.0470	U	0.0726	U	0.575	D	0.0512	U
Diethyl phthalate	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Dimethyl phthalate	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Di-n-butyl phthalate	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Di-n-octyl phthalate	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Fluoranthene	100	100	1000	0.115	D	0.0477	U	0.804	D	0.0485	U	0.0458	U	0.0458	U	0.0519	JD	0.0466	U	10.100	D	0.0485	U	1.030	D	0.307	D	30.700	D	0.0512	U
Fluorene	30	100	386	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.736	D	0.0485	U	0.0547	JD	0.0726	U	0.874	D	0.0512	U
Hexachlorobenzene	0.33	1.2	3.2	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Hexachlorobutadiene	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Hexachlorocyclopentadiene	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Hexachloroethane	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Indeno(1,2,3-cd)pyrene	0.5	0.5	8.2	0.0470	U	0.0477	U	0.225	D	0.0485	U	0.0458	U	0.0458	U	0.0575	JD	0.0466	U	**1.660**	D	0.0485	U	0.352	D	0.0834	JD	**8.730**	D	0.0512	U
Isophorone	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Naphthalene	12	100	12	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	1.150	D	0.0485	U	0.0470	U	0.0726	U	0.406	D	0.0512	U
Nitrobenzene	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
N-Nitrosodimethylamine	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
N-nitroso-di-n-propylamine	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
N-Nitrosodiphenylamine	~	~	~	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Pentachlorophenol	0.8	6.7	0.8	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Phenanthrene	100	100	1000	0.148	D	0.0477	U	0.689	D	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	11.600	D	0.0485	U	0.841	D	0.353	D	15.800	D	0.0512	U
Phenol	0.33	100	0.33	0.0470	U	0.0477	U	0.0507	U	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	0.0485	U	0.0485	U	0.0470	U	0.0726	U	0.0521	U	0.0512	U
Pyrene	100	100	1000	0.162	D	0.0477	U	0.860	D	0.0485	U	0.0458	U	0.0458	U	0.0501	U	0.0466	U	7.740	D	0.0485	U	1.240	D	0.346	D	27	D	0.0512	U

NOTES:

Q is the Qualifier Column with definitions as follows:

D=result is from an analysis that required a dilution

J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated

U=analyte not detected at or above the level indicated

B=analyte found in the analysis batch blank

E=result is estimated and cannot be accurately reported due to levels encountered or interferences

P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis

NT=this indicates the analyte was not a target for this sample

~=this indicates that no regulatory limit has been established for this analyte

Table 4
Inorganic Constituents In Soil Samples
Clay Street, Brooklyn NY

Sample ID York ID Client Matrix	UUSCO	RRUSCO	Protection of GW	SB-1 (0-2) 23B0662-01 Soil		SB-1 (4-6) 23B0662-02 Soil		SB-2 (0-2) 23B0662-03 Soil		SB-2 (4-6) 23B0662-04 Soil		SB-3 (0-2) 23B0662-13 Soil		SB-3 (4-6) 23B0662-14 Soil		SB-4 (0-2) 23B0662-11 Soil		SB-4 (4-6) 23B0662-12 Soil		SB-5 (0-2) 23B0662-09 Soil		SB-5 (4-6) 23B0662-10 Soil		SB-6 (0-2) 23B0662-05 Soil		SB-6 (4-6) 23B0662-06 Soil		SB-7 (0-2) 23B0662-07 Soil		SB-7 (4-6) 23B0662-08 Soil	
Compound				Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Metals, Target Analyte	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Dilution Factor				1		1		1		1		1		1		1		1		1		1		1		1		1		1	
Aluminum	~	~	~	6,090		9,460		7,200		13,300		7,990		8,600		13,100		6,220		4,270		16,800		6,020		8,160		9,670		6,240	
Antimony	~	~	~	4.470		2.390	U	2.570	U	2.420	U	2.290	U	2.310	U	13.400		2.360	U	7.930		2.460	U	2.370	U	2.470	U	2.650		3.310	
Arsenic	13	16	16	7.060		4.270		7.500		3.460		8.050		3.970		**15.300**		3.980		**15.100**		3.660		4.680		5.880		11.500		1.540	U
Barium	350	400	820	70.800		47.600		72.400		85.100		25.900		64.800		325		25.300		271		125		22.200		137		**513**		41.200	
Beryllium	7.2	72	47	0.790		0.919		0.896		1.640		0.719		1.110		3.380		0.635		0.614		1.810		0.543		0.583		1.160		1.300	
Cadmium	2.5	4.3	7.5	0.306		0.308		0.596		0.291	U	0.275	U	0.423		0.797		0.283	U	1.100		0.519		0.285	U	0.297	U	**6.140**		0.497	
Calcium	~	~	~	1,440	B	1,100	B	3,450	B	2,000	B	1,270	B	1,800	B	32,600	B	1,590	B	11,500	B	3,480	B	1,940	B	822	B	16,700	B	717	B
Chromium	~	~	~	12.500		23.600		18.700		33.900		12.600		25.500		12		14.200		18.500		35		10.700		27.400		39		47.400	
Cobalt	~	~	~	18.600		11.100		9.600		16.300		7.740		13.200		19.600		4.950		8.190		19.800		4.050		5.320		12.300		11.300	
Copper	50	270	1720	**62**		21.300		**115**		27.500		13.400		19.800		**128**		17.100		**311**		36.700		15.700		**50.300**		**303**		39.300	
Iron	~	~	~	33,300		25,100		21,200		30,000		19,400		29,200		45,100		17,800		35,700		32,400		12,700		18,300		28,000		44,800	
Lead	63	400	450	**359**		15.900		**327**		17.800		26.900		16.100		**1,720**		18.200		**1,980**		22.700		**125**		**392**		**6,870**		27.800	
Magnesium	~	~	~	2,030		3,270		2,640		5,510		2,210		3,870		1,160		2,180		1,940		7,160		2,170		2,750		3,100		1,720	
Manganese	1600	2000	2000	552		692		402		377		136		363		418		137		309		824		68.600		109		**3,260**		446	
Nickel	30	310	130	**36.800**		25.100		16		27		10.800		19.700		29.200		10.400		20.100		**32**		9.960		13.700		**30.700**		24.800	
Potassium	~	~	~	1,050		1,310		1,480		3,150		990	B	2,190	B	1,440	B	984	B	780	B	3,830	B	1,370		1,020	B	2,110	B	1,160	B
Selenium	3.9	180	4	2.350	U	2.390	U	2.570	U	2.420	U	2.290	U	2.310	U	2.500	U	2.360	U	2.430	U	2.460	U	2.370	U	2.470	U	2.600	U	2.560	U
Silver	2	180	8.3	0.473	U	0.481	U	0.518	U	0.489	U	0.462	U	0.465	U	0.505	U	0.476	U	0.490	U	0.495	U	0.478	U	0.499	U	0.525	U	0.516	U
Sodium	~	~	~	165		108		376		294		111		96		595		85.200		205		173		160		101		557		68.300	
Thallium	~	~	~	2.350	U	2.390	U	2.570	U	2.420	U	2.290	U	2.310	U	2.500	U	2.360	U	2.430	U	2.460	U	2.370	U	2.470	U	2.600	U	2.560	U
Vanadium	~	~	~	22.400		32.100		33.300		45.100		19.900		38.800		22.700		20.200		16		51.600		15.600		23.800		38.400		79.900	
Zinc	109	10000	2480	81.500		39.500		**497**		85.200		39		68.300		67.900		36.400		**404**		**117**		47.500		87.900		**1,400**		**125**	
Mercury by 7470/7471	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Dilution Factor				1		1		1		1		1		1		1		1		5		1		1		1		1		1	
Mercury	0.18	0.81	0.73	0.0372	U	0.0378	U	0.0407	U	0.0384	U	0.0363	U	0.0365	U	0.0960		0.0374	U	**0.193**	U	0.0389	U	0.0376	U	0.0392	U	0.0412	U	0.0406	U

NOTES:

Q is the Qualifier Column with definitions as follows:

D=result is from an analysis that required a dilution
J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated
U=analyte not detected at or above the level indicated
B=analyte found in the analysis batch blank
E=result is estimated and cannot be accurately reported due to levels encountered or interferences
P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis
NT=this indicates the analyte was not a target for this sample
~=this indicates that no regulatory limit has been established for this analyte

Table 5
Pesticides, PCBs and PFAS In Soil Samples
Clay Street, Brooklyn NY

Sample ID York ID Client Matrix	UUSCO	RRUSCO	Protection of GW	SB-1 (0-2) 23B0662-01 Soil		SB-1 (4-6) 23B0662-02 Soil		SB-2 (0-2) 23B0662-03 Soil		SB-2 (4-6) 23B0662-04 Soil		SB-3 (0-2) 23B0662-13 Soil		SB-3 (4-6) 23B0662-14 Soil		SB-4 (0-2) 23B0662-11 Soil		SB-4 (4-6) 23B0662-12 Soil		SB-5 (0-2) 23B0662-09 Soil		SB-5 (4-6) 23B0662-10 Soil		SB-6 (0-2) 23B0662-05 Soil		SB-6 (4-6) 23B0662-06 Soil		SB-7 (0-2) 23B0662-07 Soil		SB-7 (4-6) 23B0662-08 Soil	
Compound				Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PEST, 8081 MASTER	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Dilution Factor				5		5		5		5		5		5		5		5		5		5		5		5		5		5	
4,4'-DDD	0.0033	13	14	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
4,4'-DDE	0.0033	8.9	17	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	NT		0.00201	U
4,4'-DDE [2C]	~	~	~	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		0.00204	U	NT	
4,4'-DDT	0.0033	7.9	136	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	NT		0.00194	U	0.00278	D	0.00201	U
4,4'-DDT [2C]	~	~	~	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		0.00186	U	NT		NT		NT	
Aldrin	0.005	0.097	0.19	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
alpha-BHC	0.02	0.48	0.02	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
alpha-Chlordane	0.094	4.2	2.9	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	NT		0.00194	U	0.00204	U	0.00201	U
alpha-Chlordane [2C]	~	~	~	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		0.00186	U	NT		NT		NT	
beta-BHC	0.036	0.36	0.09	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
Chlordane, total	~	~	~	0.0368	U	0.0374	U	0.0403	U	0.0380	U	0.0359	U	0.0362	U	0.0393	U	0.0370	U	0.0381	U	0.0385	U	NT		0.0388	U	0.0408	U	0.0402	U
Chlordane, total [2C]	~	~	~	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		0.0372	UP	NT		NT		NT	
delta-BHC	0.04	100	0.25	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00263	D	0.00194	UP	0.00204	U	0.00201	U
Dieldrin	0.005	0.2	0.1	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
Endosulfan I	2.4	24	102	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
Endosulfan II	2.4	24	102	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
Endosulfan sulfate	2.4	24	1000	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
Endrin	0.014	11	0.06	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
Endrin aldehyde	~	~	~	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
Endrin ketone	~	~	~	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
gamma-BHC (Lindane)	0.1	1.3	0.1	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
gamma-Chlordane	~	~	~	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	NT		0.00194	U	0.00204	U	0.00201	U
gamma-Chlordane [2C]	~	~	~	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		0.00186	U	NT		NT		NT	
Heptachlor	0.042	2.1	0.38	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
Heptachlor epoxide	~	~	~	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
Methoxychlor	~	~	~	0.00184	U	0.00187	U	0.00202	U	0.00190	U	0.00180	U	0.00181	U	0.00196	U	0.00185	U	0.00191	U	0.00193	U	0.00186	U	0.00194	U	0.00204	U	0.00201	U
Toxaphene	~	~	~	0.184	U	0.187	U	0.202	U	0.190	U	0.180	U	0.181	U	0.196	U	0.185	U	0.191	U	0.193	U	0.186	U	0.194	U	0.204	U	0.201	U
Total Solids				%		%		%		%		%		%		%		%		%		%		%		%		%		%	
Dilution Factor				1		1		1		1		1		1		1		1		1		1		1		1		1		1	
% Solids	~	~	~	88.700		87.300		81		85.900		91		90.300		83.200		88.200		85.700		84.800		87.900		84.200		80		81.400	
PCB, 8082 MASTER	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Dilution Factor				1		1		1		1		1		1		1		1		1		1		1		1		1		1	
Aroclor 1016	~	~	~	0.0186	U	0.0189	U	0.0204	U	0.0192	U	0.0181	U	0.0183	U	0.0198	U	0.0187	U	0.0193	U	0.0194	U	0.0188	U	0.0196	U	0.0206	U	0.0203	U
Aroclor 1221	~	~	~	0.0186	U	0.0189	U	0.0204	U	0.0192	U	0.0181	U	0.0183	U	0.0198	U	0.0187	U	0.0193	U	0.0194	U	0.0188	U	0.0196	U	0.0206	U	0.0203	U
Aroclor 1232	~	~	~	0.0186	U	0.0189	U	0.0204	U	0.0192	U	0.0181	U	0.0183	U	0.0198	U	0.0187	U	0.0193	U	0.0194	U	0.0188	U	0.0196	U	0.0206	U	0.0203	U
Aroclor 1242	~	~	~	0.0186	U	0.0189	U	0.0204	U	0.0192	U	0.0181	U	0.0183	U	0.0198	U	0.0187	U	0.0193	U	0.0194	U	0.0188	U	0.0196	U	0.0206	U	0.0203	U
Aroclor 1248	~	~	~	0.0186	U	0.0189	U	0.0204	U	0.0192	U	0.0181	U	0.0183	U	0.0198	U	0.0187	U	0.0193	U	0.0194	U	0.0188	U	0.0196	U	0.0206	U	0.0203	U
Aroclor 1254	~	~	~	0.0186	U	0.0189	U	0.0204	U	0.0192	U	0.0181	U	0.0183	U	0.0198	U	0.0187	U	0.0193	U	0.0194	U	0.0188	U	0.0196	U	0.0206	U	0.0203	U
Aroclor 1260	~	~	~	0.0186	U	0.0189	U	0.0204	U	0.0192	U	0.0181	U	0.0183	U	0.0198	U	0.0187	U	0.0193	U	0.0194	U	0.0188	U	0.0196	U	0.0206	U	0.0203	U
Aroclor 1262	~	~	~	0.0186	U	0.0189	U	0.0204	U	0.0192	U	0.0181	U	0.0183	U	0.0198	U	0.0187	U	0.0193	U	0.0194	U	0.0188	U	0.0196	U	0.0206	U	0.0203	U
Aroclor 1268	~	~	~	0.0186	U	0.0189	U	0.0204	U	0.0192	U	0.0181	U	0.0183	U	0.0198	U	0.0187	U	0.0193	U	0.0194	U	0.0188	U	0.0196	U	0.0206	U	0.0203	U
Total PCBs	0.1	1	3.2	0.0186	U	0.0189	U	0.0204	U	0.0192	U	0.0181	U	0.0183	U	0.0198	U	0.0187	U	0.0193	U	0.0194	U	0.0188	U	0.0196	U	0.0206	U	0.0203	U
PFAS, NYSDEC Target List																mg/kg										mg/kg					
Dilution Factor																5										1					
1H,1H,2H,2H-Perfluorodecanesulfonic ac	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
1H,1H,2H,2H-Perfluorooctanesulfonic ac	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
N-EtFOSAA	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
N-MeFOSAA	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluoro-1-decanesulfonic acid (PFDS)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluoro-1-heptanesulfonic acid (PFHpS	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluoro-1-octanesulfonamide (FOSA)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluorobutanesulfonic acid (PFBS)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluorodecanoic acid (PFDA)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluorododecanoic acid (PFDoA)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluoroheptanoic acid (PFHpA)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluorohexanesulfonic acid (PFHxS)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluorohexanoic acid (PFHxA)	~	~	~	NT		NT		NT		NT		NT		NT		0.00220	D	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluoro-n-butanoic acid (PFBA)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluorononanoic acid (PFNA)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluorooctanesulfonic acid (PFOS)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluorooctanoic acid (PFOA)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluoropentanoic acid (PFPeA)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluorotetradecanoic acid (PFTA)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluorotridecanoic acid (PFTrDA)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	
Perfluoroundecanoic acid (PFUnA)	~	~	~	NT		NT		NT		NT		NT		NT		0.00142	U	NT		NT		NT		NT		0.00029	U	NT		NT	

NOTES:

Q is the Qualifier Column with definitions as follows:

D=result is from an analysis that required a dilution
J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated
U=analyte not detected at or above the level indicated
B=analyte found in the analysis batch blank
E=result is estimated and cannot be accurately reported due to levels encountered or interferences
P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis
NT=this indicates the analyte was not a target for this sample

Table 6
Volatile Organic Compounds Detected in Soil
Commercial Street, Brooklyn NY

Sample ID York ID Sampling Date Client Matrix	NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives	NYSDEC Part 375 Restricted Use Soil Cleanup Objectives - Restricted Residential	NYSDEC Part 375 Restricted Use Soil Cleanup Objectives- Protection of GW	SB-8 (0-2') 23B0727-05 2/13/2023 10:10:00 AM Soil		SB-8 (4-6') 23B0727-06 2/13/2023 10:38:00 AM Soil		SB-9 (0-2') 23B0727-01 2/13/2023 9:05:00 AM Soil		SB-9 (4-6') 23B0727-02 2/13/2023 9:15:00 AM Soil		SB-10 (0-2') 23B0727-03 2/13/2023 9:35:00 AM Soil		SB-10 (4-6') 23B0727-04 2/13/2023 9:40:00 AM Soil	
Compound				Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
VOA, 8260 MASTER	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Dilution Factor				1		1		1		1		1		1	
1,1,1,2-Tetrachloroethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,1,1-Trichloroethane	0.68	100	0.68	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,1,2,2-Tetrachloroethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,1,2-Trichloroethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,1-Dichloroethane	0.27	26	0.27	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,1-Dichloroethylene	0.33	100	0.33	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,1-Dichloropropylene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,2,3-Trichlorobenzene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,2,3-Trichloropropane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,2,4,5-Tetramethylbenzene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,2,4-Trichlorobenzene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,2,4-Trimethylbenzene	3.6	52	3.6	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,2-Dibromo-3-chloropropane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,2-Dibromoethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,2-Dichlorobenzene	1.1	100	1.1	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,2-Dichloroethane	0.02	3.1	0.02	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,2-Dichloropropane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,3,5-Trimethylbenzene	8.4	52	8.4	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,3-Dichlorobenzene	2.4	49	2.4	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,3-Dichloropropane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,4-Dichlorobenzene	1.8	13	1.8	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
1,4-Dioxane	0.1	13	0.1	0.0930	U	0.160	U	0.0600	U	0.0530	U	0.0690	U	0.0630	U
2,2-Dichloropropane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
2-Butanone	0.12	100	0.12	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
2-Chloroethylvinyl ether	~	~	~	0.0190	U	0.0320	U	0.0120	U	0.0110	U	0.0140	U	0.0130	U
2-Chlorotoluene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
2-Hexanone	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
4-Chlorotoluene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
4-Methyl-2-pentanone	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Acetone	0.05	100	0.05	0.00930	J	0.0280	J	0.00600	U	0.00640	J	0.0220		0.00630	U
Acrolein	~	~	~	0.00930	U	0.0160	U	0.00600	U	0.00530	U	0.00690	U	0.00630	U
Acrylonitrile	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Benzene	0.06	4.8	0.06	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Bromobenzene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Bromochloromethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Bromodichloromethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Bromoform	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Bromomethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Carbon disulfide	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Carbon tetrachloride	0.76	2.4	0.76	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Chlorobenzene	1.1	100	1.1	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Chloroethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Chloroform	0.37	49	0.37	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Chloromethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
cis-1,2-Dichloroethylene	0.25	100	0.25	0.0320		0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
cis-1,3-Dichloropropylene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Cyclohexane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Dibromochloromethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Dibromomethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Dichlorodifluoromethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Diisopropyl ether (DIPE)	~	~	~	0.00750	U	0.0130	U	0.00480	U	0.00420	U	0.00550	U	0.00500	U
Ethanol	~	~	~	0.0750	U	0.130	U	0.0480	U	0.0420	U	0.0550	U	0.0500	U
Ethyl Benzene	1	41	1	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Ethyl tert-butyl ether (ETBE)	~	~	~	0.00750	U	0.0130	U	0.00480	U	0.00420	U	0.00550	U	0.00500	U
Hexachlorobutadiene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Iodomethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Isopropylbenzene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Methyl acetate	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Methyl Methacrylate	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Methyl tert-butyl ether (MTBE)	0.93	100	0.93	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Methylcyclohexane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Methylene chloride	0.05	100	0.05	0.0130	J	0.0310	J	0.00600	U	0.00790	J	0.0120	J	0.0120	J
Naphthalene	12	100	12	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
n-Butylbenzene	12	100	12	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
n-Propylbenzene	3.9	100	3.9	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
o-Xylene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
p- & m- Xylenes	~	~	~	0.00930	U	0.0160	U	0.00600	U	0.00530	U	0.00690	U	0.00630	U
p-Diethylbenzene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
p-Ethyltoluene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
p-Isopropyltoluene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
sec-Butylbenzene	11	100	11	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Styrene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
tert-Amyl alcohol (TAA)	~	~	~	0.0750	U	0.130	U	0.0480	U	0.0420	U	0.0550	U	0.0500	U
tert-Amyl methyl ether (TAME)	~	~	~	0.00750	U	0.0130	U	0.00480	U	0.00420	U	0.00550	U	0.00500	U
tert-Butyl alcohol (TBA)	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
tert-Butylbenzene	5.9	100	5.9	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Tetrachloroethylene	1.3	19	1.3	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Tetrahydrofuran	~	~	~	0.00930	U	0.0160	U	0.00600	U	0.00530	U	0.00690	U	0.00630	U
Toluene	0.7	100	0.7	0.0100		0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
trans-1,2-Dichloroethylene	0.19	100	0.19	0.00700	J	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
trans-1,3-Dichloropropylene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
trans-1,4-dichloro-2-butene	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Trichloroethylene	0.47	21	0.47	0.0730		0.00800	U	0.350		0.00260	U	0.00340	U	0.00310	U
Trichlorofluoromethane	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Vinyl acetate	~	~	~	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Vinyl Chloride	0.02	0.9	0.02	0.00470	U	0.00800	U	0.00300	U	0.00260	U	0.00340	U	0.00310	U
Xylenes, Total	0.26	100	1.6	0.0140	U	0.0240	U	0.00900	U	0.00790	U	0.0100	U	0.00940	U

NOTES:

Any Regulatory Exceedences are color coded by Regulation

Q is the Qualifier Column with definitions as follows:

D=result is from an analysis that required a dilution

J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated

U=analyte not detected at or above the level indicated

B=analyte found in the analysis batch blank

E=result is estimated and cannot be accurately reported due to levels encountered or interferences

P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis

NT=this indicates the analyte was not a target for this sample

~=this indicates that no regulatory limit has been established for this analyte

Table 7
Semi-Volatile Organic Compounds Detected in Soil
Commercial Street, Brooklyn NY

Sample ID **York ID** **Sampling Date** **Client Matrix**	**NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives**	**NYSDEC Part 375 Restricted Use Soil Cleanup Objectives - Restricted Residential**	**NYSDEC Part 375 Restricted Use Soil Cleanup Objectives- Protection of GW**	**SB-8 (0-2')** **23B0727-05** **2/13/2023 10:10:00 AM** **Soil**		**SB-8 (4-6')** **23B0727-06** **2/13/2023 10:38:00 AM** **Soil**		**SB-9 (0-2')** **23B0727-01** **2/13/2023 9:05:00 AM** **Soil**		**SB-9 (4-6')** **23B0727-02** **2/13/2023 9:15:00 AM** **Soil**		**SB-10 (0-2')** **23B0727-03** **2/13/2023 9:35:00 AM** **Soil**		**SB-10 (4-6')** **23B0727-04** **2/13/2023 9:40:00 AM** **Soil**	
Compound				Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Semi-Volatiles, 1,4-Dioxane 8270 SIM-Soil	mg/Kg	mg/Kg	mg/Kg											mg/Kg	
Dilution Factor														1	
1,4-Dioxane	0.1	13	0.1	NT		NT		NT		NT		NT		0.0190	U
SVOA, 8270 MASTER	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Dilution Factor				25		2		2		2		2		2	
1,1-Biphenyl	~	~	~	0.344	D	0.0502	U	0.0891	JD	0.0488	U	0.0484	U	0.0527	U
1,2,4,5-Tetrachlorobenzene	~	~	~	0.128	U	0.100	U	0.0953	U	0.0974	U	0.0966	U	0.105	U
1,2,4-Trichlorobenzene	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
1,2-Dichlorobenzene	1.1	100	1.1	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
1,2-Diphenylhydrazine (as Azobenzene)	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
1,3-Dichlorobenzene	2.4	49	2.4	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
1,4-Dichlorobenzene	1.8	13	1.8	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
2,3,4,6-Tetrachlorophenol	~	~	~	0.128	U	0.100	U	0.0953	U	0.0974	U	0.0966	U	0.105	U
2,4,5-Trichlorophenol	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
2,4,6-Trichlorophenol	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
2,4-Dichlorophenol	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
2,4-Dimethylphenol	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
2,4-Dinitrophenol	~	~	~	0.128	U	0.100	U	0.0953	U	0.0974	U	0.0966	U	0.105	U
2,4-Dinitrotoluene	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
2,6-Dinitrotoluene	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
2-Chloronaphthalene	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
2-Chlorophenol	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
2-Methylnaphthalene	~	~	~	1.490	D	0.0502	U	0.570	D	0.0488	U	0.0484	U	0.0527	U
2-Methylphenol	0.33	100	0.33	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
2-Nitroaniline	~	~	~	0.128	U	0.100	U	0.0953	U	0.0974	U	0.0966	U	0.105	U
2-Nitrophenol	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
3- & 4-Methylphenols	0.33	100	0.33	0.0992	JD	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
3,3-Dichlorobenzidine	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
3-Nitroaniline	~	~	~	0.128	U	0.100	U	0.0953	U	0.0974	U	0.0966	U	0.105	U
4,6-Dinitro-2-methylphenol	~	~	~	0.128	U	0.100	U	0.0953	U	0.0974	U	0.0966	U	0.105	U
4-Bromophenyl phenyl ether	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
4-Chloro-3-methylphenol	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
4-Chloroaniline	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
4-Chlorophenyl phenyl ether	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
4-Nitroaniline	~	~	~	0.128	U	0.100	U	0.0953	U	0.0974	U	0.0966	U	0.105	U
4-Nitrophenol	~	~	~	0.128	U	0.100	U	0.0953	U	0.0974	U	0.0966	U	0.105	U
Acenaphthene	20	100	98	2.020	D	0.0502	U	0.0480	JD	0.0488	U	0.0484	U	0.0527	U
Acenaphthylene	100	100	107	0.573	D	0.0502	U	0.0716	JD	0.0488	U	0.0484	U	0.0527	U
Acetophenone	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Aniline	~	~	~	0.256	U	0.201	U	0.191	U	0.195	U	0.193	U	0.211	U
Anthracene	100	100	1000	5.900	D	0.0502	U	0.150	D	0.0488	U	0.0484	U	0.0527	U
Atrazine	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Benzaldehyde	~	~	~	0.469	D	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Benzidine	~	~	~	0.256	U	0.201	U	0.191	U	0.195	U	0.193	U	0.211	U
Benzo(a)anthracene	1	1	1	**9.690**	D	0.0502	U	0.454	D	0.0488	U	0.0726	JD	0.0527	U
Benzo(a)pyrene	1	1	22	**8.110**	D	0.0502	U	0.436	D	0.0488	U	0.0484	U	0.0527	U
Benzo(b)fluoranthene	1	1	1.7	**6.130**	D	0.0502	U	0.441	D	0.0488	U	0.0484	U	0.0527	U
Benzo(g,h,i)perylene	100	100	1000	4.150	D	0.0502	U	0.251	D	0.0488	U	0.0484	U	0.0527	U
Benzo(k)fluoranthene	0.8	3.9	1.7	**7.640**	D	0.0502	U	0.381	D	0.0488	U	0.0484	U	0.0527	U
Benzoic acid	~	~	~	0.135	D	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Benzyl alcohol	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Benzyl butyl phthalate	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Bis(2-chloroethoxy)methane	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Bis(2-chloroethyl)ether	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Bis(2-chloroisopropyl)ether	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Bis(2-ethylhexyl)phthalate	~	~	~	0.259	D	0.0502	U	0.0477	U	0.0488	U	0.119	D	0.0527	U
Caprolactam	~	~	~	0.128	U	0.100	U	0.0953	U	0.0974	U	0.0966	U	0.105	U
Carbazole	~	~	~	2.290	D	0.0502	U	0.0716	JD	0.0488	U	0.0484	U	0.0527	U
Chrysene	1	3.9	1	**9.060**	D	0.0502	U	0.483	D	0.0488	U	0.0788	JD	0.0527	U
Dibenzo(a,h)anthracene	0.33	0.33	1000	**3.270**	D	0.0502	U	0.0944	JD	0.0488	U	0.0484	U	0.0527	U
Dibenzofuran	7	59	210	3.070	D	0.0502	U	0.0525	JD	0.0488	U	0.0484	U	0.0527	U
Diethyl phthalate	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Dimethyl phthalate	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Di-n-butyl phthalate	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Di-n-octyl phthalate	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Fluoranthene	100	100	1000	20.500	D	0.0502	U	0.898	D	0.0488	U	0.119	D	0.0527	U
Fluorene	30	100	386	2.190	D	0.0502	U	0.0480	JD	0.0488	U	0.0484	U	0.0527	U
Hexachlorobenzene	0.33	1.2	3.2	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Hexachlorobutadiene	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Hexachlorocyclopentadiene	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Hexachloroethane	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Indeno(1,2,3-cd)pyrene	0.5	0.5	8.2	**3.480**	D	0.0502	U	0.293	D	0.0488	U	0.0484	U	0.0527	U
Isophorone	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Naphthalene	12	100	12	2.830	D	0.0502	U	0.495	D	0.0488	U	0.0484	U	0.0527	U
Nitrobenzene	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
N-Nitrosodimethylamine	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
N-nitroso-di-n-propylamine	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
N-Nitrosodiphenylamine	~	~	~	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Pentachlorophenol	0.8	6.7	0.8	0.0641	U	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Phenanthrene	100	100	1000	21.200	D	0.0502	U	0.756	D	0.0488	U	0.0842	JD	0.0527	U
Phenol	0.33	100	0.33	**0.459**	D	0.0502	U	0.0477	U	0.0488	U	0.0484	U	0.0527	U
Pyrene	100	100	1000	17.600	D	0.0502	U	0.860	D	0.0488	U	0.150	D	0.0527	U

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Table 8
Inorganic Constituents Detected in Soil
Commercial Street, Brooklyn NY

Sample ID **York ID** **Sampling Date** **Client Matrix**	**NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives**	**NYSDEC Part 375 Restricted Use Soil Cleanup Objectives - Restricted Residential**	**NYSDEC Part 375 Restricted Use Soil Cleanup Objectives- Protection of GW**	**SB-8 (0-2')** **23B0727-05** **2/13/2023 10:10:00 AM** **Soil**		**SB-8 (4-6')** **23B0727-06** **2/13/2023 10:38:00 AM** **Soil**		**SB-9 (0-2')** **23B0727-01** **2/13/2023 9:05:00 AM** **Soil**		**SB-9 (4-6')** **23B0727-02** **2/13/2023 9:15:00 AM** **Soil**		**SB-10 (0-2')** **23B0727-03** **2/13/2023 9:35:00 AM** **Soil**		**SB-10 (4-6')** **23B0727-04** **2/13/2023 9:40:00 AM** **Soil**	
Compound				Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Metals, Target Analyte	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Dilution Factor				1		1		1		1		1		1	
Aluminum	~	~	~	2,620		788		1,290		8,330		478		610	
Antimony	~	~	~	8.800		2.690		4.900		2.440	U	4.300		4.230	
Arsenic	13	16	16	7.160		3.280		**23.200**		5.240		3.460		3.840	
Barium	350	400	820	136		29.600		59.900		44.200		147		42.300	
Beryllium	7.2	72	47	0.304		0.0900		0.191		0.466		0.0940		0.114	
Cadmium	2.5	4.3	7.5	2.070		0.301	U	0.299		0.293	U	0.410		0.317	U
Calcium	~	~	~	4,630	B	172	B	830	B	536	B	544	B	420	B
Chromium	~	~	~	33.200		1.670		6.580		14.500		1.370		2.350	
Cobalt	~	~	~	4.540		0.568		4.760		6.250		0.810		0.804	
Copper	50	270	1720	**365**		2.010	U	46.500		35.200		18.100		3.330	
Iron	~	~	~	30,400		25,500		42,000		18,900		30,300		36,100	
Lead	63	400	450	**1,180**		28.100		**982**		13.200		**436**		22.400	
Magnesium	~	~	~	1,200		168		378		2,420		103		119	
Manganese	1600	2000	2000	243		8.670		56.500		247		20.800		6	
Nickel	30	310	130	**74.700**		2.440		9.560		15.400		5.510		1.900	
Potassium	~	~	~	871		1,670		1,260		1,340		1,100		2,030	
Selenium	3.9	180	4	3.200	U	2.510	U	2.410	U	2.440	U	2.470	U	2.640	U
Silver	2	180	8.3	0.646	U	0.506	U	0.486	U	0.492	U	0.498	U	0.533	U
Sodium	~	~	~	82.800		1,710		657		51.200		1,940		3,120	
Thallium	~	~	~	3.200	U	2.510	U	2.410	U	2.440	U	2.470	U	2.640	U
Vanadium	~	~	~	41.100		5.340		12.100		21.700		2.110		2.400	
Zinc	109	10000	2480	**476**		5.730		**289**		**300**		67.600		5.080	
Mercury by 7473	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Dilution Factor				1		1		1		1		1		1	
Mercury	0.18	0.81	0.73	**1.060**		0.0362	U	**0.847**		0.0352	U	**4.280**		0.0381	U

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Table 9
Pesticides, PCBs and PFAS Detected in Soil
Commercial Street, Brooklyn NY

Sample ID York ID Sampling Date Client Matrix	NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives	NYSDEC Part 375 Restricted Use Soil Cleanup Objectives - Restricted Residential	NYSDEC Part 375 Restricted Use Soil Cleanup Objectives- Protection of GW	SB-8 (0-2') 23B0727-05 2/13/2023 10:10:00 AM Soil		SB-8 (4-6') 23B0727-06 2/13/2023 10:38:00 AM Soil		SB-9 (0-2') 23B0727-01 2/13/2023 9:05:00 AM Soil		SB-9 (4-6') 23B0727-02 2/13/2023 9:15:00 AM Soil		SB-10 (0-2') 23B0727-03 2/13/2023 9:35:00 AM Soil		SB-10 (4-6') 23B0727-04 2/13/2023 9:40:00 AM Soil	
Compound				Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PEST, 8081 MASTER	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Dilution Factor				50		5		5		5		5		5	
4,4'-DDD	0.0033	13	14	0.00253	U	0.00198	U	NT		0.00193	U	NT		0.00207	U
4,4'-DDD [2C]	~	~	17	NT		NT		0.00188	UP	NT		0.00195	UP	NT	
4,4'-DDE	0.0033	8.9	~	**0.956**	D	**0.00995**	D	0.00234	D	0.00193	U	0.00264	D	0.00207	U
4,4'-DDT	0.0033	7.9	136	**0.307**	DP	**0.0230**	D	**0.00781**	D	0.00193	U	**0.00565**	D	0.00207	U
Aldrin	0.005	0.097	~	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
alpha-BHC	0.02	0.48	0.19	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
alpha-Chlordane	0.094	4.2	0.02	0.00253	U	0.00198	U	NT		0.00193	U	0.00195	U	0.00207	U
alpha-Chlordane [2C]	~	~	2.9	NT		NT		0.00188	UP	NT		NT		NT	
beta-BHC	0.036	0.36	~	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
Chlordane, total	~	~	0.09	0.0506	U	0.0396	U	NT		0.0386	U	NT		0.0413	U
Chlordane, total [2C]	~	~	~	NT		NT		0.0376	UP	NT		0.0390	UP	NT	
delta-BHC	0.04	100	~	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
Dieldrin	0.005	0.2	0.25	**0.369**	DP	NT		NT		0.00193	U	0.00195	UP	0.00207	U
Dieldrin [2C]	~	~	0.1	NT		0.00248	D	0.00188	UP	NT		NT		NT	
Endosulfan I	2.4	24	102	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
Endosulfan II	2.4	24	102	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
Endosulfan sulfate	2.4	24	1000	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
Endrin	0.014	11	0.06	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
Endrin aldehyde	~	~	~	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
Endrin ketone	~	~	~	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
gamma-BHC (Lindane)	0.1	1.3	0.1	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
gamma-Chlordane	~	~	~	0.00253	U	0.00198	U	NT		0.00193	U	NT		0.00207	U
gamma-Chlordane [2C]	~	~	~	NT		NT		0.00188	UP	NT		0.00195	UP	NT	
Heptachlor	0.042	2.1	0.38	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
Heptachlor epoxide	~	~	~	0.178	DP	0.00198	UP	0.00188	U	0.00193	U	0.00195	U	0.00207	U
Methoxychlor	~	~	~	0.00253	U	0.00198	U	0.00188	U	0.00193	U	0.00195	U	0.00207	U
Toxaphene	~	~	~	0.253	U	0.198	U	0.188	U	0.193	U	0.195	U	0.207	U
PCB, 8082 MASTER	mg/Kg	mg/Kg	mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	
Dilution Factor				10		1		1		1		1		1	
Aroclor 1016	~	~	~	0.255	U	0.0200	U	0.0190	U	0.0195	U	0.0197	U	0.0209	U
Aroclor 1221	~	~	~	0.255	U	0.0200	U	0.0190	U	0.0195	U	0.0197	U	0.0209	U
Aroclor 1232	~	~	~	0.255	U	0.0200	U	0.0190	U	0.0195	U	0.0197	U	0.0209	U
Aroclor 1242	~	~	~	0.255	U	0.0200	U	0.0190	U	0.0195	U	0.0197	U	0.0209	U
Aroclor 1248	~	~	~	0.255	U	0.0200	U	0.0190	U	0.0195	U	0.0197	U	0.0209	U
Aroclor 1254	~	~	~	7.930	D	0.438		0.0190	U	0.0195	U	0.0197	U	0.0209	U
Aroclor 1260	~	~	~	0.255	U	0.0200	U	0.0321		0.0195	U	0.0197	U	0.0209	U
Aroclor 1262	~	~	~	0.255	U	0.0200	U	0.0190	U	0.0195	U	0.0197	U	0.0209	U
Aroclor 1268	~	~	~	0.255	U	0.0200	U	0.0190	U	0.0195	U	0.0197	U	0.0209	U
Total PCBs	0.1	1	3.2	**7.930**	D	**0.438**		0.0321		0.0195	U	0.0197	U	0.0209	U
PFAS, NYSDEC Target List														ug/kg	
Dilution Factor														1	
1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FT	~	~	~	NT		NT		NT		NT		NT		0.298	U
1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FT	~	~	~	NT		NT		NT		NT		NT		0.298	U
N-EtFOSAA	~	~	~	NT		NT		NT		NT		NT		0.298	U
N-MeFOSAA	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluoro-1-decanesulfonic acid (PFDS)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluoro-1-heptanesulfonic acid (PFHpS)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluoro-1-octanesulfonamide (FOSA)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluorobutanesulfonic acid (PFBS)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluorodecanoic acid (PFDA)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluorododecanoic acid (PFDoA)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluoroheptanoic acid (PFHpA)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluorohexanesulfonic acid (PFHxS)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluorohexanoic acid (PFHxA)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluoro-n-butanoic acid (PFBA)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluorononanoic acid (PFNA)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluorooctanesulfonic acid (PFOS)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluorooctanoic acid (PFOA)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluoropentanoic acid (PFPeA)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluorotetradecanoic acid (PFTA)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluorotridecanoic acid (PFTrDA)	~	~	~	NT		NT		NT		NT		NT		0.298	U
Perfluoroundecanoic acid (PFUnA)	~	~	~	NT		NT		NT		NT		NT		0.298	U

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Table 10
Volatile Organic Compounds in Groundwater
Clay Street, Brooklyn NY

Sample ID York ID Sampling Location Client Matrix	NYSDEC TOGS Standards and Guidance Values - GA	GW-1 23B0854-01 Clay St. Water		GW-2 23B0854-03 Clay St. Water		GW-3 23B0854-02 Clay St. Water		GW-X 23B0854-04 Clay St. Water		GW-4 23B0727-09 Commercial St. Water		GW-5 23B0727-08 Commercial St. Water		S-FB-1 23B0854-05 Water		GW-FB-1 23B0854-06 Water	
Compound		Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
VOA, 8260 LOW MASTER	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor		200		1		1		1		1		1		1		1	
1,1,1,2-Tetrachloroethane	5	0.216	U	0.216	U	0.216	U	0.216	U	0.216	U	0.216	U	0.216	U	0.216	U
1,1,1-Trichloroethane	5	0.266	U	0.266	U	0.266	U	0.266	U	0.266	U	0.266	U	0.266	U	0.266	U
1,1,2,2-Tetrachloroethane	5	0.256	U	0.256	U	0.256	U	0.256	U	0.256	U	0.256	U	0.256	U	0.256	U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	5	0.850		0.286	U	0.286	U	0.286	U	0.286	U	0.286	U	0.286	U	0.286	U
1,1,2-Trichloroethane	1	**1.380**		0.249	U	0.249	U	0.249	U	0.249	U	0.249	U	0.249	U	0.249	U
1,1-Dichloroethane	5	0.650		0.272	U	0.272	U	0.272	U	0.272	U	0.272	U	0.272	U	0.272	U
1,1-Dichloroethylene	5	**11.200**		0.327	U	0.327	U	0.327	U	0.327	U	0.327	U	0.327	U	0.327	U
1,2,3-Trichlorobenzene	5	0.222	U	0.222	U	0.222	U	0.222	U	0.222	U	0.222	U	0.222	U	0.222	U
1,2,3-Trichloropropane	0.04	0.273	U	0.273	U	0.273	U	0.273	U	0.273	U	0.273	U	0.273	U	0.273	U
1,2,4-Trichlorobenzene	5	0.138	U	0.138	U	0.138	U	0.138	U	0.138	U	0.138	U	0.138	U	0.138	U
1,2,4-Trimethylbenzene	5	0.370	J	0.310	U	0.310	U	0.310	U	0.310	U	0.310	U	0.310	U	0.310	U
1,2-Dibromo-3-chloropropane	0.04	0.432	U	0.432	U	0.432	U	0.432	U	0.432	U	0.432	U	0.432	U	0.432	U
1,2-Dibromoethane	0.0006	0.215	U	0.215	U	0.215	U	0.215	U	0.215	U	0.215	U	0.215	U	0.215	U
1,2-Dichlorobenzene	3	0.270	U	0.270	U	0.270	U	0.270	U	0.270	U	0.270	U	0.270	U	0.270	U
1,2-Dichloroethane	0.6	0.510		0.377	U	0.377	U	0.377	U	0.377	U	0.377	U	0.377	U	0.377	U
1,2-Dichloropropane	1	0.327	U	0.327	U	0.327	U	0.327	U	0.327	U	0.327	U	0.327	U	0.327	U
1,3,5-Trimethylbenzene	5	0.347	U	0.347	U	0.347	U	0.347	U	0.347	U	0.347	U	0.347	U	0.347	U
1,3-Dichlorobenzene	3	0.283	U	0.283	U	0.283	U	0.283	U	0.283	U	0.283	U	0.283	U	0.283	U
1,3-Dichloropropane	5	0.260	U	0.260	U	0.260	U	0.260	U	0.260	U	0.260	U	0.260	U	0.260	U
1,4-Dichlorobenzene	3	0.311	U	0.311	U	0.311	U	0.311	U	0.311	U	0.311	U	0.311	U	0.311	U
1,4-Dioxane	~	35.300	U	35.300	U	35.300	U	35.300	U	35.300	U	35.300	U	35.300	U	35.300	U
2-Butanone	50	0.421	U	0.421	U	0.421	U	0.421	U	0.421	U	1.330		0.421	U	0.421	U
2-Hexanone	50	0.320	U	0.320	U	0.320	U	0.320	U	0.320	U	0.320	U	0.320	U	0.320	U
4-Methyl-2-pentanone	~	0.365	U	0.365	U	0.365	U	0.365	U	0.365	U	0.365	U	0.365	U	0.365	U
Acetone	50	1.340	U	3.940		1.340	U	1.340	U	1.340	U	1.340	U	1.340	U	1.340	U
Acrolein	~	0.447	U	0.447	U	0.447	U	0.447	U	0.447	U	0.447	U	0.447	U	0.447	U
Acrylonitrile	~	0.422	U	0.422	U	0.422	U	0.422	U	0.422	U	0.422	U	0.422	U	0.422	U
Benzene	1	0.279	U	0.279	U	0.279	U	0.279	U	0.279	U	0.279	U	0.279	U	0.279	U
Bromochloromethane	5	0.354	U	0.354	U	0.354	U	0.354	U	0.354	U	0.354	U	0.354	U	0.354	U
Bromodichloromethane	50	0.950		0.245	U	0.245	U	0.245	U	0.245	U	0.245	U	0.245	U	0.245	U
Bromoform	50	0.163	U	0.163	U	0.163	U	0.163	U	0.163	U	0.163	U	0.163	U	0.163	U
Bromomethane	5	0.119	U	0.119	U	0.119	U	0.119	U	0.119	U	0.119	U	0.119	U	0.119	U
Carbon disulfide	~	0.362	U	0.362	U	0.362	U	0.362	U	0.362	U	0.362	U	0.362	U	0.362	U
Carbon tetrachloride	5	0.204	U	0.204	U	0.204	U	0.204	U	0.204	U	0.204	U	0.204	U	0.204	U
Chlorobenzene	5	0.284	U	0.284	U	0.284	U	0.284	U	0.284	U	0.284	U	0.284	U	0.284	U
Chloroethane	5	0.448	U	0.448	U	0.448	U	0.448	U	0.448	U	0.448	U	0.448	U	0.448	U
Chloroform	7	**12**		0.243	U	0.390	J	0.370	J	0.930		0.243	U	0.243	U	0.243	U
Chloromethane	5	0.372	U	0.372	U	0.372	U	0.372	U	0.372	U	0.372	U	0.372	U	0.372	U
cis-1,2-Dichloroethylene	5	**1,340**	D	0.330	J	1.580		0.740		1.990		**10.400**		0.294	U	0.294	U
cis-1,3-Dichloropropylene	0.4	0.262	U	0.262	U	0.262	U	0.262	U	0.262	U	0.262	U	0.262	U	0.262	U
Cyclohexane	~	0.491	U	0.491	U	0.491	U	0.491	U	0.491	U	0.491	U	0.491	U	0.491	U
Dibromochloromethane	50	0.146	U	0.146	U	0.146	U	0.146	U	0.146	U	0.146	U	0.146	U	0.146	U
Dibromomethane	~	0.203	U	0.203	U	0.203	U	0.203	U	0.203	U	0.203	U	0.203	U	0.203	U
Dichlorodifluoromethane	5	0.451	U	0.451	U	0.451	U	0.451	U	0.451	U	0.451	U	0.451	U	0.451	U
Ethyl Benzene	5	0.290	U	0.290	U	0.290	U	0.290	U	0.290	U	0.290	U	0.290	U	0.290	U
Hexachlorobutadiene	0.5	0.241	U	0.241	U	0.241	U	0.241	U	0.241	U	0.241	U	0.241	U	0.241	U
Isopropylbenzene	5	0.405	U	0.405	U	0.405	U	0.405	U	0.405	U	0.405	U	0.405	U	0.405	U
Methyl acetate	~	0.442	U	0.442	U	0.442	U	0.442	U	0.442	U	0.442	U	0.442	U	0.442	U
Methyl tert-butyl ether (MTBE)	10	0.244	U	0.244	U	3.030		2.350		0.244	U	0.360	J	0.244	U	0.244	U
Methylcyclohexane	~	0.477	U	0.477	U	0.477	U	0.477	U	0.477	U	0.477	U	0.477	U	0.477	U
Methylene chloride	5	0.397	U	0.397	U	0.397	U	0.397	U	0.397	U	0.397	U	0.680	JB	0.680	JB
Naphthalene	10	0.560	J	0.590	J	0.212	U	0.212	U	0.212	U	0.212	U	0.212	U	0.212	U
n-Butylbenzene	5	0.399	U	0.399	U	0.399	U	0.399	U	0.399	U	0.399	U	0.399	U	0.399	U
n-Propylbenzene	5	0.384	U	0.384	U	0.384	U	0.384	U	0.384	U	0.384	U	0.384	U	0.384	U
o-Xylene	5	0.261	U	0.261	U	0.261	U	0.261	U	0.261	U	0.261	U	0.261	U	0.261	U
p- & m- Xylenes	~	0.578	U	0.578	U	0.578	U	0.578	U	0.578	U	0.578	U	0.578	U	0.578	U
p-Diethylbenzene	~	0.341	U	0.341	U	0.341	U	0.341	U	0.341	U	0.450	J	0.341	U	0.341	U
p-Ethyltoluene	~	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U
p-Isopropyltoluene	5	0.377	U	0.377	U	0.377	U	0.377	U	0.377	U	0.377	U	0.377	U	0.377	U
sec-Butylbenzene	5	0.444	U	0.444	U	0.444	U	0.444	U	0.444	U	0.444	U	0.444	U	0.444	U
Styrene	5	0.255	U	0.255	U	0.255	U	0.255	U	0.255	U	0.255	U	0.255	U	0.255	U
tert-Butyl alcohol (TBA)	~	0.608	U	0.608	U	0.608	U	0.608	U	0.608	U	0.608	U	0.608	U	0.608	U
tert-Butylbenzene	5	0.367	U	0.367	U	0.367	U	0.367	U	0.367	U	0.367	U	0.367	U	0.367	U
Tetrachloroethylene	5	**6.280**		0.239	U	0.239	U	0.239	U	0.239	U	0.239	U	0.239	U	0.239	U
Toluene	5	0.346	U	0.346	U	0.346	U	0.346	U	0.346	U	0.346	U	0.346	U	0.346	U
trans-1,2-Dichloroethylene	5	**42.600**		0.279	U	0.279	U	0.279	U	0.279	U	0.580		0.279	U	0.279	U
trans-1,3-Dichloropropylene	0.4	0.229	U	0.229	U	0.229	U	0.229	U	0.229	U	0.229	U	0.229	U	0.229	U
Trichloroethylene	5	**6,370**	D	1.300		**15.200**		**11.200**		**11.900**		**19.500**		0.370	J	0.280	J
Trichlorofluoromethane	5	0.337	U	0.337	U	0.337	U	0.337	U	0.337	U	0.337	U	0.337	U	0.337	U
Vinyl Chloride	2	**30.400**		0.469	U	0.469	U	0.469	U	0.469	U	0.469	U	0.469	U	0.469	U
Xylenes, Total	5	0.836	U	0.836	U	0.836	U	0.836	U	0.836	U	0.836	U	0.836	U	0.836	U

NOTES:

Any Regulatory Exceedences are color coded by Regulation

Q is the Qualifier Column with definitions as follows:
D=result is from an analysis that required a dilution
J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated
U=analyte not detected at or above the level indicated
B=analyte found in the analysis batch blank
E=result is estimated and cannot be accurately reported due to levels encountered or interferences
P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis
NT=this indicates the analyte was not a target for this sample
~=this indicates that no regulatory limit has been established for this analyte

Table 11
Semi-Volatile Organic Compounds in Groundwater
Clay Street, Brooklyn NY

Sample ID	NYSDEC TOGS Standards and Guidance Values - GA	GW-1		GW-2		GW-3		GW-X		GW-5		GW-4		S-FB-1		GW-FB-1	
York ID		23B0854-01		23B0854-03		23B0854-02		23B0854-04		23B0727-08		23B0727-09		23B0854-05		23B0854-06	
Sampling Location		Clay St.		Clay St.		Clay St.		Clay St.		Commercial St		Commercial St					
Client Matrix		Water		Water		Water		Water		Water		Water		Water		Water	
Compound		Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Semi-Volatiles, 1,4-Dioxane 8270 SIM-Aqueous		ug/L		ug/L		ug/L		ug/L				ug/L		ug/L		ug/L	
Dilution Factor		1		1		1		1				1		1		1	
1,4-Dioxane	~	1.230		0.300	U	0.300	U	0.300	U	NT		0.300	U	0.300	U	0.300	U
SVOA, 8270 LOW MASTER	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor		1		1		1		1		1		1		1		1	
1,1-Biphenyl	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
1,2,4,5-Tetrachlorobenzene	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
1,2,4-Trichlorobenzene	5	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
1,2-Dichlorobenzene	3	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
1,2-Diphenylhydrazine (as Azobenzene)	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
1,3-Dichlorobenzene	3	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
1,4-Dichlorobenzene	3	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2,3,4,6-Tetrachlorophenol	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2,4,5-Trichlorophenol	1	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2,4,6-Trichlorophenol	1	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2,4-Dichlorophenol	5	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2,4-Dimethylphenol	50	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2,4-Dinitrophenol	10	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2,4-Dinitrotoluene	5	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2,6-Dinitrotoluene	5	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2-Chloronaphthalene	10	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2-Chlorophenol	1	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2-Methylnaphthalene	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2-Methylphenol	1	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2-Nitroaniline	5	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
2-Nitrophenol	1	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
3- & 4-Methylphenols	1	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
3,3-Dichlorobenzidine	5	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
3-Nitroaniline	5	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
4,6-Dinitro-2-methylphenol	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
4-Bromophenyl phenyl ether	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
4-Chloro-3-methylphenol	1	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
4-Chloroaniline	5	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
4-Chlorophenyl phenyl ether	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
4-Nitroaniline	5	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
4-Nitrophenol	1	5.410	U	5.880	U	5.260	U	5.410	U	5.410	U	5.260	U	6.670	U	9.090	U
Acetophenone	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Alpha Terpineol	~	5.410	U	5.880	U	5.260	U	5.410	U	5.410	U	5.260	U	6.670	U	9.090	U
Aniline	5	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Benzaldehyde	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Benzidine	~	5.410	U	5.880	U	5.260	U	5.410	U	5.410	U	5.260	U	6.670	U	9.090	U
Benzoic acid	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Benzyl alcohol	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Benzyl butyl phthalate	50	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Bis(2-chloroethoxy)methane	5	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Bis(2-chloroethyl)ether	1	1.080	U	1.180	U	1.050	U	1.080	U	1.080	U	1.050	U	1.330	U	1.820	U
Bis(2-chloroisopropyl)ether	5	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Caprolactam	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Carbazole	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Dibenzofuran	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Diethyl phthalate	50	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Dimethyl phthalate	50	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Di-n-butyl phthalate	50	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Di-n-octyl phthalate	50	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Hexachlorocyclopentadiene	5	5.410	U	5.880	U	5.260	U	5.410	U	5.410	U	5.260	U	6.670	U	9.090	U
Isophorone	50	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
N-nitroso-di-n-propylamine	~	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
N-Nitrosodiphenylamine	50	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
Phenol	1	2.700	U	2.940	U	2.630	U	2.700	U	2.700	U	2.630	U	3.330	U	4.550	U
SVOA, 8270 SIM MASTER	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor		1		20		1		1		2		1		1		1	
Acenaphthene	20	0.0541	U	1.880		0.0526	U	0.0541	U	0.195		0.0526	U	0.0667	U	0.0909	U
Acenaphthylene	~	0.0541	U	1.720		0.0526	U	0.0541	U	0.0973		0.0526	U	0.0667	U	0.0909	U
Anthracene	50	0.0541	U	15.100	D	0.0526	U	0.0541	U	0.0865		0.0526	U	0.0667	U	0.0909	U
Atrazine	~	0.541	U	0.588	U	0.526	U	0.541	U	0.541	U	0.526	U	0.667	U	0.909	U
Benzo(a)anthracene	0.002	0.0541	U	47.100	D	0.0526	U	0.0541	U	0.0541	U	0.0526	U	0.0667	U	0.0909	U
Benzo(a)pyrene	0.002	0.0541	U	46.400	D	0.0526	U	0.0541	U	0.0541	U	0.0526	U	0.0667	U	0.0909	U
Benzo(b)fluoranthene	0.002	0.0541	U	36.200	D	0.0526	U	0.0541	U	0.0541	U	0.0526	U	0.0667	U	0.0909	U
Benzo(g,h,i)perylene	~	0.0541	U	34.400	D	0.0526	U	0.0541	U	0.0541	U	0.0526	U	0.0667	U	0.0909	U
Benzo(k)fluoranthene	0.002	0.0541	U	39.800	D	0.0526	U	0.0541	U	0.0541	U	0.0526	U	0.0667	U	0.0909	U
Bis(2-ethylhexyl)phthalate	5	0.984		0.953		0.526	U	0.541	U	4.710	BD	0.747	B	0.667	U	1.110	
Chrysene	0.002	0.0541	U	45.900	D	0.0526	U	0.0541	U	0.0541	U	0.0526	U	0.0667	U	0.0909	U
Dibenzo(a,h)anthracene	~	0.0541	U	4.780		0.0526	U	0.0541	U	0.0541	U	0.0526	U	0.0667	U	0.0909	U
Fluoranthene	50	0.0541	U	109	D	0.0526	U	0.0541	U	0.0541	U	0.0526	U	0.0667	U	0.0909	U
Fluorene	50	0.0541	U	2.220		0.0526	U	0.0541	U	0.173		0.0526	U	0.413		0.709	
Hexachlorobenzene	0.04	0.0216	U	0.0235	U	0.0211	U	0.0216	U	0.0216	U	0.0211	U	0.0267	U	0.0364	U
Hexachlorobutadiene	0.5	0.541	U	0.588	U	0.526	U	0.541	U	0.541	U	0.526	U	0.667	U	0.909	U
Hexachloroethane	5	0.541	U	0.588	U	0.526	U	0.541	U	0.541	U	0.526	U	0.667	U	0.909	U
Indeno(1,2,3-cd)pyrene	0.002	0.0541	U	31.300	D	0.0526	U	0.0541	U	0.0541	U	0.0526	U	0.0667	U	0.0909	U
Naphthalene	10	0.0541	U	1.410		0.0526	U	0.0541	U	0.346		0.0842		0.0667	U	0.0909	U
Nitrobenzene	0.4	0.270	U	0.294	U	0.263	U	0.270	U	0.270	U	0.263	U	0.333	U	0.455	U
N-Nitrosodimethylamine	~	0.541	U	0.588	U	0.526	U	0.541	U	0.541	U	0.526	U	0.667	U	0.909	U
Pentachlorophenol	1	0.270	U	0.294	U	0.263	U	0.270	U	0.270	U	0.263	U	0.333	U	0.455	U
Phenanthrene	50	0.0541	U	**62.800**	D	0.0526	U	0.0541	U	0.692		0.0526	U	0.0667	U	0.0909	U
Pyrene	50	0.0541	U	**78.400**	D	0.0526	U	0.0541	U	0.0541	U	0.0526	U	0.0800		0.145	

NOTES:

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U=analyte not detected at or above the level indicate

B=analyte found in the analysis batch blank

E=result is estimated and cannot be accurately reported due to levels encountered or interferences

P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysi

NT=this indicates the analyte was not a target for this sample

~=this indicates that no regulatory limit has been established for this analyte

Table 12
Inorganic Constituents in Groundwater
Clay Street, Brooklyn NY

Sample ID York ID Sampling Location Client Matrix	NYSDEC TOGS Standards and Guidance Values - GA	GW-1 23B0854-01 Clay St. Water		GW-2 23B0854-03 Clay St. Water		GW-3 23B0854-02 Clay St. Water		GW-X 23B0854-04 Clay St. Water		GW-5 23B0727-08 Commercial St. Water		GW-4 23B0727-09 Commercial St. Water		S-FB-1 23B0854-05 Water		GW-FB-1 23B0854-06 Water	
Compound		Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Metals, Target Analyte, ICP	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor		1		2		1		1		1		1		1		1	
Aluminum	~	94.200		64,600		196		456		7,860		2,220		55.600	U	55.600	U
Barium	1000	61.700		423		98.800		98.800		272		62.500	U	27.800	U	27.800	U
Calcium	~	107,000	B	274,000	B	202,000	B	203,000	B	62,800	B	45,900	B	189	B	165	B
Chromium	50	5.560	U	**165**		5.560	U	5.560	U	29.400		12.500	U	5.560	U	5.560	U
Cobalt	~	4.440	U	90.800		4.440	U	4.440	U	7.270		10	U	4.440	U	4.440	U
Copper	200	22.200	U	**319**		22.200	U	22.200	U	49.100		50	U	22.200	U	22.200	U
Iron	~	278	U	155,000	D	437		1,140		29,700		6,140		278	U	278	U
Lead	25	5.560	U	**159**		5.560	U	5.560	U	**75.400**		12.500	U	5.560	U	5.560	U
Magnesium	35000	31,100		**60,500**		**40,300**		**38,300**		5,730		4,700		55.600	U	55.600	U
Manganese	300	**586**		**3,700**		**1,080**		**1,000**		**660**		225		5.560	U	5.560	U
Nickel	100	11.100	U	**168**		11.100	U	11.100	U	31.500		25	U	11.100	U	11.100	U
Potassium	~	7,730		41,900		4,860		5,040		16,300		15,000		163		132	
Silver	50	5.560	U	5.560	U	5.560	U	5.560	U	5.560	U	12.500	U	5.560	U	5.560	U
Sodium	20000	**124,000**		**93,400**		**189,000**		**186,000**		13,900		**29,700**		556	U	556	U
Vanadium	~	11.100	U	217		11.100	U	11.100	U	23.900		25	U	11.100	U	11.100	U
Zinc	2000	27.800	U	535		27.800	U	27.800	U	197		219		27.800	U	27.800	U
Metals, Target Analyte, ICP Dissolved	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor		1		1		1		1		1		1		1		1	
Aluminum	~	124		7,850		174		196		1,740	B	477	B	55.600	U	55.600	U
Barium	1000	68.300		71.300		107		106		237		27.800	U	27.800	U	27.800	U
Calcium	~	107,000	B	275,000	B	208,000	B	202,000	B	68,200		49,700		157	B	105	B
Chromium	50	5.560	U	17.500		5.560	U	5.560	U	16.700		5.560	U	5.560	U	5.560	U
Cobalt	~	4.440	U	42.200		4.440	U	4.440	U	10	U	4.440	U	4.440	U	4.440	U
Copper	200	22.200	U	**230**		22.200	U	22.200	U	50	U	22.200	U	22.200	U	22.200	U
Iron	~	278	U	17,800		356		278	U	23,800		1,160		278	U	278	U
Lead	25	6.800		**86.600**		5.560	U	5.560	U	**69**		5.560	U	5.560	U	5.560	U
Magnesium	35000	33,500		**39,000**		**41,900**		**41,700**		5,240		4,840		55.600	U	55.600	U
Manganese	300	**638**		**3,180**		**1,150**		**1,120**		**700**		230		5.560	U	5.560	U
Nickel	100	11.100	U	52.200		11.100	U	11.100	U	26		13.600		11.100	U	11.100	U
Potassium	~	8,670		30,100		5,480		5,150		16,000		16,600		55.600	U	55.600	U
Silver	50	5.560	U	5.560	U	5.560	U	5.560	U	12.500	U	5.560	U	5.560	U	5.560	U
Sodium	20000	**126,000**		**94,200**		**196,000**		**189,000**		14,700		**31,900**		556	U	556	U
Vanadium	~	11.100	U	47.500		11.100	U	11.100	U	25	U	11.100	U	11.100	U	11.100	U
Zinc	2000	51.900		193		27.800	U	27.800	U	200		230		27.800	U	27.800	U
Metals, Target Analyte, ICPMS	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor		1		1		1		1		1		1		1		1	
Antimony	3	1.110	U	1.110	U	1.110	U	1.110	U	2	U	2.500	U	1.110	U	1.110	U
Arsenic	25	1.110	U	7.540		1.110	U	1.110	U	9.230		2.500	U	1.110	U	1.110	U
Beryllium	3	0.333	U	1.240		0.333	U	0.333	U	0.642		0.750	U	0.333	U	0.333	U
Cadmium	5	0.556	U	0.821		0.556	U	0.556	U	1	U	1.250	U	0.556	U	0.556	U
Selenium	10	4.840		**47.600**		**17.300**		**15.300**		2	U	2.610		1.110	U	1.110	U
Thallium	~	1.110	U	1.110	U	1.110	U	1.110	U	2	U	2.500	U	1.110	U	1.110	U
Metals, Target Analyte, ICPMS Dissolved	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor		1		1		1		1		1		1		1		1	
Antimony	3	1.110	U	1.110	U	1.110	U	1.110	U	2	U	1.110	U	1.110	U	1.110	U
Arsenic	25	1.110	U	2.110		1.110	U	1.110	U	2.300		1.110	U	1.110	U	1.110	U
Beryllium	3	0.333	U	0.769		0.333	U	0.333	U	0.600	U	0.333	U	0.333	U	0.333	U
Cadmium	5	0.556	U	0.591		0.556	U	0.556	U	1	U	0.839		0.556	U	0.556	U
Selenium	10	6.470		**29**		**16.100**		**17.600**		2	U	1.110	U	1.110	U	1.110	U
Thallium	~	1.110	U	1.110	U	1.110	U	1.110	U	2	U	1.110	U	1.110	U	1.110	U
Mercury by 7470/7471	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor		1		1		1		1		1		10		1		2	
Mercury	0.7	0.200	U	0.400		0.200	U	0.200	U	0.200	U	**2**	U	0.200	U	0.400	U
Mercury, Dissolved	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor		1		1		1		1		1		1		1		1	
Mercury	0.7	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U

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NT=this indicates the analyte was not a target for this sample
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Table 13
PCB, Pest and PFAS in Groundwater
Clay Street, Brooklyn NY

Sample ID	NYSDEC TOGS Standards and Guidance Values - GA	GW-1		GW-2		GW-3		GW-X		GW-5		GW-4		S-FB-1		GW-FB-1	
York ID		23B0854-01		23B0854-03		23B0854-02		23B0854-04		23B0727-08		23B0727-09		23B0854-05		23B0854-06	
Sampling Location		Clay St.		Clay St.		Clay St.		Clay St.		Commercial St.		Commercial St.					
Client Matrix		Water		Water		Water		Water		Water		Water		Water		Water	
Compound		Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PEST, 8081 MASTER	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor		1		1		1		1		1		1		1		1	
4,4'-DDD	0.3	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	0.00571	U	0.00457	U
4,4'-DDE	0.2	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	0.00571	U	NT	
4,4'-DDT	0.2	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	0.00571	U	0.00457	U
Aldrin	~	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	0.00571	U	NT	
alpha-BHC	0.01	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	0.00571	U	0.00457	U
alpha-Chlordane	~	0.00421	U	0.00485	U	0.00444	U	NT		0.00421	U	0.00421	U	NT		NT	
beta-BHC	0.04	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	NT		0.00457	U
Chlordane, total	0.05	0.211	U	0.242	U	0.222	U	0.216	U	0.211	U	0.211	U	0.286	U	0.229	U
delta-BHC	0.04	0.00421	U	0.00779		NT		NT		0.00421	U	NT		0.00571	U	0.00457	U
delta-BHC [2C]	~	NT		NT		0.00568		0.00432	U	NT		0.00421	U	NT		NT	
Dieldrin	0.004	0.00211	U	NT		0.00222	U	0.00216	U	0.00211	U	0.00211	U	0.00286	U	0.00229	U
Endosulfan I	~	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	0.00571	U	0.00457	U
Endosulfan II	~	NT		0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	NT		NT	
Endosulfan sulfate	~	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	0.00571	U	0.00457	U
Endrin	~	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	0.00571	U	0.00457	U
Endrin aldehyde	5	0.0105	U	0.0121	U	0.0111	U	0.0108	U	0.0105	U	0.0105	U	0.0143	U	0.0114	U
Endrin ketone	5	0.0105	U	0.0121	U	0.0111	U	0.0108	U	0.0105	U	0.0105	U	0.0143	U	0.0114	U
gamma-BHC (Lindane)	0.05	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	0.00571	U	0.00457	U
gamma-Chlordane	~	0.0105	U	0.0121	U	0.0111	U	NT		0.0105	U	0.0105	U	NT		NT	
Heptachlor	0.04	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	0.00571	U	NT	
Heptachlor epoxide	0.03	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	0.00571	U	0.00457	U
Methoxychlor	35	0.00421	U	0.00485	U	0.00444	U	0.00432	U	0.00421	U	0.00421	U	0.00571	U	0.00457	U
Toxaphene	0.06	0.105	U	0.121	U	0.111	U	0.108	U	0.105	U	0.105	U	0.143	U	0.114	U
PCB, 8082 MASTER	ug/L	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Dilution Factor		1		1		1		1		1		1		1		1	
Aroclor 1016	~	0.0526	U	0.0606	U	0.0556	U	0.0541	U	0.0526	U	0.0526	U	0.0714	U	0.0571	U
Aroclor 1221	~	0.0526	U	0.0606	U	0.0556	U	0.0541	U	0.0526	U	0.0526	U	0.0714	U	0.0571	U
Aroclor 1232	~	0.0526	U	0.0606	U	0.0556	U	0.0541	U	0.0526	U	0.0526	U	0.0714	U	0.0571	U
Aroclor 1242	~	0.0526	U	0.0606	U	0.0556	U	0.0541	U	0.0526	U	0.0526	U	0.0714	U	0.0571	U
Aroclor 1248	~	0.0526	U	0.0606	U	0.0556	U	0.0541	U	0.0526	U	0.0526	U	0.0714	U	0.0571	U
Aroclor 1254	~	0.0526	U	0.0606	U	0.0556	U	0.0541	U	0.0526	U	0.0526	U	0.0714	U	0.0571	U
Aroclor 1260	~	0.0526	U	0.0606	U	0.0556	U	0.0541	U	0.0526	U	0.0526	U	0.0714	U	0.0571	U
Aroclor 1262	~	0.0526	U	0.0606	U	0.0556	U	0.0541	U	0.0526	U	0.0526	U	0.0714	U	0.0571	U
Aroclor 1268	~	0.0526	U	0.0606	U	0.0556	U	0.0541	U	0.0526	U	0.0526	U	0.0714	U	0.0571	U
Total PCBs	0.09	0.0526	U	0.0606	U	0.0556	U	0.0541	U	0.0526	U	0.0526	U	0.0714	U	0.0571	U
PFAS, NYSDEC Target List		ug/L		ug/L		ug/L						ug/L					
Dilution Factor		5		5		5						5					
1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	~	0.00500	U	0.00500	U	0.00481	U	NT		NT		0.00463	U	NT		NT	
1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)	~	0.0125	U	0.0248	D	0.0120	U	NT		NT		0.00231	U	NT		NT	
N-EtFOSAA	~	0.00100	U	0.00100	U	0.00096	U	NT		NT		0.00093	U	NT		NT	
N-MeFOSAA	~	0.00100	U	0.00100	U	0.00096	U	NT		NT		0.00093	U	NT		NT	
Perfluoro-1-decanesulfonic acid (PFDS)	~	0.00100	U	0.00100	U	0.00096	U	NT		NT		0.00093	U	NT		NT	
Perfluoro-1-heptanesulfonic acid (PFHpS)	~	0.00105		0.00100	U	0.00096	U	NT		NT		0.00093	U	NT		NT	
Perfluoro-1-octanesulfonamide (FOSA)	~	0.00100	U	0.00100	U	0.00096	U	NT		NT		0.00093	U	NT		NT	
Perfluorobutanesulfonic acid (PFBS)	~	0.00414		0.00415		0.0197		NT		NT		0.00664		NT		NT	
Perfluorodecanoic acid (PFDA)	~	0.00100	U	0.00100	U	0.00096	U	NT		NT		0.00093	U	NT		NT	
Perfluorododecanoic acid (PFDoA)	~	0.00100	U	0.00100	U	0.00096	U	NT		NT		0.00093	U	NT		NT	
Perfluoroheptanoic acid (PFHpA)	~	0.0113		0.00333		0.0303		NT		NT		0.0225		NT		NT	
Perfluorohexanesulfonic acid (PFHxS)	~	0.00381		0.00168		0.0195		NT		NT		0.00171		NT		NT	
Perfluorohexanoic acid (PFHxA)	~	0.0103		0.00588		0.0317		NT		NT		0.00993		NT		NT	
Perfluoro-n-butanoic acid (PFBA)	~	0.00690		0.00439		0.0243		NT		NT		0.0107		NT		NT	
Perfluorononanoic acid (PFNA)	~	0.00170		0.00100	U	0.00096	U	NT		NT		0.0172		NT		NT	
Perfluorooctanesulfonic acid (PFOS)	~	0.0187		0.00182		0.00703		NT		NT		0.0318		NT		NT	
Perfluorooctanoic acid (PFOA)	~	0.0884		0.00920		0.111		NT		NT		0.0747		NT		NT	
Perfluoropentanoic acid (PFPeA)	~	0.00916		0.00505		0.0316		NT		NT		0.00562		NT		NT	
Perfluorotetradecanoic acid (PFTA)	~	0.00100	U	0.00100	U	0.00096	U	NT		NT		0.00093	U	NT		NT	
Perfluorotridecanoic acid (PFTrDA)	~	0.00100	U	0.00100	U	0.00096	U	NT		NT		0.00093	U	NT		NT	
Perfluoroundecanoic acid (PFUnA)	~	0.00100	U	0.00260		0.00096	U	NT		NT		0.00093	U	NT		NT	

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J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated
U=analyte not detected at or above the level indicated
B=analyte found in the analysis batch blank
E=result is estimated and cannot be accurately reported due to levels encountered or interferences
P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysi
NT=this indicates the analyte was not a target for this sample
~=this indicates that no regulatory limit has been established for this analyte

Table 14
Soil Vapor Samples
Clay Street, Brooklyn

Sample ID Sample Location Sampling Date Client Matrix	NYSDOH Immediate Action Levels	NYSDOH Air Guidance Values	OA-1 Clay Street 2/14/2023 12:43:00 PM Outdoor Ambient Air		SV-1 Clay Street 2/14/2023 12:07:00 PM Soil Vapor		SV-2 Clay Street 2/14/2023 12:05:00 PM Soil Vapor		SV-3 Clay Street 2/14/2023 12:10:00 PM Soil Vapor		SV-4 Clay Street 2/14/2023 11:14:00 AM Soil Vapor		SV-5 Clay Street 2/14/2023 11:25:00 AM Soil Vapor		SV-6 Clay Street 2/14/2023 11:20:00 AM Soil Vapor		OA-2 Commercial Street 2/14/2023 1:10:00 PM Outdoor Ambient Air		SV-7 Commercial Street 2/14/2023 1:01:00 PM Soil Vapor		SV-8 Commercial Street 2/14/2023 12:09:00 PM Soil Vapor		SV-9 Commercial Street 2/14/2023 12:00:00 PM Soil Vapor	
Compound			Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Volatile Organics, EPA TO15 Full List	ug/m3		ug/m3		ug/m3		ug/m3		ug/m3		ug/m3		ug/m3		ug/m3		ug/m3		ug/m3		ug/m3		ug/m3	
Dilution Factor			0.814		562.8		5.404		10746.7		328.2		130.32		1.447		0.722		7.06		31.08		6.064	
1,1,1,2-Tetrachloroethane			0.560	U	9.700	U	3.700	U	20	U	11	U	11	U	0.990	U	0.500	U	4.800	U	11	U	4.200	U
1,1,1-Trichloroethane	100		0.440	U	54	D	10	D	200	D	9	D	9.800	D	3.900	D	0.390	U	3.900	U	8.500	U	3.300	U
1,1,2,2-Tetrachloroethane			0.560	U	9.700	U	3.700	U	20	U	11	U	11	U	0.990	U	0.500	U	4.800	U	11	U	4.200	U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)			0.620	U	11	U	4.100	U	22	U	13	U	12	U	1.100	U	0.550	U	5.400	U	12	U	4.600	U
1,1,2-Trichloroethane			0.440	U	7.700	U	2.900	U	16	U	9	U	8.900	U	0.790	U	0.390	U	3.900	U	8.500	U	3.300	U
1,1-Dichloroethane			0.330	U	5.700	U	2.200	U	12	U	6.600	U	6.600	U	0.590	U	0.290	U	2.900	U	6.300	U	2.500	U
1,1-Dichloroethylene	6		0.0810	U	1.400	U	0.540	U	2.900	U	1.600	U	1.600	U	0.140	U	0.0720	U	0.700	U	1.500	U	0.600	U
1,2,4-Trichlorobenzene			0.600	U	10	U	4	U	22	U	12	U	12	U	1.100	U	0.540	U	5.200	U	12	U	4.500	U
1,2,4-Trimethylbenzene			0.400	U	6.900	U	2.700	U	14	U	8.100	U	8	U	0.780	D	0.350	U	3.500	U	7.600	U	3	U
1,2-Dibromoethane			0.630	U	11	U	4.200	U	22	U	13	U	13	U	1.100	U	0.550	U	5.400	U	12	U	4.700	U
1,2-Dichlorobenzene			0.490	U	8.500	U	3.200	U	18	U	9.900	U	9.800	U	0.870	U	0.430	U	4.200	U	9.300	U	3.600	U
1,2-Dichloroethane			0.330	U	5.700	U	2.200	U	12	U	6.600	U	6.600	U	0.590	U	0.290	U	2.900	U	6.300	U	2.500	U
1,2-Dichloropropane			0.380	U	6.500	U	2.500	U	13	U	7.600	U	7.500	U	0.670	U	0.330	U	3.300	U	7.200	U	2.800	U
1,2-Dichlorotetrafluoroethane			0.570	U	9.800	U	3.800	U	20	U	11	U	11	U	1	U	0.500	U	4.900	U	11	U	4.200	U
1,3,5-Trimethylbenzene			0.400	U	6.900	U	2.700	U	14	U	8.100	U	8	U	0.710	U	0.350	U	3.500	U	7.600	U	3	U
1,3-Butadiene			0.540	U	9.300	U	3.600	U	19	U	11	U	11	U	0.960	U	0.480	U	4.700	U	10	U	7.800	D
1,3-Dichlorobenzene			0.490	U	8.500	U	3.200	U	18	U	9.900	U	9.800	U	0.870	U	0.430	U	4.200	U	9.300	U	3.600	U
1,3-Dichloropropane			0.380	U	6.500	U	2.500	U	13	U	7.600	U	7.500	U	0.670	U	0.330	U	3.300	U	7.200	U	2.800	U
1,4-Dichlorobenzene			0.490	U	8.500	U	3.200	U	18	U	9.900	U	9.800	U	0.870	U	0.430	U	4.200	U	9.300	U	3.600	U
1,4-Dioxane			0.590	U	10	U	3.900	U	21	U	12	U	12	U	1	U	0.520	U	5.100	U	11	U	4.400	U
2-Butanone			0.820	D	4.100	U	1.900	D	8.600	U	4.800	U	4.800	U	0.430	U	0.870	D	11	D	4.600	U	1.800	U
2-Hexanone			0.670	U	12	U	4.400	U	24	U	13	U	13	U	1.200	U	0.590	U	5.800	U	13	U	5	U
3-Chloropropene			1.300	U	22	U	8.500	U	46	U	26	U	25	U	2.300	U	1.100	U	11	U	24	U	9.500	U
4-Methyl-2-pentanone			0.330	U	5.800	U	2.200	U	12	U	6.700	U	6.700	U	0.590	U	0.300	U	2.900	U	6.400	U	2.500	U
Acetone			3.700	D	42	D	36	D	330	D	74	D	180	D	99	D	8.900	D	130	D	46	D	29	D
Acrylonitrile			0.180	U	3.100	U	1.200	U	6.300	U	3.600	U	3.500	U	0.310	U	0.160	U	1.500	U	3.400	U	1.300	U
Benzene			0.310	D	4.500	U	1.700	U	9.300	U	5.200	U	5.200	U	0.460	U	0.280	D	2.500	D	5	U	1.900	U
Benzyl chloride			0.420	U	7.300	U	2.800	U	15	U	8.500	U	8.400	U	0.750	U	0.370	U	3.700	U	8	U	3.100	U
Bromodichloromethane			0.550	U	9.400	U	3.600	U	20	U	11	U	11	U	0.970	U	0.480	U	4.700	U	10	U	4.100	U
Bromoform			0.840	U	15	U	5.600	U	30	U	17	U	17	U	1.500	U	0.750	U	7.300	U	16	U	6.300	U
Bromomethane			0.320	U	5.500	U	2.100	U	11	U	6.400	U	6.300	U	0.560	U	0.280	U	2.700	U	6	U	2.400	U
Carbon disulfide			0.250	U	4.400	U	1.700	U	9.100	U	5.100	U	5.100	U	0.450	U	0.220	U	30	D	4.800	U	13	D
Carbon tetrachloride	6		0.360	D	2.200	U	0.850	U	9.200	D	2.600	U	2.600	U	0.360	D	0.360	D	1.100	U	27	D	1.500	D
Chlorobenzene			0.370	U	6.500	U	2.500	U	13	U	7.600	U	7.500	U	0.670	U	0.330	U	3.300	U	7.200	U	2.800	U
Chloroethane			0.210	U	3.700	U	1.400	U	7.700	U	4.300	U	4.300	U	0.380	U	0.190	U	1.900	U	4.100	U	1.600	U
Chloroform			0.400	U	38	D	5	D	300	D	62	D	15	D	0.710	D	0.350	U	3.400	U	52	D	3.300	D
Chloromethane			1.300	D	2.900	U	1.100	U	6	U	3.400	U	3.400	U	0.300	U	1.100	D	1.500	U	3.200	U	1.300	U
cis-1,2-Dichloroethylene	6		0.0810	U	8.900	D	7.100	D	120	D	7.800	D	4.500	D	0.140	U	0.0720	U	0.700	U	2.500	D	0.600	U
cis-1,3-Dichloropropylene			0.370	U	6.400	U	2.500	U	13	U	7.400	U	7.400	U	0.660	U	0.330	U	3.200	U	7.100	U	2.800	U
Cyclohexane			0.280	U	17	D	1.900	U	10	U	5.600	U	5.600	U	0.500	U	0.250	U	8	D	8	D	23	D
Dibromochloromethane			0.690	U	12	U	4.600	U	25	U	14	U	14	U	1.200	U	0.620	U	6	U	13	U	5.200	U
Dichlorodifluoromethane			2.400	D	7	U	2.700	U	14	U	8.100	U	8.100	U	2.900	D	2.500	D	3.500	U	7.700	U	3	U
Ethyl acetate			0.590	U	10	U	3.900	U	21	U	12	U	12	U	1	U	0.520	U	5.100	U	11	U	4.400	U
Ethyl Benzene			0.350	U	6.100	U	2.300	U	13	U	7.100	U	7.100	U	0.630	D	0.310	U	10	D	6.700	U	6.100	D
Hexachlorobutadiene			0.870	U	15	U	5.800	U	31	U	18	U	17	U	1.500	U	0.770	U	7.500	U	17	U	6.500	U
Isopropanol			2	D	19	D	2.700	U	14	U	8.100	U	8	U	6.600	D	1.800	D	5.200	D	7.600	U	3	U
Methyl Methacrylate			0.330	U	5.800	U	2.200	U	12	U	6.700	U	6.700	U	0.590	U	0.300	U	2.900	U	6.400	U	2.500	U
Methyl tert-butyl ether (MTBE)			0.290	U	5.100	U	1.900	U	11	U	5.900	U	5.900	U	0.520	U	0.260	U	2.500	U	5.600	U	2.200	U
Methylene chloride	600	60	0.760	D	9.800	U	3.800	U	20	U	11	U	11	U	1	U	0.700	D	4.900	U	11	U	4.200	U
n-Heptane			0.330	U	5.800	U	2.200	U	12	U	6.700	U	6.700	U	0.590	U	0.300	U	9.800	D	6.400	U	2.500	U
n-Hexane			0.290	U	5	D	1.900	U	10	U	5.800	U	5.700	U	0.510	U	0.250	U	17	D	9.300	D	7.100	D
o-Xylene			0.350	U	6.100	U	2.300	U	13	U	7.100	U	7.100	U	0.630	U	0.310	U	5.500	D	6.700	U	3.700	D
p- & m- Xylenes			0.710	U	12	U	4.700	U	25	U	14	U	14	U	1.500	D	0.630	U	17	D	13	U	12	D
p-Ethyltoluene			0.400	U	6.900	U	2.700	U	14	U	8.100	U	8	U	0.710	U	0.350	U	3.500	U	7.600	U	3	U
Propylene			0.140	U	2.400	U	1.200	D	7	D	2.800	U	2.800	U	0.700	D	0.120	U	33	D	29	D	160	D
Styrene			0.350	U	6	U	2.300	U	12	U	7	U	6.900	U	0.620	U	0.310	U	3	U	6.600	U	2.600	U
Tetrachloroethylene	300	30	0.550	U	56	D	3.700	D	4,500	D	220	D	120	D	4.900	D	0.490	U	430	D	220	D	260	D
Tetrahydrofuran			0.480	U	8.300	U	3.200	U	17	U	9.700	U	9.600	U	0.850	U	0.430	U	4.200	U	9.200	U	3.600	U
Toluene			1.400	D	8.500	D	18	D	46	D	19	D	31	D	15	D	0.520	D	880	D	380	D	470	D
trans-1,2-Dichloroethylene			0.320	U	5.600	U	2.100	U	31	D	6.500	U	6.500	U	0.570	U	0.290	U	2.800	U	6.200	U	2.400	U
trans-1,3-Dichloropropylene			0.370	U	6.400	U	2.500	U	13	U	7.400	U	7.400	U	0.660	U	0.330	U	3.200	U	7.100	U	2.800	U
Trichloroethylene	20	2	0.520	D	120,000	D	580	D	740,000	D	29,000	D	15,000	D	73	D	0.0970	U	11	D	5,500	D	60	D
Trichlorofluoromethane (Freon 11)			1.100	D	7.900	U	3	U	16	U	9.200	U	9.200	U	1.600	D	1.600	D	4	U	8.700	U	3.400	U
Vinyl acetate			0.290	U	5	U	1.900	U	10	U	5.800	U	5.700	U	0.510	U	0.250	U	2.500	U	5.500	U	2.100	U
Vinyl bromide			0.360	U	6.200	U	2.400	U	13	U	7.200	U	7.100	U	0.630	U	0.320	U	3.100	U	6.800	U	2.700	U
Vinyl Chloride	6		0.100	U	1.800	U	0.690	U	3.700	U	2.100	U	2.100	U	0.180	U	0.0920	U	0.900	U	2	U	0.780	U

NOTES:

Any Regulatory Exceedences are color coded by Regulation

Q is the Qualifier Column with definitions as follows:

D=result is from an analysis that required a dilution

J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated

U=analyte not detected at or above the level indicated

B=analyte found in the analysis batch blank

E=result is estimated and cannot be accurately reported due to levels encountered or interferences

P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis

NT=this indicates the analyte was not a target for this sample

~=this indicates that no regulatory limit has been established for this analyte

APPENDIX E – GREEN AND SUSTAINABLE REMEDIATION DOCUMENTATION

Climate Screening Checklist

Background

- Project Manager: Victoria Whelan
- Site Name: 29 Clay Street
- Site Number: Not Assigned
- Site Location: 29 Clay Street Brooklyn, NY
- Site Elevation (average above sea level): Approximately 16 feet above sea level (from google earth).

- ClimAID region: Region 4—New York City and Long Island

- Remedial Stage/Site Classification: Site Investigation- Class 2

- Contamination -- Media Impacted/Contaminants of Concern:

    - Soil, Vapor Intrusion/Indoor Air, Groundwater- COCs:
        - VOCs: Trichloroethylene, Carbon Tetrachloride, Cis-1,2-dichloroethene, Methylene chloride, Tetrachlorethylene (TCE), Trichloroethene (TCE), and Vinyl Chloride
        - SVOCS: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Bibenzo(a,h)anthracene, Benzo(k)fluoranthene, Chrysene, and Ideno(1,2,3-cd)pyrene
        - Metals: Arsenic, Barium, Cadmium, Copper, Lead, Manganese, and Mercury

- Proposed/Current Remedy: Proposed additional investigation to design remedial action for the future development of a residential building. Proposed investigation include soil, groundwater, and soil vapor sampling across the site.

- What is the predicted timeframe of the remedy? Will components of the remedy still be in place in 10+ years?
    - The remedial investigation is proposed to take place over 6 days of field activities. After completion of the field activities, the monitoring wells and soil vapor points will be left in place for future monitoring activities through the time of development. At the time of development, these monitoring wells and soil vapor points may be removed or modified to accommodate the development.

Is the site in a disadvantaged community (DAC) or potential environmental justice area (PEJA) (Use DECinfolocator: DECinfo Locator (ny.gov))?

☒Yes ☐ No

If the site is in a DAC or PEJA, will climate impacts be magnified? If yes, list how and why.

☐Yes ☒ No

Should thresholds of concern be lowered to account for magnification of impacts? If yes, indicate how lower thresholds will be used in the screening.

☐Yes ☒ No

Climate Screening Table*

Potential Climate Hazards	**Relevant to the Site Location (Y/N/NA)** [1]	**Projected Change (**Put the reference document/model used here) [3]	**Potential to Impact Remedy (Y/N)**	**Is remedy/site already resilient? (Y/N)** [4]
Precipitation	Potentially	Based upon FEMA's Resiliency Analysis Planning Tool the annual rain fall is projected to increase between 7.62 and 11.20 inches by the end of the century	N/A	N/A
Temperature (Extreme Heat or Cold Weather Impacts) [2]	Y	Based upon FEMA's Resiliency Analysis Planning Tool, by the end of the century there will be an estimated increase of 525.15 cooling degree days.	N	Y – RI is not susceptible to extreme temperatures.
Sea Level Rise	N	N - Based upon the NOAA's Sea Level Rise Viewer the site is not impacted at 10 feet of SLR.	N/A	N/A

Flooding[5]	Y	Based upon FEMA's Resiliency Analysis Planning Tool, a portion of the site falls within the 0.2% annual chance flood hazard area.	N	Y – The RI is not susceptible to flooding issues.
Storm Surge	Y	Y – NOAA's Storm Surge Risk Maps tool indicates that the site could be impacted by less than 3 ft of water during category 1 hurricanes and over 9 ft of water for category 3 and higher hurricanes	N	Y – The RI is not susceptible to storm surge
Wildfire	N	N/A	N/A	N/A
Drought	N	N/A	N/A	N/A
Storm Severity (could include high winds, lightening, etc.)	Y	N - Based upon FEMA's Resiliency Analysis Planning Tool, there is no increase in storm severity outlook.	N	Y – RI will not be impacted by sever weather. Activities will be rescheduled as needed during sever weather.
Landslides	N	N/A	N/A	N/A
Other Hazards:	Seismic Activity – N/A	N/A	N/A	N/A

*Links to potential data sources can be found on the following page

[1] If the first column is N --> The rest of the columns will be N/A, the hazard is not applicable to the site.

[2] Extreme Heat: periods of three or more days above 90°F- Extreme Cold: Individual days with minimum temperatures at or below 30 degrees F (NYSERDA ClimAID report), Note: this is important for sites with active remedial systems/sites where the remedy relies on the electrical grid

[3] List the projected change in specific terms or units e.g. inches of rain fall, feet of sea level rise, etc.

[4] If final column is Y, provide reasoning, if the final column is N --> Climate Vulnerability Assessment (CVA) required.

[5] For system sites- components (e.g. electrical wiring and panels) should be evaluated to determine if they would need to be raised to avoid flooding.

Required Next Steps (If no further action, provide justification):

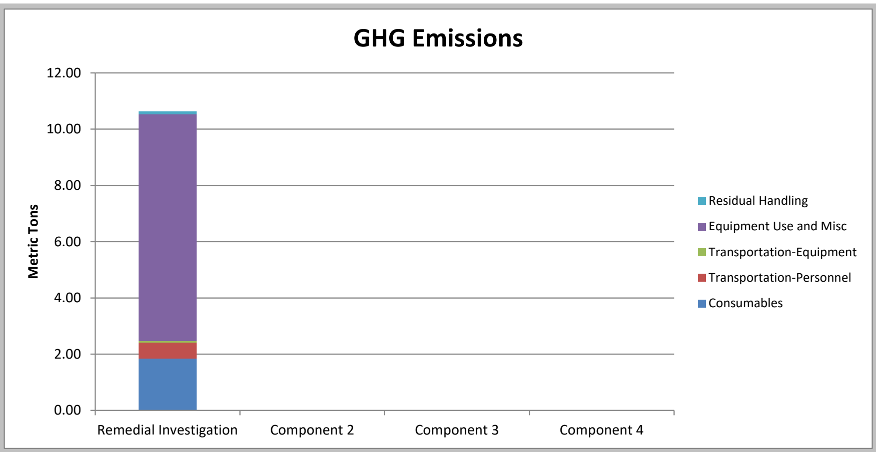
No further action is required for the evaluation of the remedial investigation resiliency. Climate related impacts are only anticipated to be temporary disturbances related to weather at the site that may make conditions unsafe for field activities. Field activities for the RI will be rescheduled as necessary if climate impacts cause unsafe conditions.

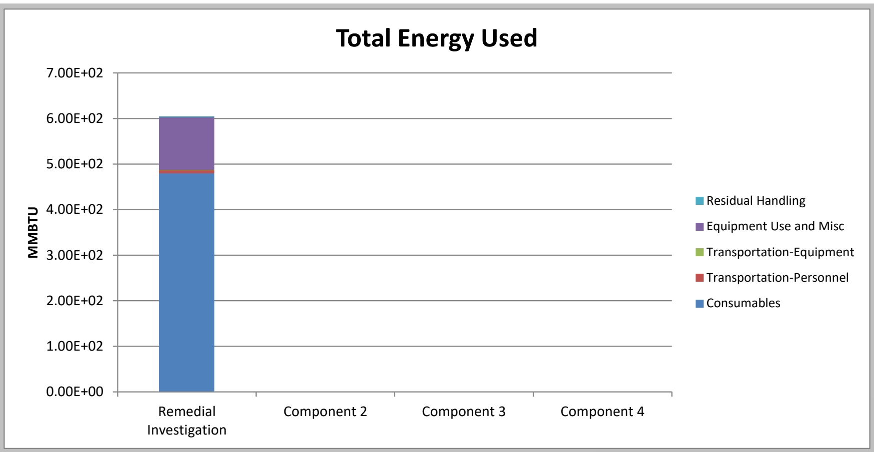
SiteWise Project Summary
Overall

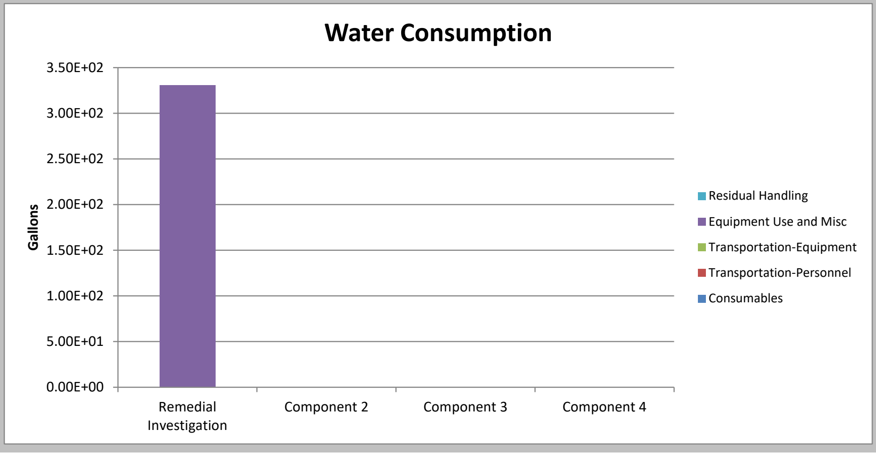
Sustainable Remediation - Environmental Footprint Summary
29 Clay Street - RIWP

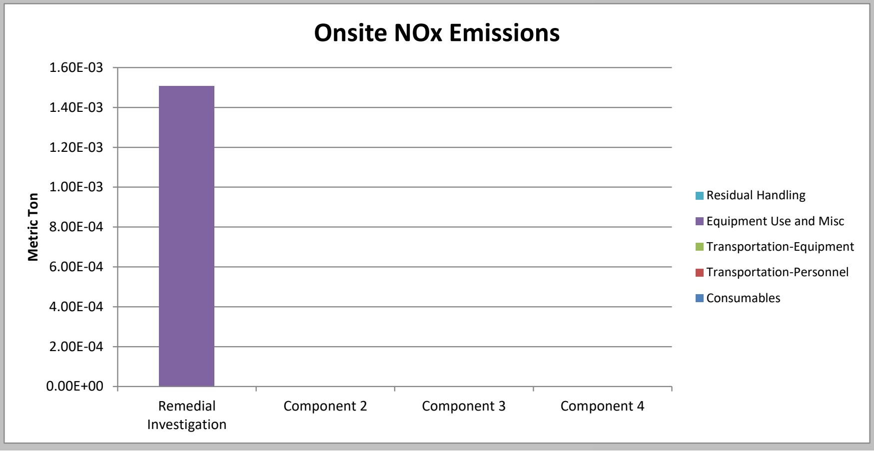
Phase	Activities	GHG Emissions	Total Energy Used	Water Consumption	Electricity Usage	Onsite NOx Emissions	Onsite SOx Emissions	Onsite PM10 Emissions	Total NOx Emissions	Total SOx Emissions	Total PM10 Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	MWH	metric ton	metric ton	metric ton	metric ton	metric ton	metric ton		
Remedial Investigation	Consumables	1.86	4.8E+02	NA	NA	NA	NA	NA	1.3E-03	1.8E-03	2.5E-04	NA	NA
	Transportation-Personnel	0.55	7.2E+00	NA	NA	NA	NA	NA	1.8E-04	3.6E-06	1.8E-05	6.9E-06	5.5E-04
	Transportation-Equipment	0.06	8.1E-01	NA	NA	NA	NA	NA	1.9E-05	3.4E-07	1.7E-06	3.3E-07	2.6E-05
	Equipment Use and Misc	8.05	1.1E+02	3.3E+02	1.2E-03	1.5E-03	1.5E-04	1.4E-04	3.9E-02	2.9E-02	3.3E-03	1.6E-06	4.0E-04
	Residual Handling	0.11	1.5E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	3.5E-05	1.4E-06	2.8E-06	6.1E-07	4.9E-05
	Sub-Total	10.63	6.04E+02	3.31E+02	1.15E-03	1.51E-03	1.54E-04	1.35E-04	4.10E-02	3.05E-02	3.58E-03	9.40E-06	1.03E-03
Component 2	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Component 3	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Component 4	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		**1.1E+01**	**6.0E+02**	**3.3E+02**	**1.2E-03**	**1.5E-03**	**1.5E-04**	**1.4E-04**	**4.1E-02**	**3.0E-02**	**3.6E-03**	**9.4E-06**	**1.0E-03**

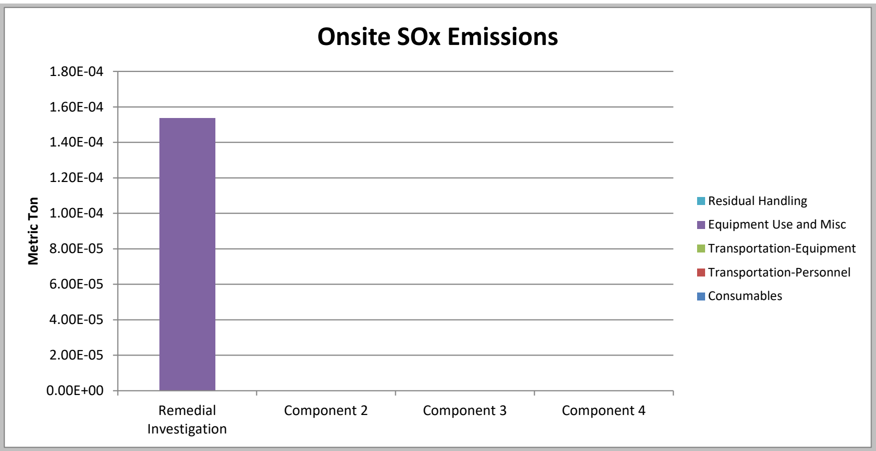
Remedial Alternative Phase	Non-Hazardous Waste Landfill Space	Hazardous Waste Landfill Space	Topsoil Consumption	Costing	Lost Hours - Injury	Percent electricity from renewable sources	Total Cost with Footprint Reduction
	tons	tons	cubic yards	$		%	
Remedial Investigation	0.0E+00	0.0E+00	0.0E+00	0	8.2E-03	24.2%	**$0**
Component 2	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Component 3	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Component 4	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Total	**0.0E+00**	**0.0E+00**	**0.0E+00**	**$0**	**8.2E-03**	**6.1%**	

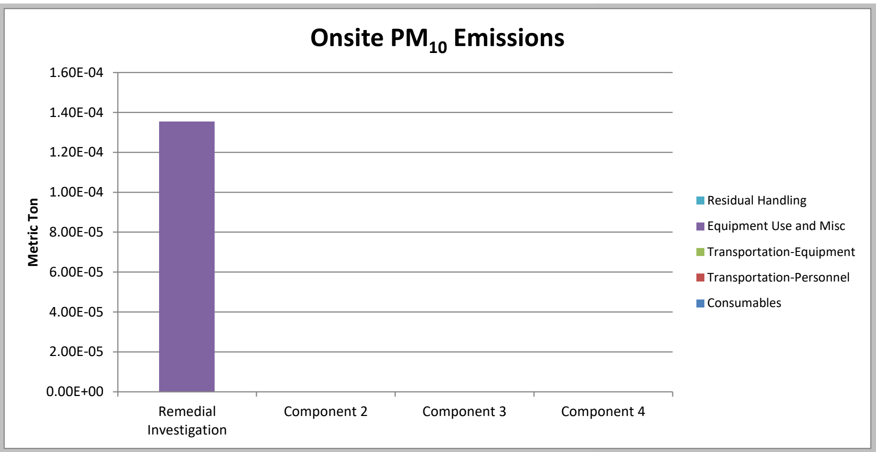

GHG Emissions
Metric Tons
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Remedial Investigation
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

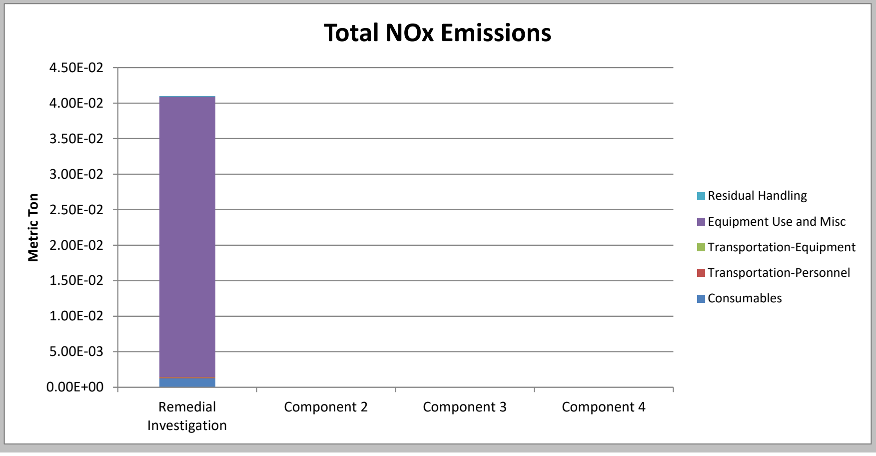

Total Energy Used
MMBTU
7.00E+02
6.00E+02
5.00E+02
4.00E+02
3.00E+02
2.00E+02
1.00E+02
0.00E+00
Remedial Investigation
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

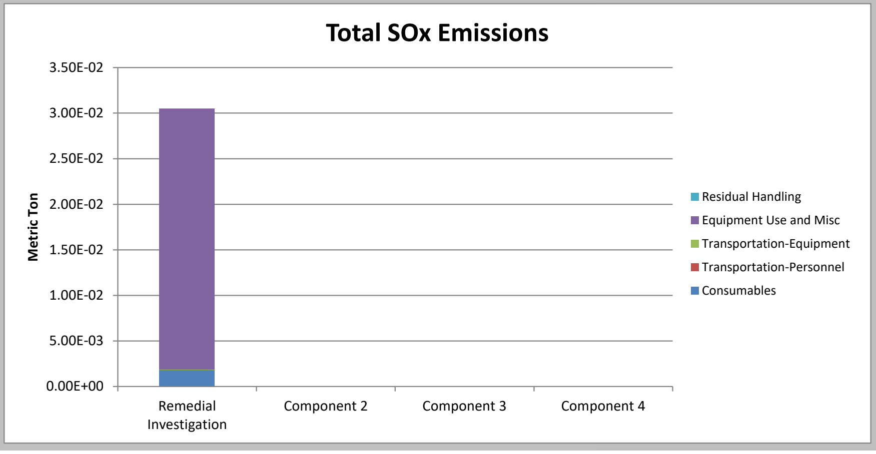

Water Consumption
Gallons
3.50E+02
3.00E+02
2.50E+02
2.00E+02
1.50E+02
1.00E+02
5.00E+01
0.00E+00
Remedial Investigation
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

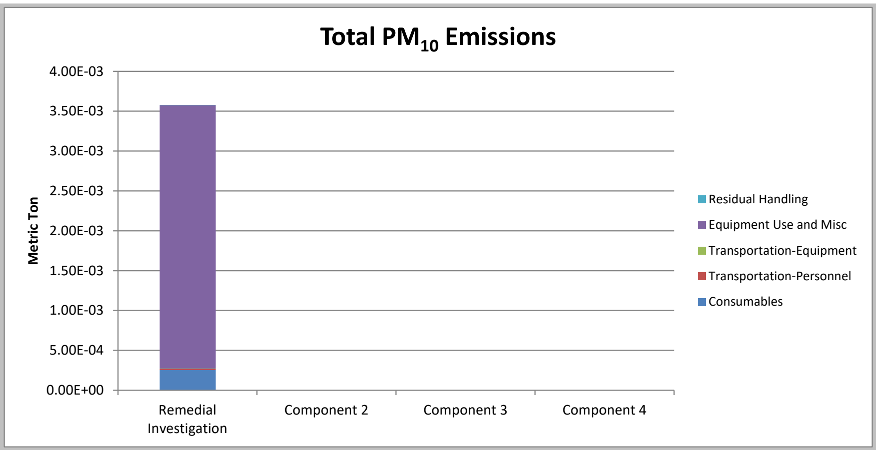

Onsite NOx Emissions
Metric Ton
1.60E-03
1.40E-03
1.20E-03
1.00E-03
8.00E-04
6.00E-04
4.00E-04
2.00E-04
0.00E+00
Remedial Investigation
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

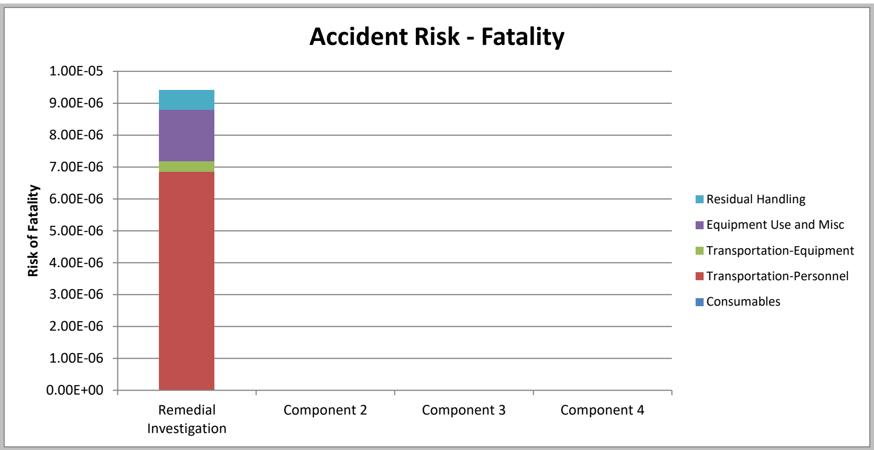

Onsite SOx Emissions
Metric Ton
1.80E-04
1.60E-04
1.40E-04
1.20E-04
1.00E-04
8.00E-05
6.00E-05
4.00E-05
2.00E-05
0.00E+00
Remedial Investigation
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

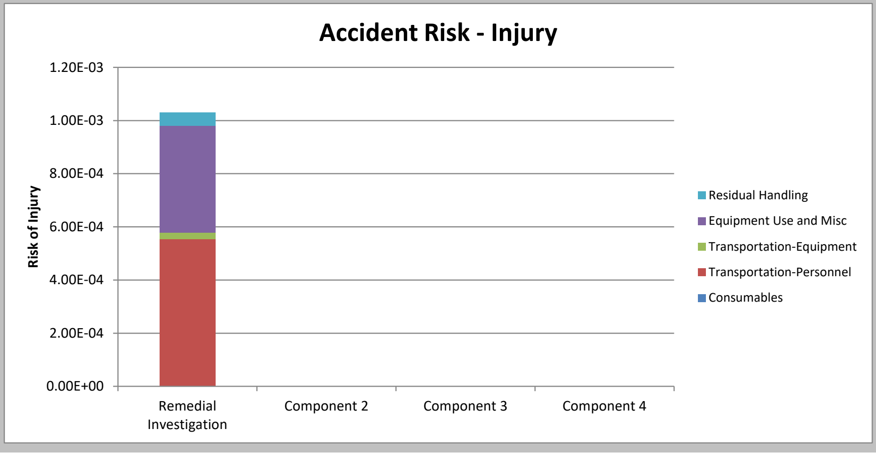

Onsite PM_{10} Emissions
Metric Ton
1.60E-04
1.40E-04
1.20E-04
1.00E-04
8.00E-05
6.00E-05
4.00E-05
2.00E-05
0.00E+00
Remedial Investigation
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

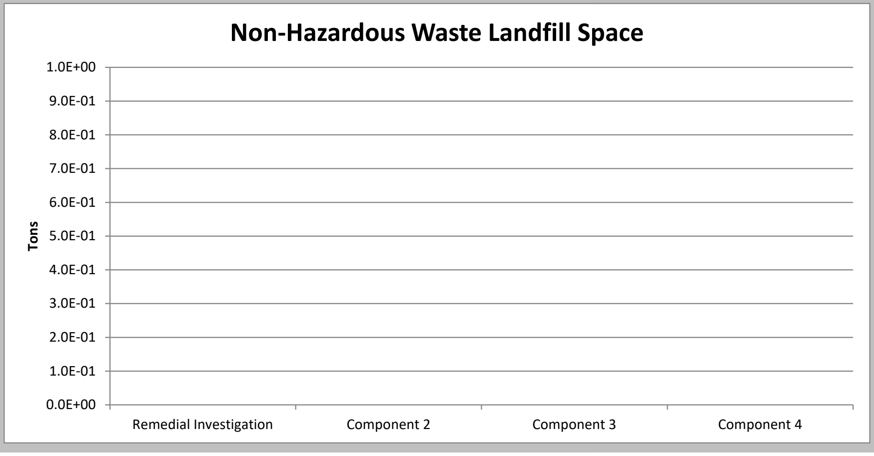

Total NOx Emissions
Metric Ton
4.50E-02
4.00E-02
3.50E-02
3.00E-02
2.50E-02
2.00E-02
1.50E-02
1.00E-02
5.00E-03
0.00E+00
Remedial Investigation
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

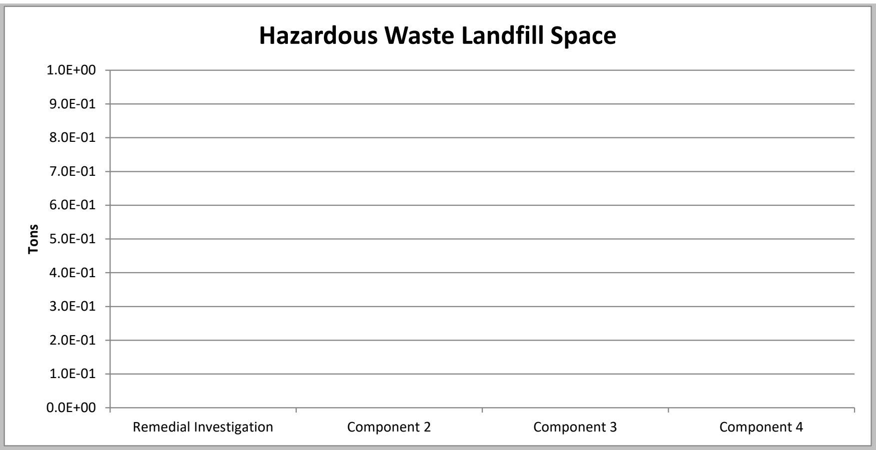

Total SOx Emissions
Metric Ton
3.50E-02
3.00E-02
2.50E-02
2.00E-02
1.50E-02
1.00E-02
5.00E-03
0.00E+00
Remedial Investigation
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

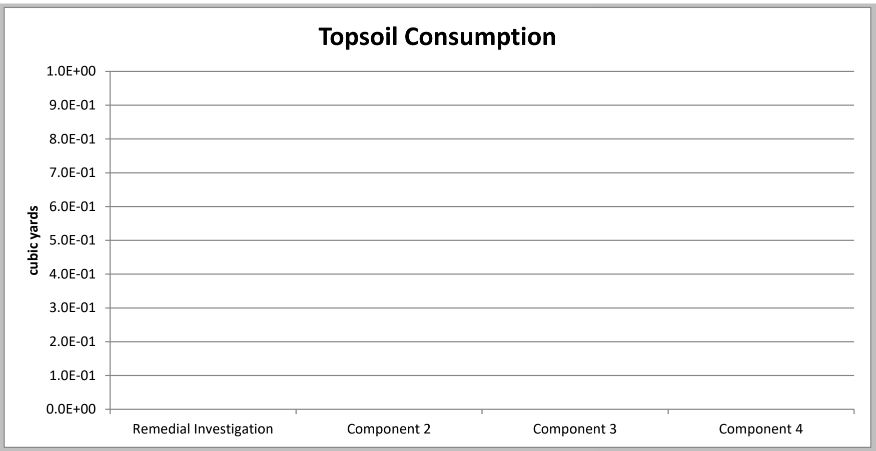

Total PM$_{10}$ Emissions
Metric Ton
4.00E-03
3.50E-03
3.00E-03
2.50E-03
2.00E-03
1.50E-03
1.00E-03
5.00E-04
0.00E+00
Remedial Investigation
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

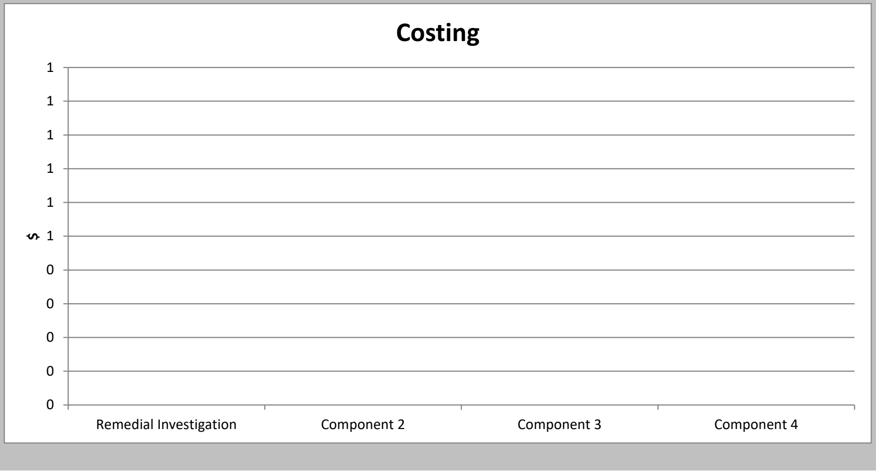

Accident Risk - Fatality
Risk of Fatality
1.00E-05
9.00E-06
8.00E-06
7.00E-06
6.00E-06
5.00E-06
4.00E-06
3.00E-06
2.00E-06
1.00E-06
0.00E+00
Remedial Investigation
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

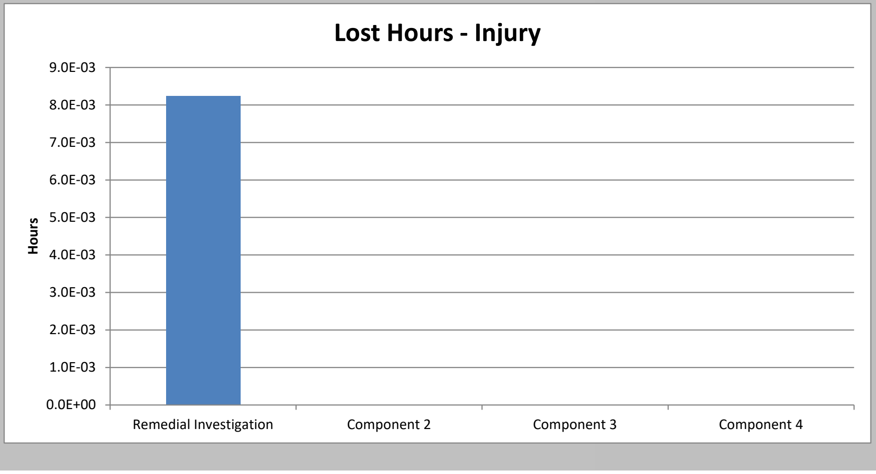

Accident Risk - Injury
Risk of Injury
1.20E-03
1.00E-03
8.00E-04
6.00E-04
4.00E-04
2.00E-04
0.00E+00
Remedial Investigation
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Non-Hazardous Waste Landfill Space
Tons
1.0E+00
9.0E-01
8.0E-01
7.0E-01
6.0E-01
5.0E-01
4.0E-01
3.0E-01
2.0E-01
1.0E-01
0.0E+00
Remedial Investigation
Component 2
Component 3
Component 4


Hazardous Waste Landfill Space


Topsoil Consumption


Costing


Lost Hours - Injury

SiteWise Project Summary
Remedial Investigation

Sustainable Remediation Summary - Remedial Investigation

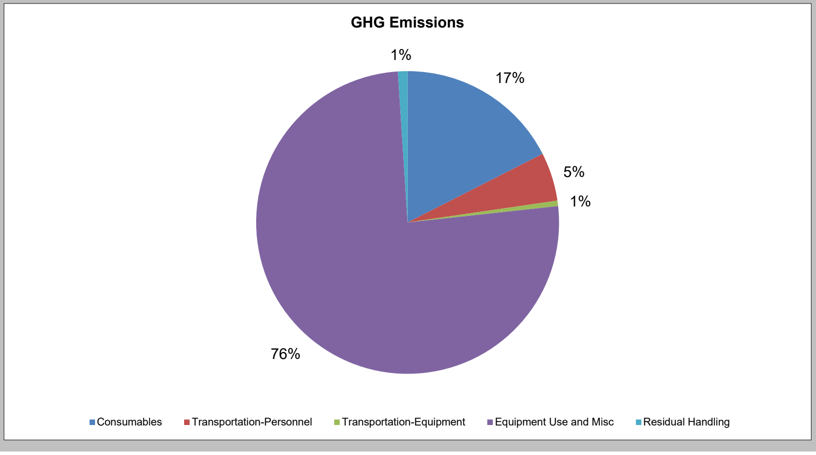
Activities	GHG Emissions metric ton	Percent Total %	Total Energy Used MMBTU	Percent Total %	Water Consumption gallons	Percent Total %	Electricity Usage MWH	Percent Total %	Onsite NOx Emissions metric ton	Percent Total %	Onsite SOx Emissions metric ton	Percent Total %	Onsite PM10 Emissions metric ton	Percent Total %	Total NOx Emissions metric ton	Percent Total %	Total SOx Emissions metric ton	Percent Total %	Total PM10 Emissions metric ton	Percent Total %	Accident Risk Fatality	Percent Total %	Accident Risk Injury	Percent Total %
Consumables	1.86	17.5	4.8E+02	79.4	NA	NA	NA	NA	NA	-	NA	-	NA	-	1.3E-03	3.1	1.8E-03	6.1	2.5E-04	7.0	NA	NA	NA	NA
Transportation-Personnel	0.55	5.2	7.2E+00	1.2	NA	NA	NA	NA	NA	-	NA	-	NA	-	1.8E-04	0.4	3.6E-06	0.0	1.8E-05	0.5	6.9E-06	73.0	5.5E-04	53.6
Transportation-Equipment	0.06	0.6	8.1E-01	0.1	NA	NA	NA	NA	NA	-	NA	-	NA	-	1.9E-05	0.0	3.4E-07	0.0	1.7E-06	0.0	3.3E-07	3.5	2.6E-05	2.6
Equipment Use and Misc	8.05	75.7	1.1E+02	19.0	3.3E+02	100.0	1.2E-03	100.0	1.5E-03	100.0	1.5E-04	100.0	1.4E-04	100.0	3.9E-02	96.4	2.9E-02	93.9	3.3E-03	92.3	1.6E-06	17.0	4.0E-04	39.1
Residual Handling	0.11	1.0	1.5E+00	0.2	NA	NA	NA	NA	0.0E+00	-	0.0E+00	-	0.0E+00	-	3.5E-05	0.1	1.4E-06	0.0	2.8E-06	0.1	6.1E-07	6.5	4.9E-05	4.8
Total	10.63	100.0	6.04E+02	100.0	3.31E+02	100.0	1.15E-03	100.0	1.51E-03	100.0	1.54E-04	100.0	1.35E-04	100.0	4.10E-02	100.0	3.05E-02	100.0	3.58E-03	100.0	9.40E-06	100.0	1.03E-03	100.0

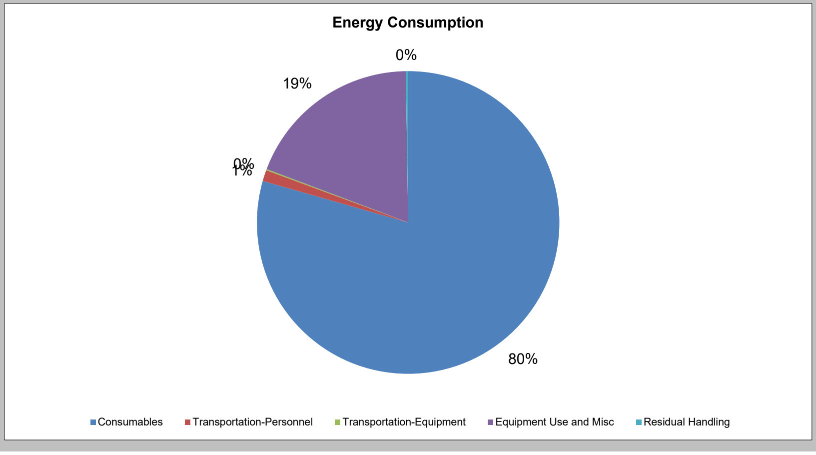
Additional Sustainability Metrics

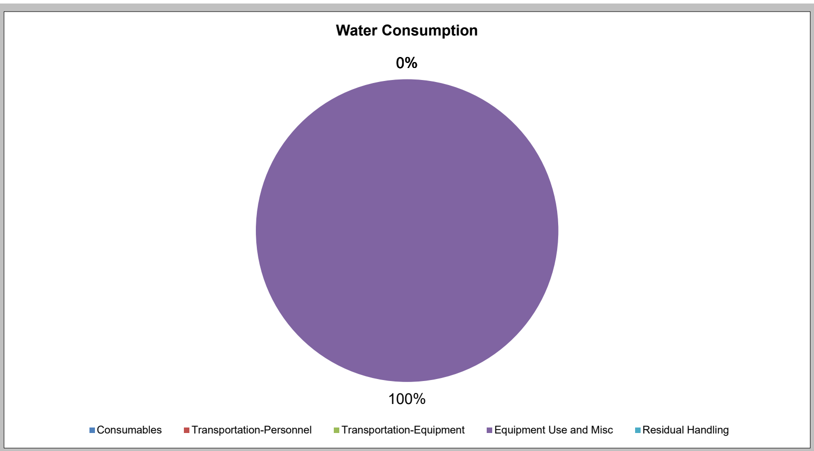
Non-Hazardous Waste Landfill Space (tons)	0.0
Hazardous Waste Landfill Space (tons)	0.0
Topsoil Consumption (yd^3)	0.0
Cost of Phase ($)	0.0
Lost Hours - Injury	0.0

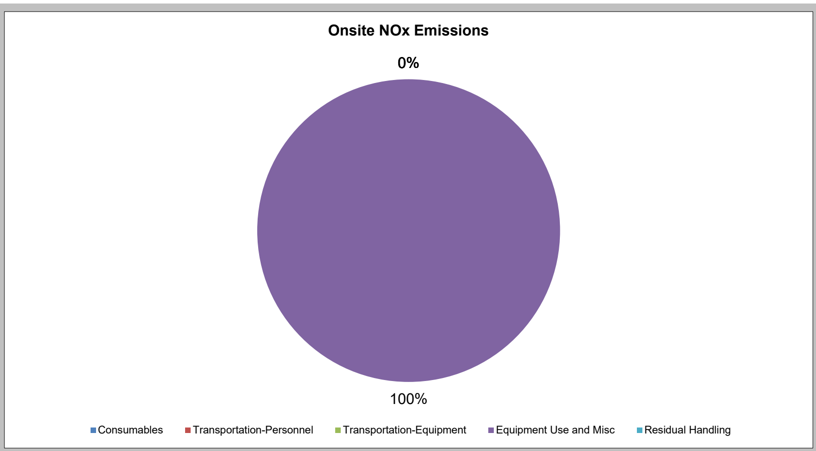
Footprint Reduction

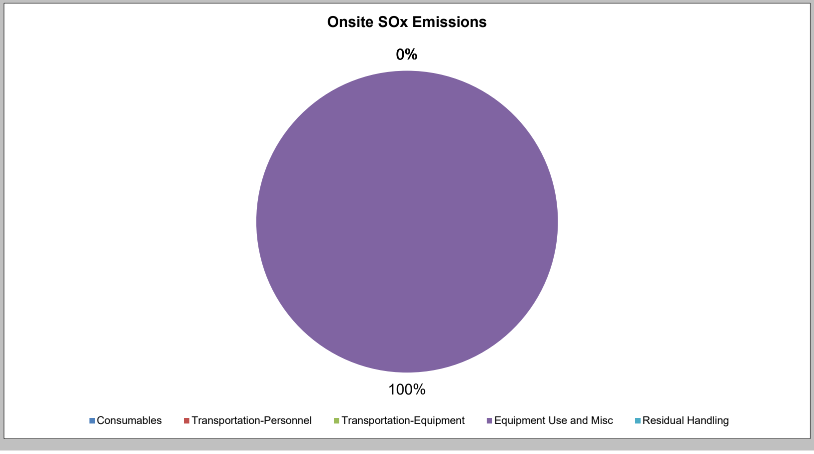
Total electricity replacement (MWh)	0.00E+00
Total electricity replacement (mmBtu)	0.00E+00
Percent electricity from renewable sources (%)	24.2%
Landfill gas reduction (metric ton CO$_2$ e)	0.00E+00
GHG emissions (metric ton CO2 e)	0.00E+00
NOx emissions (metric ton)	0.00E+00
SOx emissions (metric ton)	0.00E+00
PM10 emissions (metric ton)	0.00E+00

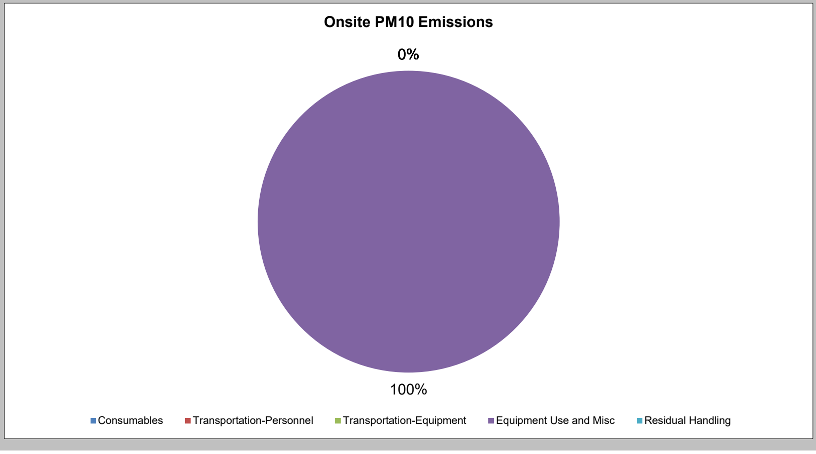


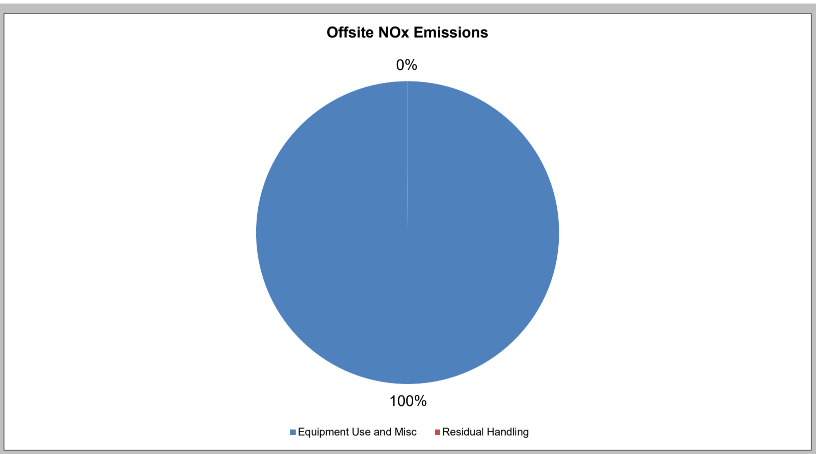


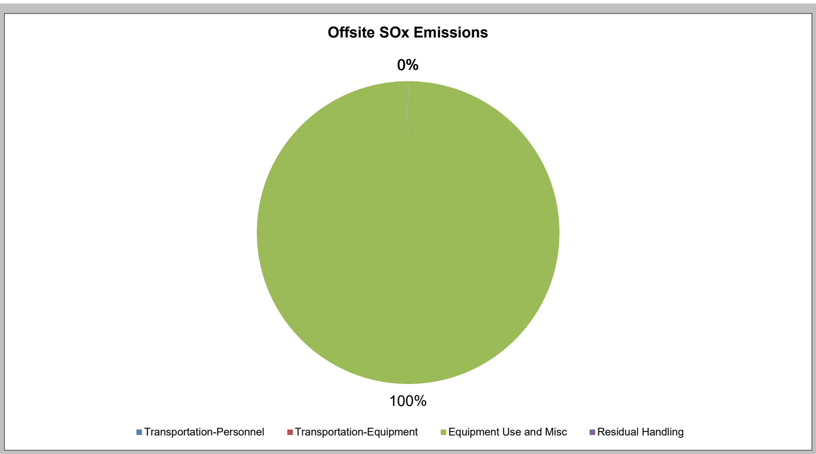

Water Consumption

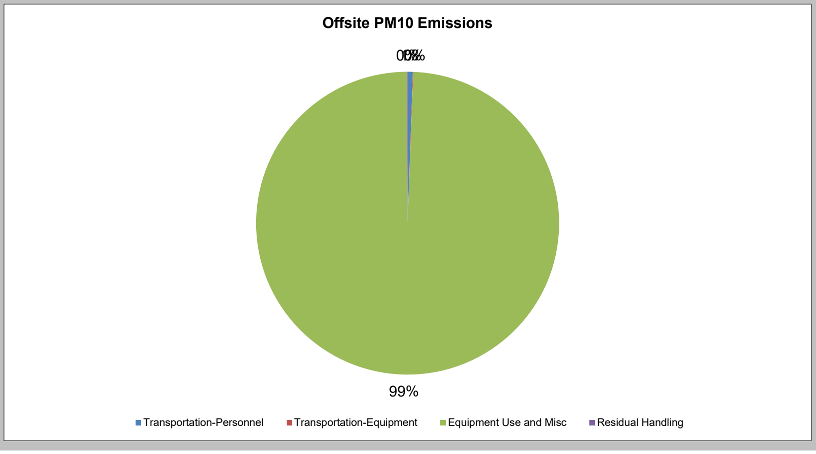

Onsite NOx Emissions

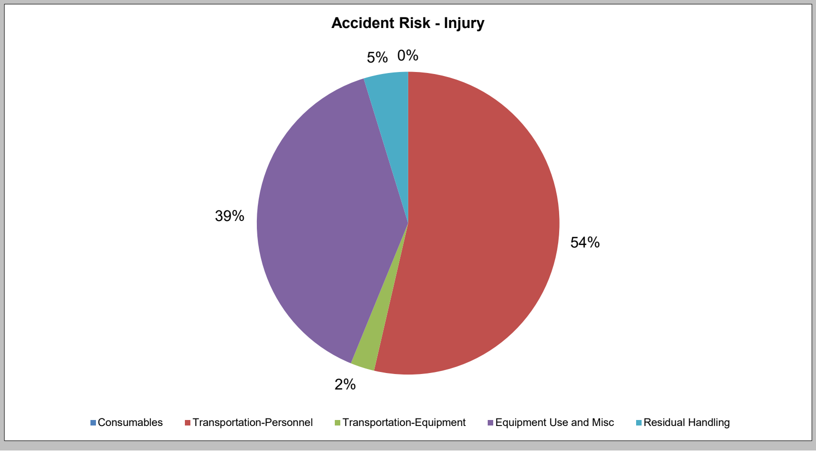

Onsite SOx Emissions

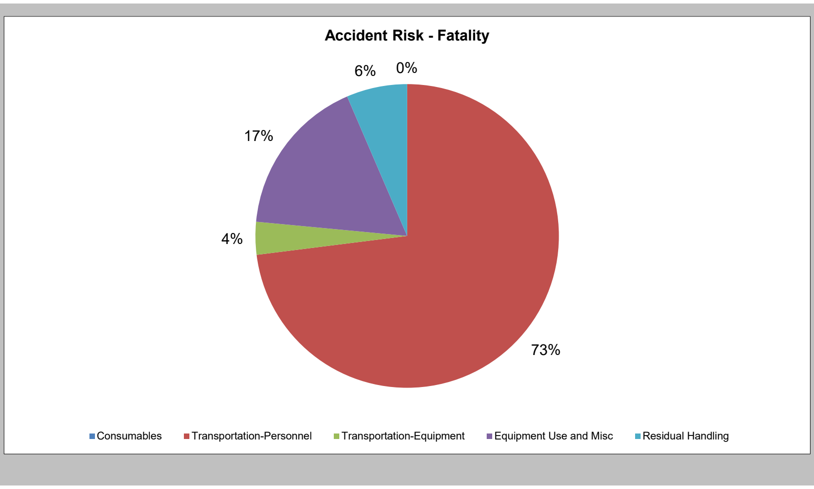

Onsite PM10 Emissions


Offsite NOx Emissions


Offsite SOx Emissions


Offsite PM10 Emissions


Accident Risk - Injury


Accident Risk - Fatality
6%
0%
17%
4%
73%
Consumables
Transportation-Personnel
Transportation-Equipment
Equipment Use and Misc
Residual Handling

GZA GeoEnvironmental, Inc.