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REMEDIAL INVESTIGATION WORK PLAN

3083 Webster Ave BCP Site
3083 Webster Avenue
Block 3331; Lot 57
Bronx, NY 10467

NYSDEC Site Number: TBD

Prepared For:
6014 BCD Realty, LLC
1144 Evergreen Avenue, Suite #1
Bronx, NY 11472

Prepared By:
HydroTech Environmental Engineering and Geology, DPC
231 West 29th Street, Suite 1104
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December 9, 2024

CERTIFICATIONS

I, Paul I. Matli, certify that I am a Qualified Environmental Professional (QEP) as defined in 6 NYCRR Part 375 and that this Remedial Investigation Work Plan was prepared for the 3083 Webster Ave BCP Site in accordance with all applicable statues and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Paul I. Matli, PhD, PG
Name

00186
NYS Professional Geologist #

Paul I. Matli
Signature

December 9, 2024
Date

LIST OF ACRONYMS

Acronym	Definition
AWQS	Ambient Water Quality Standards
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
BGS	Below Grade Surface
BN	Base Neutral
CAMP	Community Air Monitoring Plan
C&D	Construction & Demolition
CGI	Combustible Gas Indicator
CPP	Citizen Participation Plan
DCE	Dichloroethene
DB	decibels
DUSR	Data Usability Summary Report
ESA	Environmental Site Assessment
ELAP	Environmental Laboratory Accreditation Program
FID	Flame Ionization Detector
EZ	Exclusion Zone
HASP	Health and Safety Plan
MDL	Method Detection Limit

NYC DEP	New York City Department of Environmental Protection
NYS DEC	New York State Department of Environmental Conservation
NYS DOH	New York State Department of Health
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PID	Photo Ionization Detector
PFOA	Perfluorooctanoic acid
PM	Particulate Matter
PPE	personal protective equipment (PPE
QAO	Qualified Assurance Officer
QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
QHHEA	Qualitative Human Health Exposure Assessment
QEP	Qualified Environmental Professional
REC	Recognized Environmental Condition
QA/QC	Quality Assurance/Quality Control
RIR	Remedial Investigation Report
RIWP	Remedial Investigation Work Plan
SCOs	Soil Cleanup Objectives
SCG	Standards, Criteria and Guidance

SCBA	Self-Contained Breathing Apparatus
SSO	Site Safety Officer
TAL	Full Target Analyte List
TCL	Full Target Compound List
TICs	Tentatively Identified Compounds
TOGS	Technical and Operational Guidance Series
SVOCs	Semi-Volatile Organic Compounds
USCS	Unified Soil Classification System
USGS	United States Geological Survey
VOCs	Volatile Organic Compounds

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1.0 EXECUTIVE SUMMARY

This Remedial Investigation Work Plan (RIWP) has been prepared on behalf of 6014 BCD Realty, LLC (the "BCP Applicant") to document the details and protocols for the proposed environmental investigation of a property identified as 3083 Webster Ave BCP Site and located at 3083 Webster Avenue, Bronx, New York (the "Site"). The purpose of this RIWP is to further investigate the environmental quality of on-site soil and groundwater at this Site. All investigation work will be performed in accordance with the New York State Department of Environmental Conservation (NYSDEC) requirements, NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (May 2010) and NYSDEC Guidelines for Sampling, Analysis, And Assessment of Per- And Polyfluoroalkyl -Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs (April 2023) and other acceptable industry standards.

The investigation will be performed following the demolition activities of existing structures, which are anticipated after Site enrollment in the BCP. This investigation will consist of the installation and sampling of on-site monitoring wells with the sampling of soil probes at the target locations of the wells, where the soil and groundwater interface were previously encountered at this Site. All portions of the fieldwork will be conducted in accordance with a site-specific Health & Safety Plan and a Community Air Monitoring Plan.

The following sections provide the details and specific information pertaining to the various components of the RIWP.

2.0 INTRODUCTION

Hydro Tech Environmental Engineering and Geology, DPC ("HydroTech") has been retained by 6014 BCD Realty, LLC (the "BCP Applicant") to prepare this Remedial Investigation Work Plan (RIWP) for the property identified as 3083 Webster Ave BCP Site and located at 3083 Webster Avenue, Bronx, New York (the "Site"). Specifically, this RIWP provides the protocols and specifications for the proposed subsurface investigation to fully characterize the nature and extent of contamination in soil and groundwater beneath the Site. Additionally, the investigation will generate sufficient data to evaluate the remedial action alternatives for this Site in compliance with the NYSDEC Brownfield Cleanup Program requirements.

2.1 Site Description

The Site is located at 3083 Webster Avenue in a residential and commercial area in the Norwood section in Bronx, New York and is identified as Block 3331 and Lot 57 on the New York City Tax Map. The Site is 15,000-square feet and currently consists of two one-story vacant buildings in the northwestern and central portions. A gasoline dispenser canopy is in the southern portion of the Site and is surrounded by asphalt paved surfaces with some areas consisting of gravel as a result of backfilling activities related to former underground petroleum tanks closure in August 2021. Previously, the Site was used as a gasoline service station with two auto repair shops and an adjoining convenience store. **Figure 1** provides a Site location map.

The Site is bordered by multiple 2 to 5 stories residential buildings to the north, west and south The Site is bordered by multiple 2 to 5 stories residential buildings to the north, west and south and to the east by Webster Avenue where a 1-story autobody repair facility and an 11-story residential building and two day-care facilities are located. Surrounding properties within one half mile radius of the Site consist of residential, commercial, and vacant lands.

A Receptor Survey was performed within a 500-foot radius of the Site. Two sensitive receptors identified as daycare facilities were identified within this search. Both facilities are located in the 11-story building across the southeastern vicinity of the Site. One daycare facility is identified as Litte Stars Childcare Program and is facing the Site from the southeast. The other facility is identified as Baby Blossoms Daycare and is located on the southern side of East 202nd Street to the east. Other potential sensitive receptors include residential facilities situated in the immediate northern, western and southern vicinities of the Site.

2.2 Site History

The following environmental assessments and investigations were previously performed at the Site and were provided as part of the BCP Application:

- Tank Closure Report prepared by Tyree Brother's Environmental Services, Inc. (Tyree) dated May 30, 1998.
- NYSDEC correspondence dated August 12, 1998.
- Subsurface Investigation Report prepared by Tyree and dated November 1, 2009.
- Tank Closure and Remediation Excavation Report prepared by LaBella Associates, D.P.C. (Labella) and dated October 11, 2021
- Request for Spill Closure Letter issued by AG Geology D.P.C (AG) on November 12, 2021.

- Phase II Sub-Surface Investigation Report prepared by Advantage Environmental Consultants LLC (AEC) and dated January 7, 2022.
- Phase I ESA Report prepared by CA RICH Geology Services, D.P.C. (CA RICH) and dated December 27, 2023.
- Draft Remedial Investigation Report prepared by HydroTech Environmental Engineering and Geology, DPC (AEC) and dated August 29, 2024.

<u>1998 Tank Closure Report prepared by Tyree</u>

A total of nine underground storage tanks (USTs) tanks registered under Petroleum Bulk Storage (PBS) registration number 2-325953 were closed and removed by Tyree during January and February 1998. These included six 550-gallon gasoline USTs and one 4,000-gallon gasoline UST located in a gasoline tank field in the eastern portion of the Site, one 550-gallon waste oil UST located in the northeastern portion, and one 550-gallon fuel oil UST located in the northwestern portion.

NYSDEC Spill number 9711128 was issued upon encountering contaminated soil in the vicinity of excavated tanks with elevated organic vapor concentrations detected with a Photo Ionization Detector (PID) exceeding 2,500 parts per million (mg/kg). A total of 9 confirmatory endpoint soil samples were collected in the tank field following tanks excavation including 6 sidewall samples obtained at 5 feet bgs, 1 bottom sample obtained beneath the 4,000-gallon gasoline UST at 8 feet bgs and two bottom sample obtained beneath the 550-gallon gasoline USTs at 7 feet bgs. In addition, one composite bottom endpoint sample was collected beneath the removed waste oil UST. No endpoint samples were collected in the vicinity of closed and removed fuel oil UST.

The gasoline tank field endpoint samples were analyzed for VOCs via EPA Method 8021 and MTBE and the waste oil UST composite endpoint sample was also analyzed for VOCs via EPA Method 8021 and MTBE and also RCRA metals. Findings of these endpoint soil samples indicated BTEX at a maximum concentration of 1,309 mg/kg and MTBE at a maximum concentration of 170 mg/kg exceeding soil cleanup standards. A total of 550.07 tons of contaminated soil was excavated around the gasoline tank field to 8 feet deep. No endpoint samples were apparently collected following contaminated soil excavation activities. NYSDEC then requested in a correspondence dated August 12, 1998, to perform a subsurface investigation to delineate the extent of residual gasoline contamination on-site and off-site.

2009 Subsurface Investigation Report by Tyree

This Subsurface Investigation Report (SIR) was prepared to address the NYSDEC Spill number 9711128 and to confirm whether the soil and groundwater impacts around the former gasoline tank field, the fuel oil and waste oil USTs have been reduced to levels below NYSDEC standards and that no further contamination exists. This investigation reported the previous installation of five monitoring wells designated MW-1 to MW-5 during 1998. Four of these wells were located at the four corners of the Site and one well was located in the center. Groundwater flow direction beneath the Site was determined toward the south and elevated concentrations of BTEX of 12,660 µg/L and MTBE of 8,040 µg/L were detected in a downgradient monitoring well designated MW-4 located at the southern corner of the Site.

Enhanced Fluid Recovery (EFR) events were performed on MW-4 in 2000 and 2001 to reduce impacts to groundwater. This monitoring well was in fact considered as an off-Site sentinel. A total of four quarterly sampling events were then documented by Tyree from May 2002 until November 2009 and their findings were also summarized in this 2009 SIR.

The 2009 SIR consisted of installing and sampling six soil probes and the sampling of groundwater samples from two soil probes converted into temporary monitoring wells, where no refusal but soil and groundwater interface was encountered. The soil and groundwater samples were analyzed for VOCs via EPA STARS Method 8260. Soil samples were also analyzed for SVOCs via EPA STARS Method 8270. Findings of this investigation indicated no organic vapors were detected with the PID in any soil probe. No petroleum impacts were identified in the soil or groundwater above NYSDEC standards in the vicinity of the former gasoline tank field, fuel oil and waste UST areas or near the product dispensers. In this investigation, Tyree also highlighted the findings of the fourth and last quarterly groundwater sampling in November 2009, which indicated that petroleum impacted soil and groundwater have naturally attenuated. Tyree requested the closure of NYSDEC spill case based on indications that deep soil in the vicinity of the tank fields showed no impact and groundwater standards were met across the Site. NYSDEC Spill number 9711128 was closed on June 5, 2012.

2021 Tank Closure and Remediation Excavation Report by LaBella

Labella documented in this report the closure and removal of two 4,000-gallon USTs and their associated piping and dispenser island at the Site. A total of eight USTs post excavation soil samples including four shallow sidewall samples designated as EP-1 to EP-4 were collected between 5-7 feet bgs and four deep sidewall samples designated as LB-1 to LB-4 were collected toward the base of the tank pad at 11-12 feet bgs base. Two dispenser endpoint samples designated Disp-1 and Dip-2 and one product line endpoint sample designated Product Line 1 were collected between 2-4 feet bgs. Only the endpoint sample below the Product Line indicated gasoline impact with elevated PID reading of 100 mg/kg and a NYSDEC Spill number 2105015 was reported in August 2021.

All post-excavation endpoint soil samples were analyzed for VOCs via EPA Method and SVOCs via EPA Method. A total of 36 tons of impacted soil was then excavated and removed under the product line to the depth of 2 feet in an area 15 feet long and 20 feet wide and were properly disposed of. Following the excavation of contaminated soil, three additional endpoint samples designated as PE-5, PE-6 and PE-7 were collected between 3-5 feet bgs. All three post soil excavation samples indicated no residual impact was detected.

Per NYSDEC requirements, Labella excavated a pit to the depth of 20 feet toward the product feeding pipes and collected a grab soil sample designated as TP-1 at 18 feet bgs and a groundwater sample designated as GW-1 at 20 feet bgs. The groundwater sample was also analyzed for VOCs and SVOCs. A range of gasoline compounds were detected in GW-1 at concentrations exceeding the NYSDEC ambient water quality standards (GQS). Gasoline contamination was also identified in TP-1. However, Labella indicated no soil impact was observed in the excavated pit until a depth of approximately 17 feet bgs, at which depth petroleum contaminated soil with staining was encountered and organic vapor concentrations of 1,200 mg/kg were detected with a PID.

A petition to close Spill #2105015 was then filed with NYSDEC by AG Geology D.P.C (AG) in November 2021. In this petition, AG indicated the contaminants exceedances in soil and groundwater samples collected by Labella from a deep test pit in 2021 are likely to be associated with a historical residual impact from the NYSDEC spill number 9711128. NYSDEC closed Spill #2105015 on February 16, 2022, with no reported remedial action addressing the identified deep soil and groundwater impacts.

<u>2022 Phase II Sub-Surface Investigation by AEC</u>

This investigation was conducted for the purpose of further investigating residual soil impacts associated with historic filling station and auto repair activities at the Site. A total of six soil probes designated as B-1 to B-6 were installed across the Site and six soil samples were collected at the depth of refusal encountered between 9 feet and 20 feet bgs. The six soil samples were analyzed for VOCs and SVOCs. This investigation identified no petroleum impact beneath the Site.

<u>2023 Phase I ESA prepared by CA RICH</u>

CA RICH identified as RECs the historic use of the Site for auto repair and gasoline station and the listing of an active PBS registration number 2-325953 with two 240-gallon aboveground storage tanks (ASTs) containing fuel oil and waste soil that are listed as being in service. The two ASTs were observed by CA RICH along two inactive underground hydraulic lifts inside the vacant auto repair shop with an adjoining convenience store in the central portion of the Site. CA RICH also listed several NYSDEC spill numbers associated with the Site, and that were all closed to the satisfaction of NYSDEC. These spill were issued for tank test failure in 2002 (Spill number 9106593), for minor petroleum and antifreeze spills on concrete in 2004, 2005, 2006, 2007 and 2023 (Spill numbers 0402479, 0505304, 0513516, 0514557, 0613953, 0604640, 0703246, 0612394, 0612429, 0602646, 0905693,) for tanks overfill in 2005 (Spill number 0504396) and for encountering contaminated soil during tanks closure and removal activities in 1998 (Spill number 9711128) and in 2021 (Spill number 2105015).

2024 Remedial Investigation by HydroTech

This investigation was performed in accordance with NYCOER-approved RI work plan addressing the E-249 designation for hazardous material assigned to this Site. This investigation addressed the following areas of concern:

- The historic use of the Site for auto repair and as a filling station
- The presence of a conditionally closed with elevated levels of petroleum VOCs in soil and groundwater in exceedance of regulatory standards.

The scope of this investigation as published in a draft RIR consisted of the following:

- Performance of a geophysical survey to identify any USTs' anomalies;
- Installation of eight soil probes to depths that corresponded to the proposed excavation for the layout of proposed building foundations including six soil probes designated as SP-2 to SP-7 installed to the depth of 12 feet bgs and one soil probe designated SP-8 installed to the depth of 18 feet bgs. Two soil probes designated as SP-1 and SP-6 were installed outside the proposed building footprint to the depth of 4 feet bgs. Sixteen soil samples were collected including eight shallow samples from 0-2 feet bgs, one sample from each 2-4 feet bgs and 16-18 feet bgs and five samples from 10-12 feet bgs. All samples were analyzed for VOCs,

SVOCs, pesticides, PCBs and metals (including hexavalent and trivalent chromium) and four soil samples were obtained from SP-4 and SP-8 at 0-2 feet bgs and 10-12 feet bgs were analyzed for per- and polyfluoroalkyl substances (PFAS).

- Installation of four temporary groundwater monitoring wells to the depth of Geoprobe refusal. All four monitoring wells were determined to be dry, and no groundwater samples were collected.
- Installation of five (5) soil vapor points designated as SV-1 to SV-5 within the footprint of the proposed development. Two of these soil vapor probes SV-2 and SV-4 were nested and were identified as SV-2A, SB-2B and SV-4A, SV-4B. A total of seven soil vapor samples were collected including five samples obtained from SV-1, SV-2A, SV-3, SV-4A and SV-5 at 12 feet bgs and two samples were collected from SV-2B and SV-4B at 6 feet bgs.

Overall finding of the previous environmental investigation performed at the Site indicate the following:

1. No anomalies indicative of a suspect UST were identified during the geophysical survey.
2. The depth to water beneath the Site was reported between 16.42 feet bgs and 25.57 feet bgs and the Site groundwater flow direction was documented to be toward the south.
3. Geoprobe refusal was encountered between 5 feet and 27 feet bgs
4. Fill was encountered to the depth of 2 feet bgs in the northern portion of the Site and to depth of 12 feet bgs in the area of former USTs excavation and contaminated soil removal and in the southeastern portion.

5. Gasoline VOCs associated with closed NYSDEC spill number 9711128 were detected in deep soil at 18 feet bgs including trimethylbenzene and total xylenes at concentrations exceeding UUSCOS and PGWSOCs. Gasoline VOCs mainly 1,2,4-trimethylbenzene, total xylenes and 1,3,5-trimethylbenzene were also detected in the underlying groundwater at 20 feet bgs at concentrations exceeding their GQS.
6. Petroleum-related impacts also included PAHs detected in one shallow soil sample (0-2 feet bgs) at concentrations exceeding UUSCOs, RRSCOs and PGWSCOs.
7. Metals including barium, chromium trivalent, copper, lead, zinc were detected in several shallow and deep soil samples across the Site (0-18 feet bgs) at concentrations exceeding UUSCOS with one detection of chromium trivalent in shallow soil (2-4 feet bgs) also exceeded RRSCO.
8. VOCs are present in soil vapor samples such as BTEX detected at low to moderate concentrations and chlorinated VOCs mainly tetrachloroethylene, detected at low to high concentrations.

Historical soil samples analytical results are provided in **Table 1** to **Table 5**. **Figure 2** provides the map of VOCs, SVOCs and metals in soil. Historical groundwater samples analytical results are provided in **Table 6** and **Table 7**. **Figure 3** provides the map of VOCs, SVOCs and metals in groundwater samples. Historical soil vapor samples analytical results are provided in **Table 8**. **Figure 4** provides the map of VOCs in soil vapor.

2.3 Environmental Setting

The Site is located in the northern portion of Borough of Bronx, New York. The elevation of the Site is approximately 86 feet above mean sea level (USGS 7.5-Minute Central Park, New York Quadrangle, 2019).

The vicinity of the Site is characterized by metamorphosed sequence of bedrock known as the Manhattan Prong of the Hartland Formation. The Hartland Formation was formed during the late Cambrian to early Ordovician period and consists of undivided pelitic schist with gneiss and amphibolite. The formation is frequently crosscut by transverse and parallel faults. The area is overlain by Pleistocene aged glacial till deposits. Bedrock outcrops are present in the adjacent property to the east, across Third Avenue.

According to a site survey prepared by Statewide Land Surveying P.C. dated May 24, 2024, Site elevation varies across the site, and it declines on average 4 feet from the north to south (el. 90.47 feet and 88.78 feet to 85.79 and 85.39 NAVD88) and it also declines on average 1.69 feet from west to east (el. 90.47 ft and 88.78 ft to 85.79 and 85.39 NAVD88).

The depth to groundwater reported by Tyree during 1998 until 2010 ranges between 16.42 feet bgs and 25.57 feet bgs and the Site groundwater flow direction was documented to be toward the south. This groundwater depth and flow direction are consistent with the Site topography and the Geoprobe refusal encountered beneath the property.

2.4 Objective & Project Goals

The objective of the RIWP is to set forth the details and protocols for the additional investigation of soil and groundwater environmental quality beneath the Site so that a remedy can be evaluated and selected for the Site in accordance with 6 NYCRR Part 375-1.8(f).

The fieldwork will be performed in accordance with accordance with the NYSDEC requirements and in compliance NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (May 2010) and NYSDEC Guidelines for Sampling, Analysis, And Assessment of Per- And Polyfluoroalkyl -Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs (April 2023) and other acceptable industry standards.

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3.0 INVESTIGATION SPECIFICATIONS

3.1 Introduction

The purpose of this section is to document the details and protocols intended to address the data gaps for the further assessment of contaminants in on-site soil and groundwater. To accomplish this, HydroTech will install and sample monitoring wells with soil sampling utilizing Hollow Stem Auger by Geoprobe at target locations within the Site, where soil and groundwater interface was historically encountered. Select soil and groundwater samples will be analyzed via approved analytical methods, and all laboratory results will be evaluated and documented along with all relevant historical data in a Remedial Investigation Report. All these activities will be implemented consistent with a NYSDEC BCP Citizen Participation Plan (CPP) and in accordance with a site-specific Health and Safety Plan (HASP) and a Community Air Monitoring Plan (CAMP). CAMP data will be reported to the NYSDEC and NYSDOH via daily reports describing any CAMP exceedances and actions taken to correct the issue. Contaminated soil and water generated during an investigation will be containerized in DOT-approved 55-gallon drums and will be subject to waste characterization sampling consistent with disposal facilities requirements. **Appendix A** provides a Site-specific HASP. **Appendix B** provides a Site-specific CAMP.

The fieldwork for this investigation will be performed following the demolition activities of existing structures, which are anticipated after Site enrollment in the BCP. Prior to the performance of the fieldwork, a public utility mark-out will be requested from the New York City-Long Island One-Call Center. All work will also be coordinated with representatives of the NYSDEC.

3.2 Soil Probes

Prior to monitoring wells installation, six (6) soil probes designated as SP-9 to SP-14 will be installed during this investigation. The soil probes will be installed at the target locations of proposed six monitoring wells in the vicinity of historically installed monitoring wells and groundwater probes, where soil and groundwater interface was reported to be successfully encountered during previous investigations. **Figure 5** provides the proposed locations of the soil probes. These soil probes will surpass the depth to groundwater and terminate at the depth refusal.

Specifically, SP-9 will be installed at the western corner of the Site in the vicinity of historical monitoring well MW-1, SP-10 at the northern corner in the vicinity of MW-2, SP-11 at the eastern corner in the vicinity of MW-3, SP-12 at the southern corner in the vicinity of MW-4, and SP-13 in the central portion of the Site in the vicinity of MW-5 and SP-14 in the southeastern portion in the vicinity of historical groundwater probe GW-1. Each soil probe will be advanced in at least three different locations within the target area shown on the proposed sampling map in **Figure 5** to determine the correct placement of the monitoring well, where soil and groundwater interface is intercepted by evaluating the soil texture and assessing soil saturation thickness relative to depth of refusal.

The soil probes will be installed utilizing a Geoprobe 7822DT, which operates via direct-push technology and can be fitted with Geoprobe® tooling and sampling equipment. If necessary, two probes will be installed in each proposed location to ensure that there will be adequate soil recovered from each sampling interval.

Soil sampling will comply with NYSDEC DER-10 3.5.2. Soil samples will be collected in all probes at 2-foot intervals utilizing a 4-foot or 5-foot-long Macro Core sampler fitted with dedicated acetate liners. The Macro sampler allows for the collection of discrete soil samples. Each sampler will be installed with 2½-inch diameter drill rods. The soil retrieved in the acetate liners will be characterized in the field at 2-foot intervals by a HydroTech geologist. This characterization will consist of soil classification and screening for evidence of organic vapors utilizing a Photoionization Detector (PID) with an 11.7eV bulb. This is accomplished by running the PID across the soil samples. The soil classification will be based upon the Unified Soil Classification System (USCS). In addition, any visual or olfactory evidence of hydrocarbons will be identified. Soil classification and PID readings will be recorded in the daily field reports. Soil probe logs will be generated based upon the soil characterization, along with the PID field screening. **Appendix C** provides a sample boring log.

The soil probes will terminate at the depth refusal and will surpass the historically reported depth to groundwater in MW-1 at 23.54-to-24.82 feet bgs, in MW-2 at 15.02-to-21.91 feet bgs, in MW-3 at 10.62-to-16.49 feet bgs, in MW-4 at 22.73-to-25.03 feet bgs, in MW-5 at 20.56-to-25.01 feet bgs and in GW-1 at 20 feet bgs.

Soil samples from each of soil probe, which is installed at the correct location of a monitoring well, will be collected at the following depths:

- One sample will be collected from above the soil and groundwater interface biased toward the highest contamination consistent with the highest organic vapor concentrations detected with the PID;

- One sample will be collected at the soil and groundwater interface;
- One sample will be collected from the most impacted depth in the saturated zone consistent with the highest organic vapor concentrations detected with the PID; and

A duplicate sample from a randomly selected soil sample will also be collected. All collected soil samples will be containerized in laboratory supplied soil jars and appropriately labeled.

Table 9 - Summary of Proposed Soil Sampling Locations and Analyses

Soil Probe (SP)	Location	Soil Characterization Depth	Analytical Methods
SP-9	Western Coner	* Sample that contains staining, odor and/or highest PID reading above the groundwater interface * Sample at the groundwater interface * Sample that	* TCL VOCs via EPA Method 8260 * TCL SVOCs via EPA Method 8270 * Pesticides via EPA Method 8081 * Herbicides via EPA Method 8151 * Polychlorinated biphenyls via EPA Method 8082
SP-10	Northern Coner		
SP-11	Eastern Coner		
SP-12	Southern Coner		
SP-13	Central Portion		

SP-14	Southeastern Portion	contains staining, odor and/or highest PID reading below the groundwater interface	* TAL Metals via EPA Method 6010 & EPA Method 7471 for Mercury * Emerging Contaminants: *1,4-Dioxane via Method 8270 SIM *21 target Perfluorooctanoic acid (PFOA) via EPA Method 1633

3.3 Groundwater Monitoring Wells

Upon confirming the soil and groundwater interface at the location of installed six soil probes SP-9 to SP-14, a total of six (6) monitoring wells will then be installed during this investigation utilizing a 4-inch diameter Hollow Stem Auger by Geoprobe. These monitoring wells are intended to further characterize the groundwater quality across the entire Site and specifically in the vicinity of former UST fields in the southeastern portion of the Site.

The monitoring wells will be designated as MW-1a to MW-5a and MW-6 and will be installed in the vicinity of historically installed monitoring wells MW-1 to MW-4 and groundwater probe GW-1 as shown on **Figure 5** - Proposed Sampling Plan. Specially MW-1a will be installed at SP-9 at the western corner of the Site (vicinity of MW-1), MW-2a will be installed at SP-10 at the northern corner Site (vicinity of MW-2), MW-3a will be installed at SP-11 will be installed at the eastern corner Site (vicinity of MW-3), MW-4a will be installed at SP-12 at the southern corner Site (vicinity of MW-4), MW-5a will be installed at SP-13 in the central portion Site (vicinity of MW-5), and MW-6 will be installed at SP-13 in the southeastern portion Site (vicinity of GW-1).

The monitoring wells will be installed utilizing Hollow Stem Auger by Geoprobe. All monitoring wells will be constructed of 2-inch diameter PVC with 2-inch annular space surrounding the monitoring well. Filter media (No. 0 or 00 silica sand) will be placed around the PVC to a minimum of 2′ above the screen. A bentonite seal will be placed on top of the filter media and the remaining annular space to grade will be filled with quick cement. The monitoring well will be sealed in place with a concrete pad with a 5-inch manhole cover. The casing of each well will be appropriately labeled inside the manhole cover by attaching a water-resistant tag listing the well identification number. **Appendix D** provides a sample well construction log.

Approximately 48 hours after installation, the monitoring wells will be developed in accordance with NYCRR Part 360-2.11(a)(8) in order to obtain groundwater samples that represent natural undisturbed aquifer. Assuming the monitoring wells will be constructed in a water-bearing zone, well development will be performed via overpumping method utilizing a Waterra Pump in order to remove residual fine sediments from within well screen and to promote good hydraulic connection between the well and the formation, which may have been disturbed by the well construction. The wells will be developed in a start-stop cycle pumping until the column of water in the well is free of visible sediment, and the pH, temperature, turbidity, and specific conductivity have stabilized. Static water level and total well depth will be recorded for each well before and after each round of pumping. Once the pumping starts, initial pumping rate and turbidity will be recorded. Each pumping cycle will continue until turbidity reaches desired level of less than 50 NTU and the next cycle will initiate after the water in the well is recharged to the initial static level. The amount of pumping in a following cycle that is required to achieve the desired turbidity level should be less than the previous round. The process will be repeated until the well yields water of acceptable turbidity of 50 NTU at the beginning of a pumping cycle. Well development will be completed by verifying the water turbidity level 30 minutes after the well is recharged following the end of the last pumping cycle. Aquifer parameters including pH, dissolved Oxygen, redox potential or ORP, temperature and specific conductivity will also be documented after the development is completed. Equilibration of the well with the formation after its installation and development will be allowed in order to stabilize groundwater flow and approach chemical equilibrium. Since site specific information on the permeability of the formation around the wells will not be available, the monitoring wells will be sampled a minimum of 7 days after development.

The monitoring wells will be monitored and gauged for separate phase products. The monitoring will be performed utilizing a Solinst® 122 Oil/Water Interface Probe (Interface Probe). The Interface Probe can measure depths to water to 0.01 inch. The static depth to water will be measured in each well from the northern portion of the top of casing.

Following the well monitoring, the casing elevation of each well will be surveyed by a land surveyor licensed to practice in the State of New York. The determination of the casing elevation will allow for the calculation of the groundwater elevation beneath the site, which therefore allows for the determination of the groundwater flow direction. The groundwater elevations will then be imported into a computer-contouring program to determine the site-specific groundwater flow direction.

The monitoring wells will be purged and sampled in accordance with the USEPA's Region 1 Low-Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells (EQASOP #GW4, Rev. September 19, 2017) and following the stabilization of water quality indicator parameters. As per the USEPA's Low Stress/Flow Groundwater Sampling Protocol, the sampling tubing will be lowered slowly into the well to appropriate intake depth to minimize disturbance. Each well will be pumped with a Peristaltic DC Pump by Geotech Geopump at a rate between 100 – 200 ml/min. The pumped groundwater will run through a Horiba U-52 Multiparameter Meter flow-through cell to measure the aquifer parameters. Sampling of groundwater will occur following 5-minute purging cycles of groundwater and until the stabilization of water quality indicator parameters including pH, dissolved Oxygen, redox potential or ORP, temperature, specific conductance, and turbidity as specified in the Quality Assurance Project Plan (QAPP) presented in **Appendix E**. The static depth to water will also be gauged during the purging exercise. Stabilization of aquifer parameters is achieved when three consecutive measurements are within the following specified confidence limits:

- Turbidity (10% for values greater than 5 NTUs; if three Turbidity values are less
- than 5 NTUs, consider the values as stabilized),
- Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three Dissolved
- Oxygen values are less than 0.5 mg/L, consider the values as
- stabilized),
- Specific Conductance (3%),
- Temperature (3%),
- pH (± 0.1 unit),

- Oxidation/Reduction Potential (±10 millivolts),
- Depth to Water.

Following purging, a groundwater sample will be collected from each monitoring well directly from the pump after disconnecting the pump tubing from the Horiba U-52 Multiparameter Meter flow-through cell. The collected groundwater samples along with a duplicate sample will be placed into laboratory supplied containers and appropriately labeled.

Table 10 - Summary of Proposed Groundwater Monitoring Well Sampling Locations and Analyses

Well ID	Location	Analysis
MW-1a	Western portion at SP-9 – direct vicinity of MW-1	* TCL VOCs via EPA Method 8260 * TCL SVOCs via EPA Method 8270 * Pesticides via EPA Method 8081 * Herbicides via EPA Method 8151 * Polychlorinated biphenyls via EPA Method 8082
MW-2a	Northern portion at SP-10 – direct vicinity of MW-2	
MW-3a	Eastern portion at SP-11 – direct vicinity of MW-3	
MW-4a	Western portion at SP-12 – direct vicinity of MW-4	

MW-5a	Central portion at SP-13– direct vicinity of MW-5	* TAL Metals via EPA Method 6010 & EPA Method 7471 for Mercury *1,4-dioxane via EPA Method 8270D SIM *21 target Perfluorooctanoic acid (PFOA) via EPA Method 1633
MW-6	Southeastern portion at SP-14 – direct vicinity of GW-1	

3.5 Field Management of Investigation Derived Waste

Soil and Groundwater Sampling

- Soil cuttings generated during soil probe installation and sampling will be placed into 55-gallon drum(s) and properly disposed of.
- Fluids generated during groundwater sampling and equipment decontamination will be contained in the 55-gallons drums and properly disposed of as hazardous waste.
- Fine grade sand will be applied immediately around the boreholes to prevent any runoff of storm water from discharging unknown surface contaminants into the subsurface soil and groundwater. The sand will be disposed of into 55-gallons drum(s) along the soil cuttings.
- The 55-gallon drum containing IDW will be temporarily staged in a secure area on-site at grade level and beneath the unfinished building until waste characterization sampling is complete and arrangements with permitted

disposal facility are finalized for. All boreholes will be backfilled with fine grade sand and properly sealed with a layer of slurry and native shallow dirt.

3.6 Laboratory Analytical Methods

As indicated in **Table 9** and **Table 10**, the soil and groundwater samples will be analyzed for volatile organic compounds (VOCs) via EPA Method 8260, semi-volatile organic compounds (SVOCs) via EPA Method 8270, Pesticides via EPA Method 8081, Herbicides via EPA Method 8151, Polychlorinated biphenyls via EPA Method 8082 and TAL Metals via EPA Method 6010 and EPA Method 7471 for Mercury. Groundwater samples analysis for TAL Metals will be performed for both filtered and unfiltered samples. All soil and groundwater samples will also be analyzed for Emerging Contaminants, i.e. 1,4-Dioxane via EPA Method 8270D SIM and the 21 target Perfluorooctanoic acid (PFAS) compounds via EPA Method 1633.

3.7 Quality Assurance/Quality Control

A HydroTech Quality Assurance Officer (QAO) (Ruijie Xu) will adopt a Quality Assurance Project Plan (QAPP) during the collection of soil and groundwater samples in order to ensure that proper procedures are performed and subsequently followed during samples collection and analysis. The QAPP for this investigation is provided in **Appendix E**. Resumes of key personnel involved in this project are provided in **Appendix F**.

4.0 REPORT OF FINDINGS

A Remedial Investigation Report (RIR) will be prepared following the completion of the fieldwork and the laboratory analyses in accordance with DER-10 Section 3.14. This report will be certified by a QEP as per DER-10 Table 1.5 and will contain the findings and conclusions of the investigation and will include appropriate maps and diagrams, tabulations of all analytical data, written narratives, boring logs and well construction diagrams, well purging and sampling logs, and appendices.

The soil quality results will be compared to the 6 NYCRR Part 375 Unrestricted Residential Use and Restricted Residential Use. The groundwater quality results will be compared to the AWQS documented in NYSDEC's Technical and Operational Guidance Series (TOGS) 1.1.1. All soil samples that exceed their respective soil cleanup objectives (SCOs) and groundwater samples that exceed the Ambient Water Quality Standards (AWQS) will be highlighted in tables and shown on spider diagrams. The RIR will include the Data Usability Summary Report.

All data will also be submitted electronically to NYSDEC through the Environmental Information Management System, using the standardized electronic data deliverable (EDD) format.

4.1 Anticipated Project Schedule

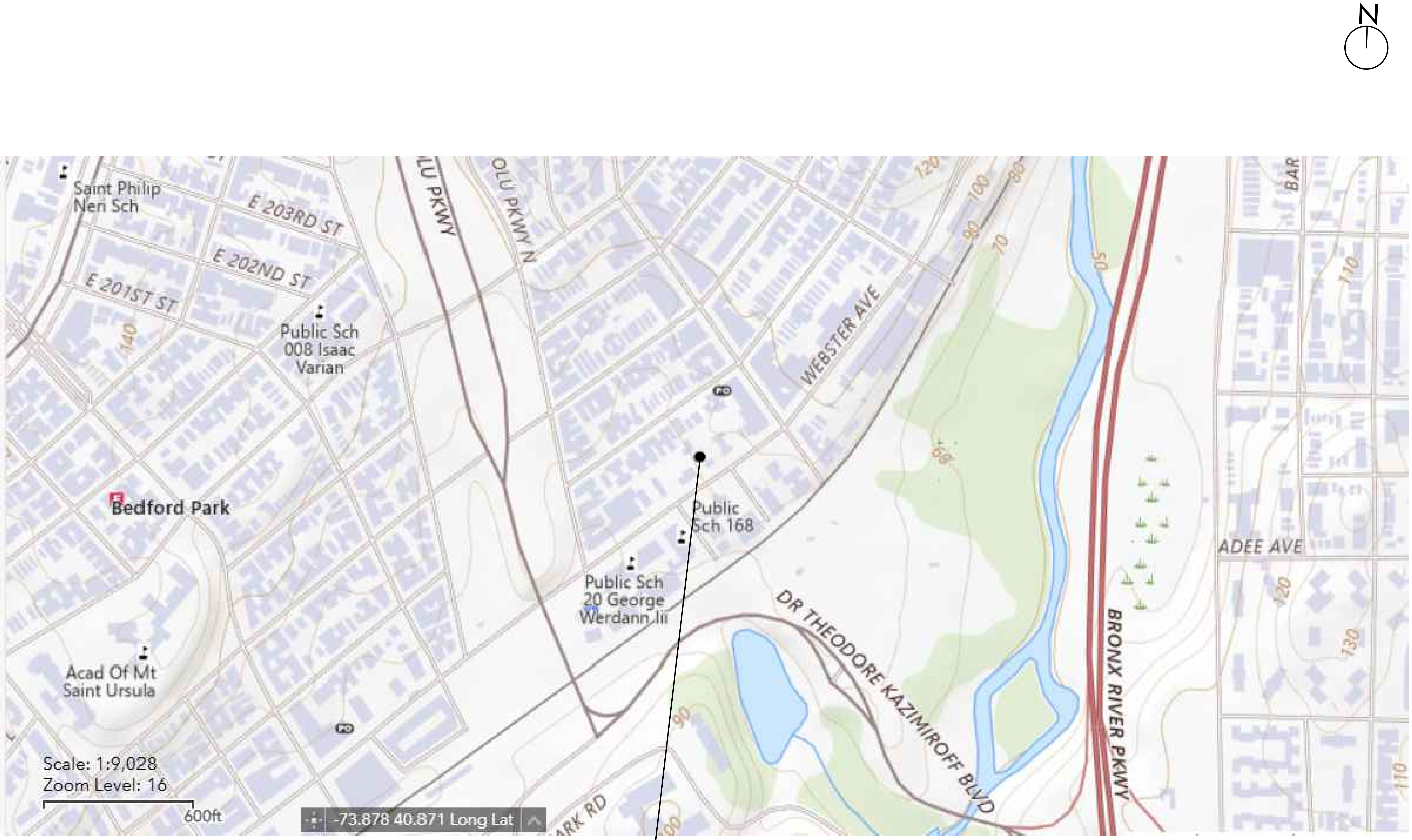
The table below provides a tentative schedule for the performance of the remedial investigation and other major tasks leading to the date of issuance of a

Certificate of Complete (COC). This schedule is tentative based upon the approvals of documents by the NYSDEC.

Table 11 - Summary of Anticipated Project Schedule

Schedule Milestone	Anticipated Date
NYSDEC Approval of RIWP	January 2025
Implementation RIWP	January /February 2025
Submit RIR/RAWP	March/April 2025
Fact Sheet Announcing the 45-day Public Comment Period for RAWP Activities	May 2025
NYSDEC RAWP Approval/ Issuance of Decision Document	July 2025
Begin Implementation of Remedial Action	August 2025
Submittal of FER and SMP	July/August 2027
Issuance of Certificate of Completion	December 2027

FIGURES



SUBJECT PROPERTY:
3083 WEBSTER AVENUE,
BRONX, NY

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

HydroTech

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

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NY 10001

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BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

3083 WEBSTER AVENUE, BRONX, NY.

PROJECT FIGURE

FIGURE 1: SITE LOCATION MAP

PROJECT NO. 240040	DATE 11/20/24
DRAWN BY A.S.	REVIEWED BY P.M.
SCALE (11X17) AS SHOWN	APPROVED BY P.M.

Sample ID	SP-1		UUSCOs	RRSCOs	PWGSCOs
Sampling Depth	0-2'	2'-4'			
Sampling Date	7/24/2024	7/24/2024			
Unit	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
VOCs	ND				
SVOCs	NAS	ND	~	~	~
METALS					
Chromium, Trivalent	ND	31.6	30	180	~

Sample ID	SP-2		UUSCOs	RRSCOs	PWGSCOs
Sampling Depth	0-2'	10'-12'			
Sampling Date	7/24/2024	7/24/2024			
Unit	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
VOCs	ND				
SVOCs	NAS				
METALS					
Copper	50.4	71.8	50	270	1,720
Lead	104	ND	63	400	450
Zinc	346	ND	109	10,000	2,480

Sample ID	SP-5		UUSCOs	RRSCOs	PWGSCOs
Sampling Depth	0-2'	10'-12'			
Sampling Date	7/24/2024	7/24/2024			
Unit	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
VOCs	ND				
SVOCs	NAS	ND	~	~	~
METALS					
Chromium, Trivalent	ND	96.7	30	180	~
Lead	102	ND	63	400	450
Nickel	38.4	50.6	30	310	130
Zinc	112	ND	109	10,000	2,480

Location / Sample ID	TP-1	UUSCO	RRSCO	PWGSCOs
Sample Depth (fbg)	18'			
Sample Date	9/7/2021			
Unit	mg/Kg	mg/Kg	mg/Kg	mg/Kg
VOCS				
1,2,4-Trimethylbenzene	**28**	3.6	52	3.6
Total Xylenes	**3.17**	0.26	100	1.6
SVOCS	NAS			

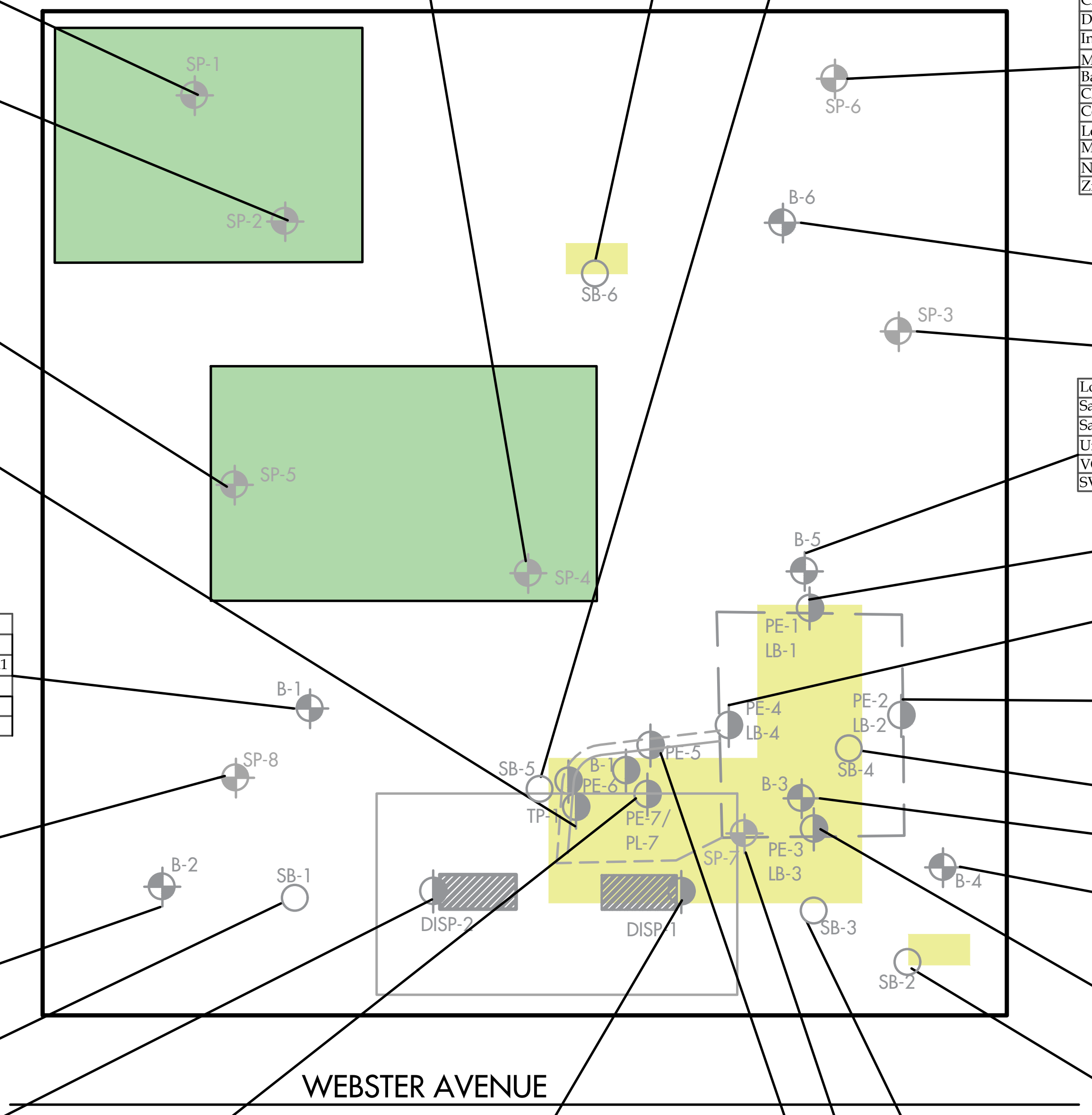
Location / Sample ID	B-1
Sample Depth (fbg)	20'
Sample Date	12/23/2021
Unit	mg/Kg
VOCS	ND
SVOCS	ND

Sample ID	SP-8		UUSCOs	RRSCOs	PWGSCOs
Sampling Depth	0-2'	16'-18'			
Sampling Date	7/24/2024	7/24/2024			
Unit	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
VOCs	NAS	ND	~	~	~
SVOCs	NAS	ND	~	~	~
METALS					
Chromium, Trivalent	33.5	32.2	30	180	~
Lead	177	ND	63	400	450
Zinc	115	ND	109	10,000	2,480

Location / Sample ID	B-2
Sample Depth (fbg)	20'
Sample Date	12/23/2021
Unit	mg/Kg
VOCS	NAS
SVOCS	NAS

Sample ID	SB-1
Sampling Depth	10-'13'
Sampling Date	10/8/2009
Compound	ug/kg
VOCs	ND
SVOCs	ND

Location / Sample ID	Disp-2
Sample Depth (fbg)	3'-4'
Sample Date	8/26/2021
Unit	mg/Kg
VOCS	ND
SVOCS	ND



Sample ID	SP-4		UUSCOs	RRSCOs	PWGSCOs
Sampling Depth	0-2'	10'-12'			
Sampling Date	7/24/2024	7/24/2024			
Unit	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
VOCs	ND				
SVOCs	ND				
METALS					
Chromium, Trivalent	55.4	ND	30	180	~
Nickel	31.5	ND	30	310	130

Sample ID	SB-6
Sampling Depth	12'-15'
Sampling Date	10/8/2009
Compound	ug/kg
VOCs	ND
SVOCs	ND

Sample ID	SB-5
Sampling Depth	18'-20'
Sampling Date	10/8/2009
Compound	ug/kg
VOCs	ND
SVOCs	ND

Sample ID	SP-6		UUSCOs	RRSCOs	PWGSCOs
Sampling Depth	0-2'	2'-4'			
Sampling Date	7/24/2024	7/24/2024			
Unit	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
VOCs	ND				
SVOCs					
Benzo(a)anthracene	7.16	ND	1	1	1
Benzo(a)pyrene	6.45	ND	1	1	22
Benzo(b)fluoranthene	5.84	ND	1	1	1.7
Benzo(k)fluoranthene	2.65	ND	0.8	3.9	1.7
Chrysene	6.83	ND	1	3.9	1
Dibenzo(a,h)anthracene	0.932	ND	0.33	0.33	1,000
Indeno(1,2,3-cd)pyrene	4.13	ND	0.5	0.5	8.2
METALS					
Barium	ND	392	350	400	~
Chromium, Trivalent	ND	214	30	180	~
Copper	70.9	ND	50	270	1,720
Lead	279	ND	63	400	450
Mercury	0.221	ND	0.18	0.81	0.73
Nickel	ND	100	30	310	130
Zinc	190	116	109	10,000	2,480

Location / Sample ID	B-6
Sample Depth (fbg)	9'
Sample Date	12/23/2021
Unit	mg/Kg
VOCS	NAS
SVOCS	ND

Sample ID	SP-3		UUSCOs	RRSCOs	PWGSCOs
Sampling Depth	0-2'	10'-12'			
Sampling Date	7/24/2024	7/24/2024			
Unit	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
VOCs	ND				
SVOCs	NAS	ND	~	~	~
METALS					
Nickel	ND	39.6	30	310	130

Location / Sample ID	B-5
Sample Depth (fbg)	14'
Sample Date	12/23/2021
Unit	mg/Kg
VOCS	NAS
SVOCS	ND

Location / Sample ID	PE-1	LB-1
Sample Depth (fbg)	5'-6'	3-4'
Sample Date	8/25/2021	9/7/2021
Unit	mg/Kg	mg/Kg
VOCS	ND	ND
SVOCS	ND	ND

Location / Sample ID	PE-4	LB-4
Sample Depth (fbg)	6'-7'	11-12'
Sample Date	8/26/2021	8/26/2021
Unit	mg/Kg	mg/Kg
VOCS	ND	
SVOCS	ND	

Location / Sample ID	PE-2	LB-2
Sample Depth (fbg)	7'-8'	11-12'
Sample Date	8/25/2021	8/25/2021
Unit	mg/Kg	mg/Kg
VOCS	ND	
SVOCS	ND	

Sample ID	SB-4
Sampling Depth	11-'13'
Sampling Date	10/8/2009
Compound	ug/kg
VOCs	ND
SVOCs	ND

Location / Sample ID	B-3
Sample Depth (fbg)	15'
Sample Date	12/23/2021
Unit	mg/Kg
VOCS	NAS
SVOCS	ND

Location / Sample ID	B-4
Sample Depth (fbg)	18'
Sample Date	12/23/2021
Unit	mg/Kg
VOCS	NAS
SVOCS	ND

Location / Sample ID	PE-3	LB-3
Sample Depth (fbg)	7'-8'	11-12'
Sample Date	8/26/2021	8/26/2021
Unit	mg/Kg	mg/Kg
VOCS	ND	
SVOCS	ND	

Sample ID	SB-2
Sampling Depth	15'-17'
Sampling Date	10/8/2009
Compound	ug/kg
VOCs	ND
SVOCs	ND

Location / Sample ID	PE-7
Sample Depth (fbg)	4-5'
Sample Date	9/7/2021
Unit	mg/Kg
VOCS	ND
SVOCS	ND

Location / Sample ID	Disp-1
Sample Depth (fbg)	2'-3'
Sample Date	8/26/2021
Unit	mg/Kg
VOCS	ND
SVOCS	ND

Location / Sample ID	PE-5
Sample Depth (fbg)	3-4'
Sample Date	9/7/2021
Unit	mg/Kg
VOCS	ND
SVOCS	ND

Sample ID	SB-3
Sampling Depth	25'-27
Sampling Date	10/8/2009
Compound	ug/kg
VOCs	ND
SVOCs	ND

Sample ID	SP-7		UUSCOs	RRSCOs	PWGSCOs
Sampling Depth	0-2'	10'-12'			
Sampling Date	7/24/2024	7/24/2024			
Unit	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
VOCs	ND				
SVOCs	NAS				
METALS					
Lead	ND	100	63	400	450

LEGEND:

- ⊕ SOIL PROBE (SP-) INSTALLED BY HYDROTECH IN JULY 2024
- ⊕ SOIL PROBES (B-) INSTALLED BY ADVANTAGE ENVIRONMENTAL CONSULTANTS, LLC IN DECEMBER 2021
- ◐ POST-USTs, DISPENSERS, TEST PIT AND PRODUCT LINE EXCAVATION ENDPOINT SAMPLES (PE-, LB-, PL-, TP-, DISP-) COLLECTED BY LABELLA ASSOCIATES, D.P.C. (LABELLA) IN AUGUST & SEPTEMBER 2021
- ○ SOIL PROBE INSTALLED BY TYREE BROTHER'S ENVIRONMENTAL SERVICES, INC (TYREE) IN OCTOBER 2009
- ━ SITE BOUNDARY
- 🟨 FORMER LOCATIONS OF REMOVED USTs BY TYREE IN JANUARY 1998
- — — FORMER LOCATIONS OF REMOVED UNDERGROUND STORAGE TANKS (USTs) BY LABELLA IN AUGUST 2021

- ▨ FORMER LOCATIONS OF REMOVED DISPENSERS
- — FORMER LOCATION OF REMOVED PRODUCT LINE
- ☐ CANOPY OF FORMER DISPENSERS
- 🟩 1-STORY FORMER AUTO REPAIR BUILDINGS

ND = THIS INDICATES THE ANALYTE WAS NOT DETECTED
NAS NONE ABOVE STANDARD
~ = INDICATES THAT NO REGULATORY LIMIT HAS BEEN ESTABLISHED FOR THIS ANALYTE
UUSCO = NYSDEC PART 375 UNRESTRICTED USE SOIL CLEANUP OBJECTIVES
RRSCO = NYSDEC PART 375 RESTRICTED USE SOIL CLEANUP OBJECTIVES-RESTRICTED RESIDENTIAL
PGWSCO = NYSDEC PART 375 RESTRICTED USE SOIL CLEANUP OBJECTIVES - PROTECTION OF GROUNDWATER

- ■ INDICATES CONCENTRATION EXCEEDS UUSCO
- 🟧 INDICATES CONCENTRATION EXCEEDS PGWSCO
- 🟦 INDICATES CONCENTRATION EXCEEDS RRSCO

0' 40'
APPROXIMATE SCALE IN FEET

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

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BASE DRAWING PREPARED BY

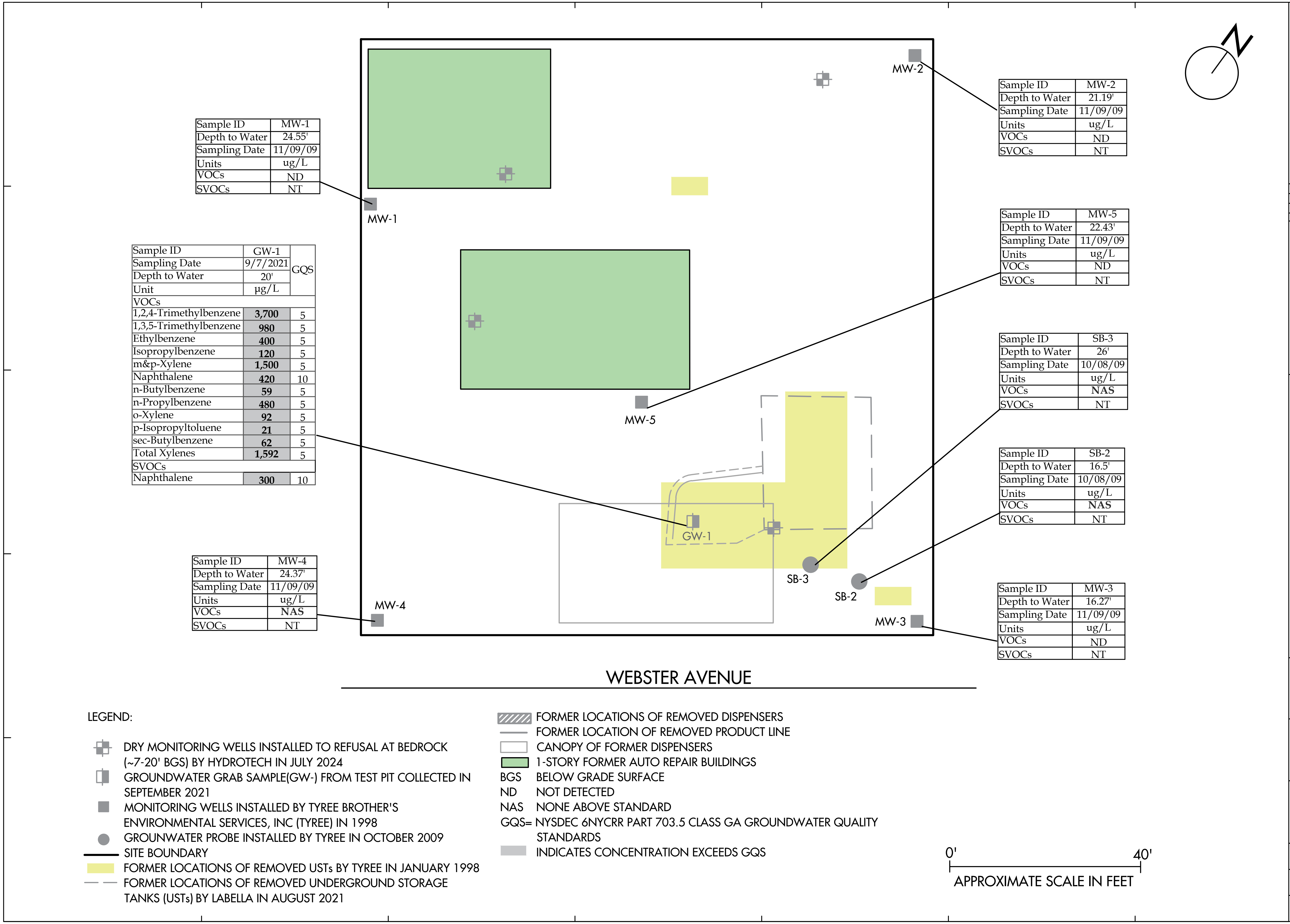
PROJECT NAME AND ADDRESS

3083 WEBSTER AVENUE, BRONX, NY.

PROJECT FIGURE

FIGURE 2: MAP OF VOCs, SVOCs AND METALS IN SOIL

PROJECT NO. 240040	DATE 11/20/24
DRAWN BY A.S.	REVIEWED BY P.M.
SCALE (11X17) AS SHOWN	APPROVED BY P.M.



Sample ID	MW-1
Depth to Water	24.55'
Sampling Date	11/09/09
Units	ug/L
VOCs	ND
SVOCs	NT

Sample ID	GW-1	GQS
Sampling Date	9/7/2021	
Depth to Water	20'	
Unit	µg/L	
VOCs		
1,2,4-Trimethylbenzene	**3,700**	5
1,3,5-Trimethylbenzene	**980**	5
Ethylbenzene	**400**	5
Isopropylbenzene	**120**	5
m&p-Xylene	**1,500**	5
Naphthalene	**420**	10
n-Butylbenzene	**59**	5
n-Propylbenzene	**480**	5
o-Xylene	**92**	5
p-Isopropyltoluene	**21**	5
sec-Butylbenzene	**62**	5
Total Xylenes	**1,592**	5
SVOCs		
Naphthalene	**300**	10

Sample ID	MW-4
Depth to Water	24.37'
Sampling Date	11/09/09
Units	ug/L
VOCs	**NAS**
SVOCs	NT

Sample ID	MW-2
Depth to Water	21.19'
Sampling Date	11/09/09
Units	ug/L
VOCs	ND
SVOCs	NT

Sample ID	MW-5
Depth to Water	22.43'
Sampling Date	11/09/09
Units	ug/L
VOCs	ND
SVOCs	NT

Sample ID	SB-3
Depth to Water	26'
Sampling Date	10/08/09
Units	ug/L
VOCs	**NAS**
SVOCs	NT

Sample ID	SB-2
Depth to Water	16.5'
Sampling Date	10/08/09
Units	ug/L
VOCs	**NAS**
SVOCs	NT

Sample ID	MW-3
Depth to Water	16.27'
Sampling Date	11/09/09
Units	ug/L
VOCs	ND
SVOCs	NT

LEGEND:

⊕ DRY MONITORING WELLS INSTALLED TO REFUSAL AT BEDROCK (~7-20' BGS) BY HYDROTECH IN JULY 2024
◧ GROUNDWATER GRAB SAMPLE(GW-) FROM TEST PIT COLLECTED IN SEPTEMBER 2021
■ MONITORING WELLS INSTALLED BY TYREE BROTHER'S ENVIRONMENTAL SERVICES, INC (TYREE) IN 1998
● GROUNWATER PROBE INSTALLED BY TYREE IN OCTOBER 2009
— SITE BOUNDARY
▬ FORMER LOCATIONS OF REMOVED USTs BY TYREE IN JANUARY 1998
– – FORMER LOCATIONS OF REMOVED UNDERGROUND STORAGE TANKS (USTs) BY LABELLA IN AUGUST 2021
▨ FORMER LOCATIONS OF REMOVED DISPENSERS
— FORMER LOCATION OF REMOVED PRODUCT LINE
☐ CANOPY OF FORMER DISPENSERS
🟩 1-STORY FORMER AUTO REPAIR BUILDINGS
BGS BELOW GRADE SURFACE
ND NOT DETECTED
NAS NONE ABOVE STANDARD
GQS= NYSDEC 6NYCRR PART 703.5 CLASS GA GROUNDWATER QUALITY STANDARDS
▬ INDICATES CONCENTRATION EXCEEDS GQS

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

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TEL: (631) 462-5866

BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

3083 WEBSTER AVENUE, BRONX, NY.

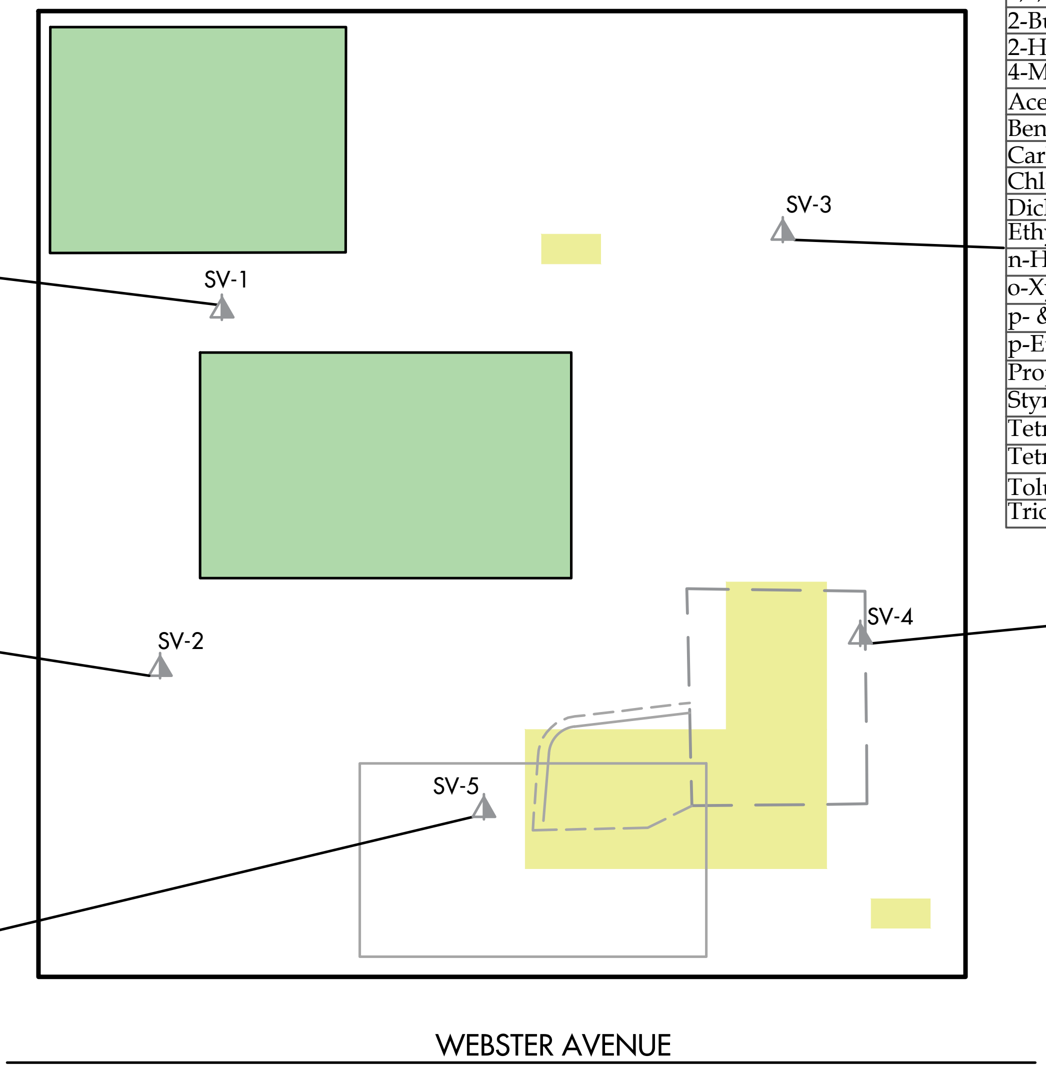
PROJECT FIGURE

FIGURE 3: MAP OF VOCs, AND SVOCs IN GROUNDWATER

PROJECT NO. 240040	DATE 11/20/24
DRAWN BY A.S.	REVIEWED BY P.M.
SCALE (11X17) AS SHOWN	APPROVED BY P.M.

Sample ID	SV-1	
Sampling Depth	12'	
Sampling Date	7/30/2024	
Unit	ug/m3	
1,1,1-Trichloroethane	1.6	D
1,2,4-Trimethylbenzene	9	D
1,3,5-Trimethylbenzene	3.3	D
2,2,4-Trimethylpentane	0.67	D
2-Butanone	5.6	D
2-Hexanone	1.6	D
Acetone	180	BD
Benzene	1.2	D
Chloromethane	1.4	D
Dichlorodifluoromethane	2.6	D
Ethyl Benzene	2.6	D
Isopropanol	3.6	D
n-Heptane	0.81	D
o-Xylene	7	D
p- & m- Xylenes	13	D
p-Ethyltoluene	8.7	D
Propylene	1.2	D
Styrene	0.84	D
Tetrachloroethylene	260	D
Tetrahydrofuran	1.2	D
Toluene	4.5	D
Trichlorofluoromethane (Freon 11)	1.8	D

Sample ID	SV-3	
Sampling Depth	12'	
Sampling Date	7/30/2024	
Unit	ug/m3	
1,2,4-Trimethylbenzene	8.6	D
1,3,5-Trimethylbenzene	3.3	D
2,2,4-Trimethylpentane	0.99	D
2-Butanone	8.2	D
2-Hexanone	2.5	D
4-Methyl-2-pentanone	1.9	D
Acetone	190	BD
Benzene	0.62	D
Carbon disulfide	7.5	D
Chloromethane	0.73	D
Dichlorodifluoromethane	3	D
Ethyl Benzene	6.7	D
n-Heptane	0.87	D
o-Xylene	15	D
p- & m- Xylenes	30	D
p-Ethyltoluene	7.5	D
Propylene	1.5	D
Styrene	0.75	D
Tetrachloroethylene	160	D
Tetrahydrofuran	2.2	D
Toluene	4.8	D
Trichlorofluoromethane (Freon 11)	1.9	D



Sample ID	SV-2A		SV-2B	
Sampling Depth	12'		6'	
Sampling Date	7/30/2024		7/30/2024	
Unit	ug/m3		ug/m3	
1,2,4-Trimethylbenzene	8.7	D	6.9	D
1,3,5-Trimethylbenzene	3.1	D	2.5	D
2,2,4-Trimethylpentane	1.1	D	ND	
2-Butanone	9.5	D	6.7	D
Acetone	200	BD	160	BD
Acrylonitrile	10	D	10	D
Benzene	1.7	D	1.8	D
Bromodichloromethane	14	D	ND	
Carbon disulfide	3.4	D	1.7	D
Chloroform	590	D	23	D
Chloromethane	0.78	D	ND	
cis-1,2-Dichloroethylene	0.6	D	ND	
Dichlorodifluoromethane	3	D	2.7	D
Ethyl Benzene	3.1	D	2.1	D
Isopropanol	2.7	D	3.3	D
n-Heptane	1.5	D	ND	
n-Hexane	1.7	D	ND	
o-Xylene	8.3	D	6.4	D
p- & m- Xylenes	16	D	10	D
p-Ethyltoluene	8.1	D	5.5	D
Propylene	3.2	D	2.7	D
Tetrachloroethylene	1,100	D	970	D
Tetrahydrofuran	3.3	D	ND	
Toluene	6.2	D	4.5	D
Trichloroethylene	0.61	D	ND	

Sample ID	SV-5	
Sampling Depth	12'	
Sampling Date	7/30/2024	
Unit	ug/m3	
1,2,4-Trimethylbenzene	11	D
1,3,5-Trimethylbenzene	3.9	D
2,2,4-Trimethylpentane	1.2	D
2-Butanone	7.4	D
Acetone	90	BD
Benzene	1.2	D
Carbon disulfide	1.6	D
Chloromethane	1	D
Dichlorodifluoromethane	2.8	D
Ethyl Benzene	3.8	D
o-Xylene	10	D
p- & m- Xylenes	18	D
p-Ethyltoluene	9.2	D
Propylene	4.4	D
Tetrachloroethylene	890	D
Tetrahydrofuran	2.3	D
Toluene	7.7	D
Trichloroethylene	1.3	D

Sample ID	SV-4A		SV-4B	
Sampling Depth	12'		6'	
Sampling Date	7/30/2024		7/30/2024	
Unit	ug/m3		ug/m3	
1,2,4-Trimethylbenzene	6.7	D	8.7	D
1,3,5-Trimethylbenzene	ND		3	D
2,2,4-Trimethylpentane	1.5	J	0.52	D
2-Butanone	11	D	3	D
Acetone	300	BD	45	BD
Benzene	ND		0.51	D
Carbon disulfide	ND		0.5	D
Dichlorodifluoromethane	ND		2.7	D
Ethyl Benzene	2.8	D	1.6	D
o-Xylene	7.6	D	5.2	D
p- & m- Xylenes	13	D	8.2	D
p-Ethyltoluene	5.7	D	6.5	D
Propylene	1.7	D	3.9	D
Tetrachloroethylene	150	D	86	D
Tetrahydrofuran	ND		1.6	D
Toluene	6.1	D	2.5	D
Trichlorofluoromethane (Freon 11)	ND		1.6	D

LEGEND:

— SITE BOUNDARY
▲ SOIL VAPOR PROBE (SV-)
▬ FORMER LOCATIONS OF REMOVED USTs BY TYREE BROTHER'S ENVIRONMENTAL SERVICES, INC. (LABELLA) IN JANUARY 1998
– – FORMER LOCATIONS OF REMOVED UNDERGROUND STORAGE TANKS (USTs) BY LABELLA IN AUGUST 2021
— FORMER LOCATION OF REMOVED PRODUCT LINE
☐ CANOPY OF FORMER DISPENSERS
🟩 1-STORY FORMER AUTO REPAIR BUILDINGS

Q IS THE QUALIFIER COLUMN WITH DEFINITIONS AS FOLLOW:
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
ND = NONE DETECTED

0' 40'
APPROXIMATE SCALE IN FEET

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

HydroTech

HYDROTECH ENVIRONMENTAL
ENGINEERING AND GEOLOGY,
DPC

231 WEST 29TH STREET, SUITE
1104, NEW YORK,
NY 10001

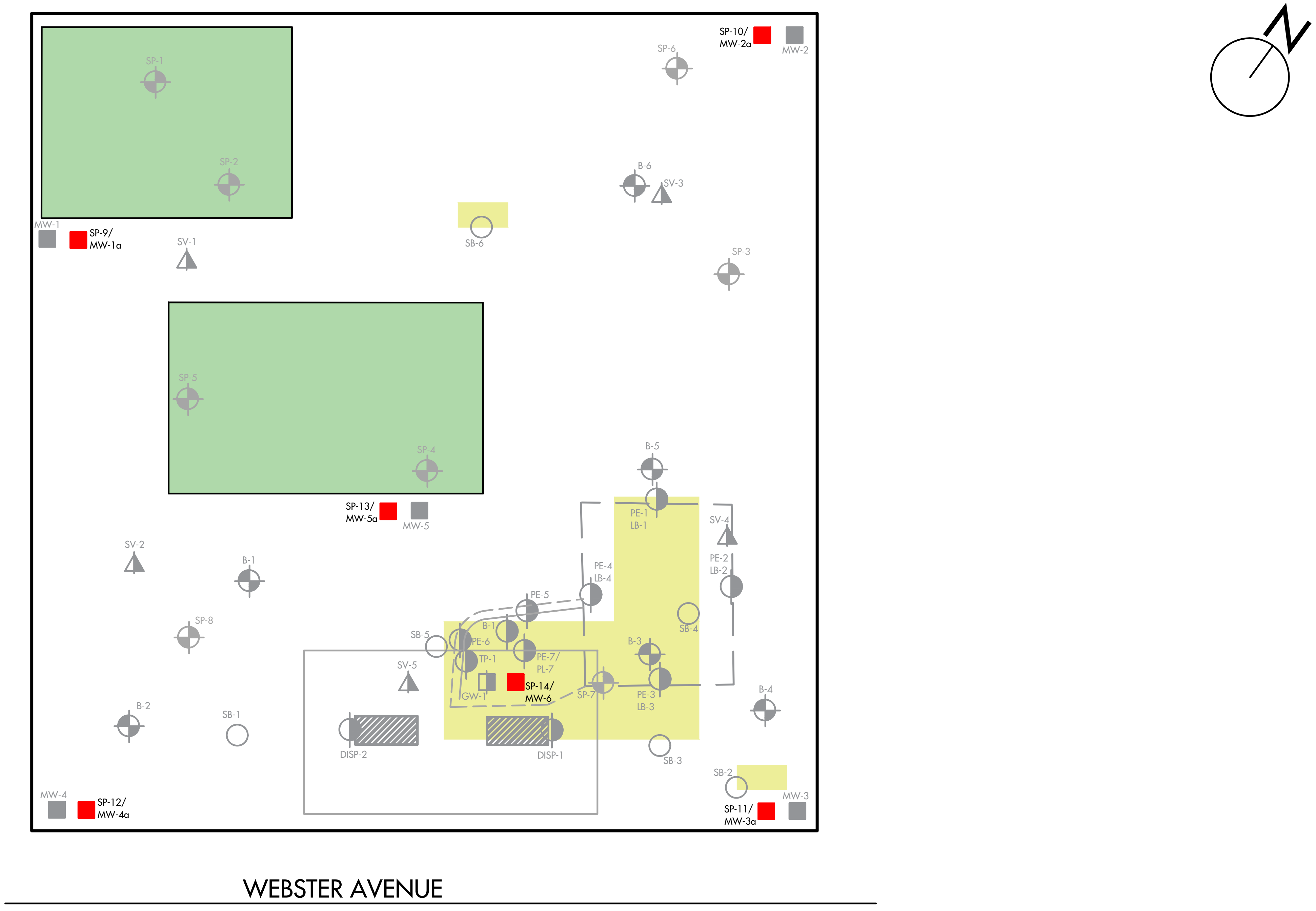
TEL: (631) 462-5866

BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS
3083 WEBSTER AVENUE, BRONX, NY.

PROJECT FIGURE
FIGURE 4: MAP OF VOCs IN SOIL VAPOR

PROJECT NO. 240040	DATE 11/20/24
DRAWN BY A.S.	REVIEWED BY P.M.
SCALE (11X17) AS SHOWN	APPROVED BY P.M.



LEGEND:

- ⊕ SOIL PROBE (SP-) INSTALLED BY HYDROTECH IN JULY 2024
- ⊕ SOIL PROBES (B-) INSTALLED BY ADVANTAGE ENVIRONMENTAL CONSULTANTS, LLC IN DECEMBER 2021
- ◐ POST-USTs, DISPENSERS, TEST PIT AND PRODUCT LINE EXCAVATION ENDPOINT SAMPLES (PE-, LB-, PL-, TP-, DISP-) COLLECTED BY LABELLA ASSOCIATES, D.P.C. (LABELLA) IN AUGUST & SEPTEMBER 2021
- ○ SOIL PROBE INSTALLED BY TYREE BROTHER'S ENVIRONMENTAL SERVICES, INC (TYREE) IN OCTOBER 2009 (WITH SB-2 AND SB-3 CONVERTED INTO GROUNDWATER PROBES)
- △ SOIL VAPOR PROBE (SV-)
- ■ MONITORING WELLS INSTALLED BY TYREE BROTHER'S ENVIRONMENTAL SERVICES, INC (TYREE) IN 1998
- ◨ GROUNDWATER GRAB SAMPLE(GW-) FROM TEST PIT COLLECTED IN SEPTEMBER 2021
- ― SITE BOUNDARY
- 🟨 FORMER LOCATIONS OF REMOVED USTs BY TYREE IN JANUARY 1998
- – – FORMER LOCATIONS OF REMOVED UNDERGROUND STORAGE TANKS (USTs) BY LABELLA IN AUGUST 2021
- ▨ FORMER LOCATIONS OF REMOVED DISPENSERS
- ― FORMER LOCATION OF REMOVED PRODUCT LINE
- ☐ CANOPY OF FORMER DISPENSERS
- 🟩 1-STORY FORMER AUTO REPAIR BUILDINGS
- 🟥 PROPOSED LOCATION OF MONITORING WELL (MW-) AND SOIL PROBE (SP-)

0' 40'
APPROXIMATE SCALE IN FEET

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

HydroTech

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

231 WEST 29TH STREET, SUITE 1104, NEW YORK, NY 10001

TEL: (631) 462-5866

BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

3083 WEBSTER AVENUE, BRONX, NY.

PROJECT FIGURE

FIGURE 5: PROPOSED SAMPLING PLAN

PROJECT NO. 240040	DATE 11/20/24
DRAWN BY A.S.	REVIEWED BY P.M.
SCALE (11X17) AS SHOWN	APPROVED BY P.M.

TABLES

Table 1
Soil Samples Analytical Results for VOCs
3083 Webster Avenue, Bronx, NY

Sample ID	TP-1	PE-1	LB-1	PE-2	LB-2	PE-3	LB-3	PE-4	LB-4	PE-5	PE-6	PE-7	Disp-1	Disp-2	B-1	B-2	B-3	B-4	B-5	B-6	UUSCOs	RRSCOs	PGWSCOs
Sampling Depth	18'	5'-6'	11'-12'	7'-8'	11-12'	7'-8'	11-12'	6'-7'	11-12'	3-4'	3-4'	4'-5'	2'-3'	3'-4'	20'	20'	15'	18'	14'	9'			
Sampling Date	9/7/2021	8/25/2021	8/25/2021	8/25/2021	8/25/2021	8/26/2021	8/26/2021	8/26/2021	8/26/2021	9/7/2021	9/7/2021	9/7/2021	8/26/2021	8/26/2021	12/23/2021	12/23/2021	12/23/2021	12/23/2021	12/23/2021	12/23/2021			
Client Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Unit	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	mg/Kg	mg/Kg	mg/Kg			
1,2,4-Trimethylbenzene	**28**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	3.6	52	3.6
1,3,5-Trimethylbenzene	**7.70**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	8.4	52	8.4
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	0.06	4.8	0.06
Ethylbenzene	**0.64**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	1	41	1
Isopropylbenzene	**0.53**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	~	~	~
m&p-Xylene	**3**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	0.26	100	1.6
Methyl t-Butyl Ether (MTBE)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	0.93	100	0.93
Naphthalene	**4**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.005**	**0.005**	**0.005**	**0.005**	**0.006**	**0.005**	~	~	~
n-Butylbenzene	**1.20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	12	100	12
n-Propylbenzene	**2.90**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	3.9	100	3.9
o-Xylene	**0.17**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	0.26	100	1.6
p-Isopropyltoluene	**0.27**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	~	~	~
sec-Butylbenzene	**0.64**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	11	100	11
tert-Butylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	5.9	100	5.9
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	0.7	100	0.7
Total Xylenes	**3.17**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	0.26	100	1.6

NOTES:

ND= Not detected

UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives

RRSCOS=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential

PGWSCO=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives-Protection of Groundwater

🟧 indicates concentration exceeds PGWSCO

Table 1 (Cont.)
Soil Samples Analytical Results for VOCs
3083 Webster Avenue, Bronx, NY

Sample ID	SB-1	SB-2	SB-3	SB-4	SB-5	SB-6	SP-1		SP-1		SP-2		SP-2		SP-3		SP-3		SP-4		SP-4		SP-5		SP-5		SP-6		SP-6		SP-7		SP-7		SP-8		SP-8		UUSCOs	RRSCOs	PWGSCOs
Sampling Depth	10-'13'	15'-17'	25'-27	11-'13'	18'-20'	12'-15'	0-2'		2'-4'		0-2'		10'-12'		0-2'		10'-12'		0-2'		10'-12'		0-2'		10'-12'		0-2'		2'-4'		0-2'		10'-12'		0-2'		16'-18'				
Sampling Date	10/8/2009	10/8/2009	10/8/2009	10/8/2009	10/8/2009	10/8/2009	7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024				
Client Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil				
Unit	Result	Result	Result	Result	Result	Result	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				
Compound	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q		Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q			
1,1,1,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.68	100	0.68
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NT	NT	NT	NT	NT	NT	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.27	26	0.27
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.33	100	0.33
1,2,3-Trichlorobenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
1,2,3-Trichloropropane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
1,2,4-Trimethylbenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	3.6	52	3.6
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
1,2-Dibromoethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	1.1	100	1.1
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.02	3.1	0.02
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
1,3,5-Trimethylbenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	8.4	52	8.4
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	2.4	49	2.4
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	1.8	13	1.8
1,4-Dioxane	NT	NT	NT	NT	NT	NT	0.027	U	0.0310	U	0.0490	U	0.0250	U	0.0350	U	0.0430	U	0.0370	U	0.0460	U	0.0490	U	0.0300	U	0.0470	U	0.0440	U	0.040	U	0.045	U	0.031	U	0.0500	U	0.1	13	0.1
2-Butanone	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.12	100	0.12
2-Hexanone	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
4-Methyl-2-pentanone	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Acetone	ND	ND	ND	ND	ND	ND	0.0027	U	0.0031	U	0.0049	U	0.0025	U	0.0035	U	0.0043	U	0.0037	U	0.0046	U	0.0049	U	0.0030	U	0.0047	U	0.0044	U	0.004	U	0.0045	U	0.0031	U	0.005	U	0.05	100	0.05
Acrolein	NT	NT	NT	NT	NT	NT	0.0027	U	0.0031	U	0.0049	U	0.0025	U	0.0035	U	0.0043	U	0.0037	U	0.0046	U	0.0049	U	0.0030	U	0.0047	U	0.0044	U	0.004	U	0.0045	U	0.0031	U	0.005	U	~	~	~
Acrylonitrile	NT	NT	NT	NT	NT	NT	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Benzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.06	4.8	0.06
Bromochloromethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Bromodichloromethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Bromoform	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Bromomethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Carbon disulfide	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.76	2.4	0.76
Chlorobenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	1.1	100	1.1
Chloroethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Chloroform	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.37	49	0.37
Chloromethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
cis-1,2-Dichloroethylene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.25	100	0.25
cis-1,3-Dichloropropylene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Cyclohexane	NT	NT	NT	NT	NT	NT	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Dibromochloromethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Dibromomethane	NT	NT	NT	NT	NT	NT	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Ethyl Benzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	1	41	1
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Isopropylbenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Methyl acetate	NT	NT	NT	NT	NT	NT	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Methyl tert-butyl ether (MTBE)	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.93	100	0.93
Methylcyclohexane	NT	NT	NT	NT	NT	NT	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Methylene chloride	ND	ND	ND	ND	ND	ND	0.0027	U	0.0031	U	0.0049	U	0.0025	U	0.0035	U	**0.0051**	JB	0.0037	U	0.0046	U	**0.0110**	B	0.0030	U	0.0047	U	0.0044	U	0.004	U	**0.005**	JB	0.0031	U	0.005	U	0.05	100	0.05
Naphthalene	ND	ND	ND	ND	ND	ND	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT				
n-Butylbenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	12	100	12
n-Propylbenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	3.9	100	3.9
o-Xylene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.26	100	1.6
p- & m- Xylenes	ND	ND	ND	ND	ND	ND	0.0027	U	0.0031	U	0.0049	U	0.0025	U	0.0035	U	0.0043	U	0.0037	U	0.0046	U	0.0049	U	0.0030	U	0.0047	U	0.0044	U	0.004	U	0.0045	U	0.0031	U	0.0050	U	0.26	100	1.6
p-Isopropyltoluene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
sec-Butylbenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	11	100	11
Styrene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
tert-Butyl alcohol (TBA)	NT	NT	NT	NT	NT	NT	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
tert-Butylbenzene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	5.9	100	5.9
Tetrachloroethylene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	**0.0024**	J	0.0025	U	1.3	19	1.3
Toluene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.7	100	0.7
trans-1,2-Dichloroethylene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.19	100	0.19
trans-1,3-Dichloropropylene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
trans-1,4-dichloro-2-butene	NT	NT	NT	NT	NT	NT	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Trichloroethylene	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.47	21	0.47
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	~	~	~
Vinyl Chloride	ND	ND	ND	ND	ND	ND	0.0013	U	0.0016	U	0.0025	U	0.0012	U	0.0018	U	0.0022	U	0.0018	U	0.0023	U	0.0024	U	0.0015	U	0.0023	U	0.0022	U	0.002	U	0.0023	U	0.0015	U	0.0025	U	0.02	0.9	0.02
Xylenes, Total	ND	ND	ND	ND	ND	ND	0.004	U	0.0047	U	0.0074	U	0.0037	U	0.0053	U	0.0065	U	0.0055	U	0.0069	U	0.0073	U	0.0044	U	0.0070	U	0.0067	U	0.0059	U	0.0068	U	0.0046	U	0.0075	U	0.26	100	1.6

NOTES:

Q is the Qualifier Column with definitions as follows:
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
ND=this indicates the analyte was not detected
NT=this indicates the analyte was not a target for this sample
~=this indicates that no regulatory limit has been established for this analyte
UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives
RRSCOS=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential
PGWSCO=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives-Protection of Groundwater

Table 2
Soil Samples Analytical Results for SVOCs
3083 Webster Avenue, Bronx, NY

Sample ID	TP-1	PE-1	LB-1	PE-2	LB-2	PE-3	LB-3	PE-4	LB-4	PE-5	PE-6	PE-7	Disp-1	Disp-2	B-1	B-2	B-3	B-4	B-5	B-6	UUSCOs	RRSCOs	PGWSCOs
Sampling Depth	18'	5'-6'	11'-12'	7'-8'	11-12'	7'-8'	11-12'	6'-7'	11-12'	3-4'	3-4'	4'-5'	2'-3'	3'-4'	20'	20'	15'	18'	14'	9'			
Sampling Date	9/7/2021	8/25/2021	8/25/2021	8/25/2021	8/25/2021	8/26/2021	26/8/2021	8/26/2021	26/8/2021	9/7/2021	9/7/2021	9/7/2021	26/8/2021	26/8/2021	12/23/2021	12/23/2021	12/23/2021	12/23/2021	12/23/2021	12/23/2021			
Client Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Unit	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	mg/Kg	mg/Kg	mg/Kg			
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	100	98
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	107
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	1000
Benz(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	1	1
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.04**	ND	ND	ND	ND	1	1	22
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	1	1.7
Benzo(ghi)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	1000
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8	3.9	1.7
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	3.9	1
Dibenz(a,h)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33	0.33	1000
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	1000
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30	100	386
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.04**	ND	ND	ND	ND	0.5	0.5	8.2
Naphthalene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12	100	12
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	1000
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	1000

NOTES:

ND=this indicates the analyte was not detected

UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives

RRSCOS=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential

PGWSCO=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives-Protection of Groundwater

Table 2 (Cont.)
Soil Samples Analytical Results for SVOCs
3083 Webster Avenue, Bronx, NY

Sample ID	SB-1	SB-2	SB-3	SB-4	SB-5	SB-6	SP-1		SP-1		SP-2		SP-2		SP-3		SP-3		SP-4		SP-4		SP-5		SP-5		SP-6		SP-6		SP-7		SP-7		SP-8		SP-8		SP-8		Equipment Blank		UUSCOs	RRSCOs	PWGSCOs
Sampling Depth	10-'13'	15'-17'	25'-27	11-'13'	18'-20'	12'-15'	0-2'		2'-4'		0-2'		10'-12'		0-2'		10'-12'		0-2'		10'-12'		0-2'		10'-12'		0-2'		2'-4'		0-2'		10'-12'		0-2'		10'-12'		16'-18'						
Sampling Date	10/08/09	10/08/09	10/08/09	10/08/09	10/08/09	10/08/09	7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024				
Client Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		DI Water				
Unit	Result	Result	Result	Result	Result	Result	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		ug/L				
Compound	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	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	Result	Q	Result	Q	Result	Q	Result	Q			
1,1-Biphenyl	NT	NT	NT	NT	NT	NT	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	**0.10**	JD	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
1,2,4,5-Tetrachlorobenzene	NT	NT	NT	NT	NT	NT	0.0963	U	0.0934	U	0.0938	U	0.0878	U	0.0963	U	0.0878	U	0.102	U	0.0877	U	0.0929	U	0.0873	U	0.101	U	0.0877	U	0.0932	U	0.0904	U	0.0968	U	NT		0.0852	U	2.5	U	~	~	~
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	1.1	100	1.1
1,2-Diphenylhydrazine	ND	kli	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	2.4	49	2.4
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	1.8	13	1.8
1,4-Dioxane	NT	NT	NT	NT	NT	NT	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		0.0198	U	0.0198	U	NT		0.3	U	0.1	13	0.1
2,3,4,6-Tetrachlorophenol	NT	NT	NT	NT	NT	NT	0.0963	U	0.0934	U	0.0938	U	0.0878	U	0.0963	U	0.0878	U	0.102	U	0.0877	U	0.0929	U	0.0873	U	0.101	U	0.0877	U	0.0932	U	0.0904	U	0.0968	U	NT		0.0852	U	2.5	U	~	~	~
2,4,5-Trichlorophenol	NT	NT	NT	NT	NT	NT	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	0.0963	U	0.0934	U	0.0938	U	0.0878	U	0.0963	U	0.0878	U	0.102	U	0.0877	U	0.0929	U	0.0873	U	0.101	U	0.0877	U	0.0932	U	0.0904	U	0.0968	U	NT		0.0852	U	2.5	U	~	~	~
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
2-Chloronaphthalene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
2-Chlorophenol	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
2-Methylnaphthalene	NT	NT	NT	NT	NT	NT	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	**0.274**	D	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	
2-Methylphenol	NT	NT	NT	NT	NT	NT	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	0.33	100	0.33
2-Nitroaniline	NT	NT	NT	NT	NT	NT	0.0963	U	0.0934	U	0.0938	U	0.0878	U	0.0963	U	0.0878	U	0.102	U	0.0877	U	0.0929	U	0.0873	U	0.101	U	0.0877	U	0.0932	U	0.0904	U	0.0968	U	NT		0.0852	U	2.5	U	~	~	~
2-Nitrophenol	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
3- & 4-Methylphenols	NT	NT	NT	NT	NT	NT	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	0.33	100	0.33
3,3-Dichlorobenzidine	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
3-Nitroaniline	NT	NT	NT	NT	NT	NT	0.0963	U	0.0934	U	0.0938	U	0.0878	U	0.0963	U	0.0878	U	0.102	U	0.0877	U	0.0929	U	0.0873	U	0.101	U	0.0877	U	0.0932	U	0.0904	U	0.0968	U	NT		0.0852	U	2.5	U	~	~	~
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND	ND	0.0963	U	0.0934	U	0.0938	U	0.0878	U	0.0963	U	0.0878	U	0.102	U	0.0877	U	0.0929	U	0.0873	U	0.101	U	0.0877	U	0.0932	U	0.0904	U	0.0968	U	NT		0.0852	U	2.5	U	~	~	~
4-Bromophenyl phenyl ether	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
4-Chloro-3-methylphenol	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
4-Chloroaniline	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
4-Chlorophenyl phenyl ether	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
4-Nitroaniline	NT	NT	NT	NT	NT	NT	0.0963	U	0.0934	U	0.0938	U	0.0878	U	0.0963	U	0.0878	U	0.102	U	0.0877	U	0.0929	U	0.0873	U	0.101	U	0.0877	U	0.0932	U	0.0904	U	0.0968	U	NT		0.0852	U	2.5	U	~	~	~
4-Nitrophenol	ND	ND	ND	ND	ND	ND	0.0963	U	0.0934	U	0.0938	U	0.0878	U	0.0963	U	0.0878	U	0.102	U	0.0877	U	0.0929	U	0.0873	U	0.101	U	0.0877	U	0.0932	U	0.0904	U	0.0968	U	NT		0.0852	U	2.5	U	~	~	~
Acenaphthene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	**0.05**	JD	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	**1.39**	D	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	0.05	U	20	100	98
Acenaphthylene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	**0.07**	JD	0.0437	U	**0.13**	D	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	0.05	U	100	100	107
Acetophenone	NT	NT	NT	NT	NT	NT	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Aniline	NT	NT	NT	NT	NT	NT	0.193	U	0.187	U	0.188	U	0.176	U	0.193	U	0.176	U	0.204	U	0.176	U	0.186	U	0.175	U	0.202	U	0.176	U	0.187	U	0.181	U	0.194	U	NT		0.171	U	2.5	U	~	~	~
Anthracene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	**0.12**	D	0.044	U	**0.06**	JD	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	**3.15**	D	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	0.05	U	100	100	1000
Atrazine	NT	NT	NT	NT	NT	NT	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	0.5	U	~	~	~
Benzaldehyde	NT	NT	NT	NT	NT	NT	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Benzidine	ND	ND	ND	ND	ND	ND	0.193	U	0.187	U	0.188	U	0.176	U	0.193	U	0.176	U	0.204	U	0.176	U	0.186	U	0.175	U	0.202	U	0.176	U	0.19	U	0.181	U	0.194	U	NT		0.171	U	10	U	~	~	~
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	**0.06**	JD	0.0468	U	**0.24**	D	0.044	U	**0.37**	D	0.044	U	0.051	U	0.044	U	**0.19**	D	0.0437	U	🟧 **7.16**	D	0.044	U	**0.13**	D	0.0453	U	**0.07**	JD	NT		0.0427	U	0.05	U	1	1	1
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	**0.07**	JD	0.0468	U	**0.20**	D	0.044	U	**0.37**	D	0.044	U	0.051	U	0.044	U	**0.25**	D	0.0437	U	🟦 **6.45**	D	0.044	U	**0.13**	D	0.0453	U	**0.06**	JD	NT		0.0427	U	0.05	U	1	1	22
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	**0.07**	JD	0.0468	U	**0.28**	D	0.044	U	**0.48**	D	0.044	U	0.051	U	0.044	U	**0.23**	D	0.0437	U	🟧 **5.84**	D	0.044	U	**0.17**	D	0.0453	U	**0.09**	JD	NT		0.0427	U	0.05	U	1	1	1.7
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	**0.06**	JD	0.0468	U	**0.14**	D	0.044	U	**0.28**	D	0.044	U	0.051	U	0.044	U	**0.17**	D	0.0437	U	**3.92**	D	0.044	U	**0.09**	JD	**0.05**	JD	0.0485	U	NT		0.0427	U	0.05	U	100	100	1000
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	**0.07**	JD	0.0468	U	**0.10**	D	0.044	U	**0.41**	D	0.044	U	0.051	U	0.044	U	**0.24**	D	0.0437	U	🟧 **2.65**	D	0.044	U	**0.06**	JD	0.0453	U	0.0485	U	NT		0.0427	U	0.05	U	0.8	3.9	1.7
Benzoic acid	NT	NT	NT	NT	NT	NT	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	25	U	~	~	~
Benzyl alcohol	NT	NT	NT	NT	NT	NT	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Benzyl butyl phthalate	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	**0.388**	D	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Bis(2-chloroethoxy)methane	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Bis(2-chloroethyl)ether	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Bis(2-chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	**0.37**	D	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	0.5	U	~	~	~
Caprolactam	NT	NT	NT	NT	NT	NT	0.0963	U	0.0934	U	0.0938	U	0.0878	U	0.0963	U	0.0878	U	0.102	U	0.0877	U	0.0929	U	0.0873	U	0.101	U	0.0877	U	0.0932	U	0.0904	U	0.0968	U	NT		0.0852	U	2.5	U	~	~	~
Carbazole	NT	NT	NT	NT	NT	NT	0.0482	U	0.0468	U	**0.06**	JD	0.044	U	**0.08**	JD	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	**1.6**	D	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Chrysene	ND	ND	ND	ND	ND	ND	**0.08**	JD	0.0468	U	**0.24**	D	0.044	U	**0.45**	D	0.044	U	0.051	U	0.044	U	**0.22**	D	0.0437	U	🟧 **6.83**	D	0.044	U	**0.15**	D	0.0453	U	**0.07**	JD	NT		0.0427	U	0.05	U	1	3.9	1
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	**0.10**	D	0.044	U	0.051	U	0.044	U	**0.06**	JD	0.0437	U	🟦 **0.93**	D	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	0.05	U	0.33	0.33	1000
Dibenzofuran	NT	NT	NT	NT	NT	NT	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	**0.98**	D	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	7	59	210
Diethyl phthalate	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Dimethyl phthalate	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Di-n-butyl phthalate	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Di-n-octyl phthalate	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Diphenylamine	NT	NT	NT	NT	NT	NT	0.0963	U	0.0934	U	0.0938	U	0.0878	U	0.0963	U	0.0878	U	0.102	U	0.0877	U	0.0929	U	0.0873	U	0.101	U	0.0877	U	0.0932	U	0.0904	U	0.0968	U	NT		0.0852	U	2.5	U	~	~	~
Fluoranthene	ND	ND	ND	ND	ND	ND	**0.135**	D	0.0468	U	**0.54**	D	0.044	U	**0.86**	D	0.044	U	0.051	U	0.044	U	**0.32**	D	0.0437	U	**15.9**	D	0.044	U	**0.27**	D	0.0453	U	**0.10**	D	NT		0.0427	U	0.05	U	100	100	1000
Fluorene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	**0.05**	JD	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	**1.27**	D	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	**0.27**		30	100	386
Hexachlorobenzene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	0.02	U	0.33	1.2	3.2
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	0.5	U	~	~	~
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Hexachloroethane	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	0.5	U	~	~	~
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	**0.06**	JD	0.0468	U	**0.16**	D	0.044	U	**0.05**	JD	0.044	U	0.051	U	0.044	U	**0.15**	D	0.0437	U	🟦 **4.13**	D	0.044	U	**0.10**	D	0.0453	U	**0.06**	JD	NT		0.0427	U	0.05	U	0.5	0.5	8.2
Isophorone	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Naphthalene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	**0.47**	D	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	**0.33**		12	100	12
Nitrobenzene	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	0.25	U	~	~	~
N-Nitrosodimethylamine	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	0.5	U	~	~	~
N-nitroso-di-n-propylamine	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
N-Nitrosodiphenylamine	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	~	~	~
Pentachlorophenol	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	0.25	U	0.8	6.7	0.8
Phenanthrene	ND	ND	ND	ND	ND	ND	**0.07**	JD	0.0468	U	**0.57**	D	0.044	U	**0.44**	D	0.044	U	0.051	U	0.044	U	**0.13**	D	0.0437	U	**15.4**	D	0.044	U	**0.129**	D	0.0453	U	**0.05**	JD	NT		0.0427	U	0.05	U	100	100	1000
Phenol	ND	ND	ND	ND	ND	ND	0.0482	U	0.0468	U	0.047	U	0.044	U	0.0483	U	0.044	U	0.051	U	0.044	U	0.0466	U	0.0437	U	0.0504	U	0.044	U	0.0467	U	0.0453	U	0.0485	U	NT		0.0427	U	2.5	U	0.33	100	0.33
Pyrene	ND	ND	ND	ND	ND	ND	**0.12**	D	0.0468	U	**0.47**	D	0.044	U	**0.70**	D	0.044	U	0.051	U	0.044	U	**0.25**	D	0.0437	U	**14.5**	D	0.044	U	**0.258**	D	**0.05**	JD	**0.10**	D	NT		0.0427	U	0.05	U	100	100	1000

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

ND=this indicates the analyte was not detected

NT=this indicates the analyte was not a target for this sample

~=this indicates that no regulatory limit has been established for this analyte

UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives

RRSCOS=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential

PGWSCO=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives-Protection of Groundwater

🟦	indicates concentration exceeds RRSCO
🟧	indicates concentration exceeds PGWSCO

Table 3
Soil Samples Analytical Results for Pesticides and PCBs
3083 Webster Avenue, Bronx, NY

Sample ID	SP-1		SP-1		SP-2		SP-2		SP-3		SP-3		SP-4		SP-4		SP-5		SP-5		SP-6		SP-6		SP-7		SP-7		SP-8		SP-8		Equipment Blank		UUSCOs	RRSCOs	PWGSCOs
Sampling Depth	0-2'		2'-4'		0-2'		10'-12'		0-2'		10'-12'		0-2'		10'-12'		0-2'		10'-12'		0-2'		2'-4'		0-2'		10'-12'		0-2'		16'-18'						
Sampling Date	7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024				
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		DI Water				
Unit	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		ug/L				
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	Result	Q	Result	Q	Result	Q			
Pesticides																																					
4,4'-DDD	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	0.0033	13	14
4,4'-DDE	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	0.0033	8.9	17
4,4'-DDT	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	0.0033	7.9	136
Aldrin	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	0.005	0.097	0.19
alpha-BHC	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	0.02	0.48	0.02
alpha-Chlordane	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	0.094	4.2	2.9
beta-BHC	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	0.036	0.36	0.09
Chlordane, total	0.0381	U	0.0377	U	0.0371	U	0.0345	U	0.0381	U	0.0348	U	0.040	U	0.0348	U	0.0369	U	0.0342	U	0.0397	U	0.0347	U	0.037	U	0.0359	U	0.0382	U	0.0339	U	0.0222	U	~	~	~
delta-BHC	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	0.04	100	0.25
Dieldrin	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00222	U	0.005	0.2	0.1
Endosulfan I	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	2.4	24	102
Endosulfan II	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	2.4	24	102
Endosulfan sulfate	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	2.4	24	1000
Endrin	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	0.014	11	0.06
Endrin aldehyde	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.0111	U	~	~	~
Endrin ketone	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.0111	U	~	~	~
gamma-BHC (Lindane)	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	0.1	1.3	0.1
gamma-Chlordane	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.0111	U	~	~	~
Heptachlor	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	0.042	2.1	0.38
Heptachlor epoxide	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	~	~	~
Methoxychlor	0.0019	U	0.00188	U	0.00186	U	0.00172	U	0.00191	U	0.00174	U	0.002	U	0.00174	U	0.00184	U	0.00171	U	0.00198	U	0.00174	U	0.00185	U	0.00179	U	0.00191	U	0.0017	U	0.00444	U	~	~	~
Toxaphene	0.190	U	0.188	U	0.186	U	0.172	U	0.191	U	0.174	U	0.200	U	0.174	U	0.184	U	0.171	U	0.198	U	0.174	U	0.185	U	0.179	U	0.191	U	0.170	U	0.111	U	~	~	~
PCBs																																					
Aroclor 1016	0.0192	U	0.019	U	0.0187	U	0.0174	U	0.0192	U	0.0176	U	0.0202	U	0.0176	U	0.0186	U	0.0173	U	0.02	U	0.0175	U	0.0187	U	0.0181	U	0.0193	U	0.0171	U	0.0556	U	~	~	~
Aroclor 1221	0.0192	U	0.019	U	0.0187	U	0.0174	U	0.0192	U	0.0176	U	0.0202	U	0.0176	U	0.0186	U	0.0173	U	0.02	U	0.0175	U	0.0187	U	0.0181	U	0.0193	U	0.0171	U	0.0556	U	~	~	~
Aroclor 1232	0.0192	U	0.019	U	0.0187	U	0.0174	U	0.0192	U	0.0176	U	0.0202	U	0.0176	U	0.0186	U	0.0173	U	0.02	U	0.0175	U	0.0187	U	0.0181	U	0.0193	U	0.0171	U	0.0556	U	~	~	~
Aroclor 1242	0.0192	U	0.019	U	0.0187	U	0.0174	U	0.0192	U	0.0176	U	0.0202	U	0.0176	U	0.0186	U	0.0173	U	0.02	U	0.0175	U	0.0187	U	0.0181	U	0.0193	U	0.0171	U	0.0556	U	~	~	~
Aroclor 1248	0.0192	U	0.019	U	0.0187	U	0.0174	U	0.0192	U	0.0176	U	0.0202	U	0.0176	U	0.0186	U	0.0173	U	0.02	U	0.0175	U	0.0187	U	0.0181	U	0.0193	U	0.0171	U	0.0556	U	~	~	~
Aroclor 1254	0.0192	U	0.019	U	0.0187	U	0.0174	U	0.0192	U	0.0176	U	0.0202	U	0.0176	U	0.0186	U	0.0173	U	0.02	U	0.0175	U	0.0187	U	0.0181	U	0.0193	U	0.0171	U	0.0556	U	~	~	~
Aroclor 1260	0.0192	U	0.019	U	0.0187	U	0.0174	U	0.0192	U	0.0176	U	0.0202	U	0.0176	U	0.0186	U	0.0173	U	0.02	U	0.0175	U	0.0187	U	0.0181	U	0.0193	U	0.0171	U	0.0556	U	~	~	~
Total PCBs	0.0192	U	0.019	U	0.0187	U	0.0174	U	0.0192	U	0.0176	U	0.0202	U	0.0176	U	0.0186	U	0.0173	U	0.02	U	0.0175	U	0.0187	U	0.0181	U	0.0193	U	0.0171	U	0.0556	U	0.1	1	1

NOTES:

Q is the Qualifier Column with definitions as follows:

U=analyte not detected at or above the level indicated

~=this indicates that no regulatory limit has been established for this analyte

UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives

RRSCOS=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential

PGWSCO=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives-Protection of Groundwater

Table 4
Soil Samples Analytical Results for Metals
3083 Webster Avenue, Bronx, NY

Sample ID	SP-1		SP-1		SP-2		SP-2		SP-3		SP-3		SP-4		SP-4		SP-5		SP-5		SP-6		SP-6		SP-7		SP-7		SP-8		SP-8		Equipment		UUSCOs	RRSCOs	PWGSCOs
Sampling Depth	0-2'		2'-4'		0-2'		10'-12'		0-2'		10'-12'		0-2'		10'-12'		0-2'		10'-12'		0-2'		2'-4'		0-2'		10'-12'		0-2'		16'-18'		Blank				
Sampling Date	7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024				
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		DI Water				
Unit	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		ug/L				
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	Result	Q	Result	Q	Result	Q			
Aluminum	**16,700**		**18,000**		**11,700**		**12,400**		**20,400**		**9,790**		**23,100**		**12,300**		**12,100**		**18,800**		**13,900**		**29,700**		**11,000**		**7,890**		**13,500**		**11,500**		55.6	U	~	~	~
Antimony	2.41	U	2.39	U	2.35	U	2.2	U	2.43	U	2.22	U	2.55	U	2.21	U	2.34	U	2.19	U	2.52	U	2.21	U	2.35	U	2.27	U	2.45	U	2.17	U	1.11	U	~	~	~
Arsenic	**5.1**		**3.31**		**8.93**		**1.6**		**4.88**		1.33	U	**4.1**		**3.07**		**5.48**		**1.78**		**8.52**		**1.78**		**4.02**		**2.3**		**4.11**		**1.75**		1.11	U	13	16	16
Barium	**129**		**59.4**		**95.6**		**80.2**		**129**		**70.6**		**190**		**47**		**120**		**109**		**228**		**392**		**89.3**		**49.2**		**138**		**111**		27.8	U	350	400	820
Beryllium	**0.36**		**0.33**		**0.30**		0.044	U	**0.50**		**0.11**		**0.36**		**0.20**		**0.17**		**0.27**		**0.55**		0.045	U	**0.09**		**0.08**		**0.26**		0.044	U	0.333	U	7.2	72	47
Cadmium	0.29	U	0.286	U	**0.988**		0.264	U	0.292	U	0.267	U	0.306	U	0.266	U	0.281	U	0.263	U	**1.64**		0.266	U	0.282	U	0.273	U	**0.53**		0.26	U	0.556	U	2.5	4.3	7.5
Calcium	**11,500**		**1,580**		**13,400**		**3,770**		**3,210**		**1,270**		**2,750**		**1,960**		**3,780**		**3,160**		**15,100**		**3,380**		**42,700**		**45,900**		**12,200**		**3,080**		131		~	~	~
Chromium, Hexavalent	0.579	U	0.573	U	0.564	U	0.528	U	0.583	U	0.533	U	0.612	U	0.531	U	0.562	U	0.527	U	0.605	U	0.531	U	0.564	U	**0.611**		0.588	U	0.521	U	10	U	1	110	19
Chromium, Trivalent	**21.90**		**31.6**		**17.5**		**29.5**		**29**		**27.9**		**55.4**		**29.7**		**27.8**		**96.7**		**26.6**		**214**		**25.50**		**16.5**		**33.5**		**32.2**		5.56	U	30	180	~
Cobalt	**8.6**		**10.8**		**7.39**		**12.8**		**9.57**		**11.8**		**13**		**11.2**		**11.4**		**13.3**		**8.14**		**26.9**		**7.42**		**5.72**		**9.2**		**11.3**		4.44	U	~	~	~
Copper	**19.2**		**28**		**50.4**		**71.8**		**17.4**		**30.2**		**31**		**23.4**		**42.5**		**28.6**		**70.90**		**29.1**		**25.8**		**18.4**		**43**		**44.1**		22.2	U	50	270	1720
Iron	**19,700**		**22,200**		**15,300**		**20,100**		**20,800**		**14,400**		**31,600**		**19,100**		**23,600**		**23,700**		**17,400**		**39,800**		**16,900**		**16,800**		**19,000**		**17,500**		278	U	~	~	~
Lead	**42.1**		**7.25**		**104**		**2.93**		**21.8**		**2.93**		**10.3**		**18.2**		**102**		**5.62**		**279**		**3.12**		**39.2**		**100**		**177**		**3.31**		5.56	U	63	400	450
Magnesium	**4,350**		**5,970**		**3,930**		**6,410**		**4,490**		**3,880**		**7,110**		**6,430**		**4,530**		**12,000**		**6,710**		**21,400**		**12,200**		**13,600**		**5,080**		**5,840**		55.6	U	~	~	~
Manganese	**282**		**318**		**210**		**345**		**619**		**338**		**164**		**471**		**303**		**362**		**342**		**198**		**283**		**1,010**		**390**		**266**		5.56	U	1600	2000	2000
Mercury	**0.11**		**0.06**		**0.16**		0.0317	U	**0.09**		0.032	U	**0.04**		0.0319	U	**0.11**		0.0316	U	**0.221**		0.0319	U	**0.14**		0.0327	U	**0.06**		0.0313	U	0.20	U	0.18	0.81	0.73
Nickel	**16.4**		**23.5**		**18.9**		**25.40**		**20.5**		**39.6**		**31.5**		**23**		**38.4**		**50.6**		**28.1**		**100**		**16.6**		**11.90**		**23.8**		**27.7**		11.1	U	30	310	130
Potassium	**1,730**		**1,300**		**2,040**		**3,250**		**1,260**		**2,760**		**2,070**		**1,760**		**2,080**		**2,120**		**1,660**		**9,110**		**2,930**		**2,390**		**2,390**		**2,930**		207		~	~	~
Selenium	2.41	U	2.39	U	2.35	U	2.2	U	2.43	U	**2.22**	U	2.55	U	2.21	U	2.34	U	**2.19**	U	2.52	U	2.21	U	2.35	U	2.27	U	2.45	U	2.17	U	1.11	U	3.9	180	4
Silver	0.486	U	0.481	U	0.474	U	0.443	U	0.49	U	0.448	U	0.514	U	0.446	U	0.472	U	0.442	U	0.508	U	0.446	U	0.474	U	0.458	U	0.494	U	0.438	U	5.56	U	2	180	8.3
Sodium	**327**		**232**		**294**		**279**		**237**		**150**		**362**		**173**		**245**		**233**		**463**		**730**		**258**		**141**		**333**		**373**		556	U	~	~	~
Thallium	2.41	U	2.39	U	2.35	U	2.2	U	2.43	U	2.22	U	2.55	U	2.21	U	2.34	U	2.19	U	2.52	U	2.21	U	2.35	U	2.27	U	2.45	U	2.17	U	1.11	U	~	~	~
Vanadium	**32.1**		**39.9**		**25.8**		**42.2**		**38.5**		**34.3**		**75.6**		**33.9**		**34**		**39.6**		**34.7**		**143**		**32.2**		**21.8**		**39**		**36.5**		11.1	U	~	~	~
Zinc	**83.6**		**73.8**		**346**		**47.9**		**57.1**		**44.5**		**63.7**		**43**		**112**		**62.1**		**190**		**116**		**73.9**		**44.2**		**115**		**39.1**		27.8	U	109	10000	2480

NOTES:

Q is the Qualifier Column with definitions as follows:

U=analyte not detected at or above the level indicated

NT=this indicates the analyte was not a target for this sample

~=this indicates that no regulatory limit has been established for this analyte

UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives

RRSCOS=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential

PGWSCO=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives-Protection of Groundwater

▨	= indicates concentration exceeds NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives
🟦	= indicates concentration exceeds NYSDEC Part 375 Restricted Use Soil Cleanup Objectives Restricted Residential

Table 5
Soil Samples Analytical Results for PFAS
3083 Webster Avenue, Bronx, NY

Sample ID	SP-4		SP-4		SP-8		SP-8		Equipment Blank		Soil Guidance Values (1)	
Sampling Depth	0-2'		10'-12'		0-2'		10'-12'					
Sampling Date	7/24/2024		7/24/2024		7/24/2024		7/24/2024		7/24/2024			
Client Matrix	Soil		Soil		Soil		Soil		DI Water			
Unit	mg/Kg		mg/Kg		mg/Kg		mg/Kg		ug/L		Unrestricted Site Use	Restricted Site Use
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q		
11CL-PF3OUdS	0.00035	U	0.00033	U	0.00037	U	0.00032	U	0.00131	U	~	~
1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	0.00084	U	0.00079	U	0.00089	U	0.00078	U	0.00195	U	~	~
1H,1H,2H,2H-Perfluorohexanesulfonic acid (4:2 FTS)	0.00066	U	0.00063	U	0.0007	U	0.00062	U	0.0017	U	~	~
1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)	0.00066	U	0.00063	U	0.0007	U	0.00062	U	0.00101	U	~	~
3-Perfluoroheptyl propanoic acid (FHpPA)	0.00167	U	0.00158	U	0.00176	U	0.00155	U	0.00898	U	~	~
3-Perfluoropentyl propanoic acid (FPePA)	0.00234	U	0.00221	U	0.00247	U	0.00217	U	0.00695	U	~	~
3-Perfluoropropyl propanoic acid (FPrPA)	0.00071	U	0.00067	U	0.00075	U	0.00066	U	0.00193	U	~	~
9CL-PF3ONS	0.00027	U	0.00026	U	0.00029	U	0.00025	U	0.00066	U	~	~
ADONA	0.00019	U	0.00018	U	0.0002	U	0.00018	U	0.0005	U	~	~
HFPO-DA (Gen-X)	0.00068	U	0.00064	U	0.00071	U	0.00063	U	0.00306	U	~	~
N-EtFOSA	0.00022	U	0.00021	U	0.00023	U	0.00021	U	0.00171	U	~	~
N-EtFOSAA	0.00022	U	0.0002	U	0.00023	U	0.00020	U	0.00098	U	~	~
N-EtFOSE	0.00078	U	0.00073	U	0.00082	U	0.00072	U	0.00379	U	~	~
N-MeFOSA	0.0002	U	0.00019	U	0.00021	U	0.00019	U	0.0015	U	~	~
N-MeFOSAA	0.00017	U	0.00016	U	0.00017	U	0.00015	U	0.00075	U	~	~
N-MeFOSE	0.00068	U	0.00064	U	0.00072	U	0.00063	U	0.00379	U	~	~
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	0.00016	U	0.00015	U	0.00016	U	0.00014	U	0.00047	U	~	~
Perfluoro-1-decanesulfonic acid (PFDS)	0.00021	U	0.0002	U	0.00022	U	0.00020	U	0.00125	U	~	~
Perfluoro-1-heptanesulfonic acid (PFHpS)	0.00017	U	0.00016	U	0.00018	U	0.00016	U	0.00086	U	~	~
Perfluoro-1-nonanesulfonic acid (PFNS)	0.00014	U	0.00013	U	0.00015	U	0.00013	U	0.00082	U	~	~
Perfluoro-1-octanesulfonamide (FOSA)	0.00016	U	0.00015	U	0.00017	U	0.00015	U	0.00084	U	~	~
Perfluoro-1-pentanesulfonate (PFPeS)	0.00018	U	0.00017	U	0.00018	U	0.00016	U	0.00072	U	~	~
Perfluoro-3,6-dioxaheptanoic acid (NFDHA)	0.00022	U	0.0002	U	0.00023	U	0.0002	U	0.00203	U	~	~
Perfluoro-4-oxapentanoic acid (PFMPA)	0.00007	U	0.00007	U	0.00007	U	0.00006	U	0.00024	U	~	~
Perfluoro-5-oxahexanoic acid (PFMBA)	0.00011	U	0.0001	U	0.00011	U	0.00010	U	0.00035	U	~	~
Perfluorobutanesulfonic acid (PFBS)	0.00012	U	0.00012	U	0.00013	U	0.00012	U	0.00045	U	~	~
Perfluorodecanoic acid (PFDA)	0.00021	U	0.0002	U	0.00022	U	0.00020	U	0.00071	U	~	~
Perfluorododecanesulfonic acid (PFDoS)	0.00019	U	0.00018	U	0.0002	U	0.00018	U	0.00088	U	~	~
Perfluorododecanoic acid (PFDoA)	0.00018	U	0.00017	U	0.00019	U	0.00017	U	0.00084	U	~	~
Perfluoroheptanoic acid (PFHpA)	0.00012	U	0.00011	U	0.00012	U	0.00011	U	0.00067	U	~	~
Perfluorohexanesulfonic acid (PFHxS)	0.0002	U	0.00019	U	0.00021	U	0.00019	U	0.00065	U	~	~
Perfluorohexanoic acid (PFHxA)	0.00006	U	0.00006	U	0.00006	U	0.00005	U	0.00033	U	~	~
Perfluoro-n-butanoic acid (PFBA)	0.00012	U	0.00012	U	0.00013	U	0.00011	U	0.00031	U	~	~
Perfluorononanoic acid (PFNA)	0.00021	U	0.0002	U	0.00022	U	0.0002	U	0.00049	U	~	~
Perfluorooctanesulfonic acid (PFOS)	0.00019	U	0.00018	U	**0.00039**		0.00017	U	0.00078	U	0.00088	0.044
Perfluorooctanoic acid (PFOA)	0.00019	U	0.00018	U	0.0002	U	0.00018	U	0.0004	U	0.00066	0.033
Perfluoropentanoic acid (PFPeA)	0.00012	U	0.00012	U	0.00013	U	0.00011	U	0.00022	U	~	~
Perfluorotetradecanoic acid (PFTA)	0.00012	U	0.00011	U	0.00012	U	0.00011	U	0.00066	U	~	~
Perfluorotridecanoic acid (PFTrDA)	0.00014	U	0.00013	U	0.00015	U	0.00013	U	0.0007	U	~	~
Perfluoroundecanoic acid (PFUnA)	0.00022	U	0.00021	U	0.00023	U	0.00021	U	0.00107	U	~	~

NOTES:

Q is the Qualifier Column with definitions as follows:

U=analyte not detected at or above the level indicated

~=this indicates that no regulatory limit has been established for this analyte

(1)= NYSDEC Guidance Values for Anticipated Site Use in accordance with Sampling, Analysis, And Assessment Of Per- And Polyfluoroalkyl Substances (PFAS) - April 2023

Table 6
Groundwater Sample Analytical Results for VOCs
3083 Webster Avenue, Bronx, NY

Sample ID	SB-2	SB-3	MW-1	MW-2	MW-3	MW-4	MW-5	GW-1	GQS
Depth to Water	16.5'	26'	24.55'	21.19'	16.27'	24.37'	22.43'	20'	
Sampling Date	10/8/2009	10/8/2009	11/9/2009	11/9/2009	11/9/2009	11/9/2009	11/9/2009	9/7/2021	
Client Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
Compound	Result	Result	Result	Result	Result	Result	Result	Result	
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	
1, 1, 1,2-Tetrachloroethane	ND	ND	NT	NT	NT	NT	NT	NT	5
1, 1, 2, 2-Tetrachloroethane	ND	ND	NT	NT	NT	NT	NT	NT	5
1, 1,2-Trichloroethane	ND	ND	NT	NT	NT	NT	NT	NT	1
1, 1-Dichloroethane	ND	ND	NT	NT	NT	NT	NT	NT	5
1, 1-Dichloroethene	ND	ND	NT	NT	NT	NT	NT	NT	5
1, 1-dichloropropene	ND	ND	NT	NT	NT	NT	NT	NT	1
1, 2, 3-Trichlorobenzene	ND	ND	NT	NT	NT	NT	NT	NT	5
1, 2-Dichloropropane	ND	ND	NT	NT	NT	NT	NT	NT	1
1, 3, 5-Trimethylbenzene	ND	ND	ND	ND	ND	ND	ND	**980**	5
1,1, 1-Trichloroethane	ND	ND	NT	NT	NT	NT	NT	NT	5
1,2,3-Trichloropropane	ND	ND	NT	NT	NT	NT	NT	NT	0.04
1,2,4-Trichlorobenzene	ND	ND	NT	NT	NT	NT	NT	NT	5
1,2,4-Trimethylbenzene	ND	ND	ND	ND	ND	ND	ND	**3,700**	5
1,2-Dibromo-3-chloropropa	ND	ND	NT	NT	NT	NT	NT	NT	0.04
1,2-Dibromoethane	ND	ND	NT	NT	NT	NT	NT	NT	0.0006
1,2-Dichlorobenzene	ND	ND	NT	NT	NT	NT	NT	NT	3
1,2-Dichloroethane	ND	ND	NT	NT	NT	NT	NT	NT	0.6
1,3-Dichlorobenzene	ND	ND	NT	NT	NT	NT	NT	NT	3
1,3-dichloropropane	ND	ND	NT	NT	NT	NT	NT	NT	~
1,4-Dichlorobenzene	ND	ND	NT	NT	NT	NT	NT	NT	3
2, 2-dichloropropane	ND	ND	NT	NT	NT	NT	NT	NT	~
2-Butanone (MEK)	ND	ND	NT	NT	NT	NT	NT	NT	50
2-Hexanone	ND	ND	NT	NT	NT	NT	NT	NT	50
4-Methyl-2-pentanone	ND	ND	NT	NT	NT	NT	NT	NT	~
Acetone	**14.5**	ND	NT	NT	NT	NT	NT	NT	50
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	1
Bromobenzene	ND	ND	NT	NT	NT	NT	NT	NT	~
Bromochloromethane	ND	ND	NT	NT	NT	NT	NT	NT	5
Bromodichloromethane	ND	ND	NT	NT	NT	NT	NT	NT	50
Bromoform	ND	ND	NT	NT	NT	NT	NT	NT	50
Bromomethane	ND	ND	NT	NT	NT	NT	NT	NT	5
Carbon tetrachloride	ND	ND	NT	NT	NT	NT	NT	NT	5
Carbon disulfide	ND	ND	NT	NT	NT	NT	NT	NT	~
Chlorobenzene	ND	ND	NT	NT	NT	NT	NT	NT	5
Chloroethane	ND	ND	NT	NT	NT	NT	NT	NT	5
Chloroform	**1.9**	**1.5**	NT	NT	NT	NT	NT	NT	7
Chloromethane	ND	ND	NT	NT	NT	NT	NT	NT	5
cis-1, 2-Dichloroethene	ND	1.1	NT	NT	NT	NT	NT	NT	5
cis-1, 3-dichloropropene	ND	ND	NT	NT	NT	NT	NT	NT	0.4
Dibromochloromethane	ND	ND	NT	NT	NT	NT	NT	NT	50
Dichlorodifluoromethane	ND	ND	NT	NT	NT	NT	NT	NT	5
Ethyl benzene	ND	ND	ND	ND	ND	**2.7**	ND	**400**	5
Hexachlorobutadiene	ND	ND	NT	NT	NT	NT	NT	NT	0.5
Iodomethane	ND	ND	NT	NT	NT	NT	NT	NT	~
Isopropyl benzene	ND	ND	ND	ND	ND	ND	ND		5
Methyl Tert Butyl Ether	ND	ND	ND	ND	ND	ND	ND	ND	10
Methylene bromide	ND	ND	NT	NT	NT	NT	NT	NT	~
Methylene chloride	ND	ND	NT	NT	NT	NT	NT	NT	5
m,p-Xylene	ND	ND	ND	ND	ND	**1**	ND	**1,500**	5
Naphthalene	ND	ND	ND	ND	ND	ND	ND	**420**	10
n-Butylbenzene	ND	ND	ND	ND	ND	ND	ND	**59**	5
n-Propylbenzene	ND	ND	ND	ND	ND	ND	ND	**480**	5
o-Chlorotoluene	ND	ND	NT	NT	NT	NT	NT	NT	~
o-Xylene	ND	ND	ND	ND	ND	ND	ND	**92**	5
p-Chlorotoluene	ND	ND	NT	NT	NT	NT	NT	NT	5
p-Isopropyltoluene	ND	ND	ND	ND	ND	ND	ND	**21**	5
sec-Butylbenzene	ND	ND	ND	ND	ND	ND	ND	**62**	5
Styrene	ND	ND	NT	NT	NT	NT	NT	NT	~
tert-Butylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	ND	ND	NT	NT	NT	NT	NT	NT	5
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	5
trans-1, 2-Dichloroethene	ND	ND	NT	NT	NT	NT	NT	NT	5
trans-1, 3-dichloropropene	ND	ND	NT	NT	NT	NT	NT	NT	5
Trichloroethene	ND	ND	NT	NT	NT	NT	NT	NT	0.4
Trichlorofluoromethane	ND	ND	NT	NT	NT	NT	NT	NT	2
Vinyl Acetate	ND	ND	NT	NT	NT	NT	NT	NT	~
Vinyl chloride	ND	ND	NT	NT	NT	NT	NT	NT	2
Xylene (total)	ND	ND	ND	ND	ND	**1**	ND	**1,592**	5

NOTES:

ND = this indicates the analyte was not detected

NT = this indicates the analyte was not a target for this sample

~ = this indicates that no regulatory limit has been established for this analyte

GQS = NYSDEC 6NYCRR Part 703.5 Class GA groundwater quality standards

▨ = indicates concentration exceeds GQS

Table 7
Groundwater Sample Analytical Results for SVOCs
3083 Webster Avenue, Bronx, NY

Sample ID	GW-1	GQS
Depth to Water	20'	
Sampling Date	9/7/2021	
Client Matrix	Groundwater	
Unit	µg/L	
2-Methylnaphthalene	**190**	-
Acenaphthene	1.8	20
Acenaphthylene	0.77	-
Anthracene	1.1	50
Benz(a)anthracene	**0.24**	0.002
Benzo(a)pyrene	**0.15**	0.002
Benzo(b)fluoranthene	**0.14**	0.002
Benzo(ghi)perylene	ND	-
Benzo(k)fluoranthene	**0.07**	0.002
Chrysene	**0.16**	0.002
Dibenz(a,h)anthracene	ND	-
Fluoranthene	0.67	50
Fluorene	5	50
Indeno(1,2,3-cd)pyrene	0.12	0.002
Naphthalene	**300**	10
Phenanthrene	5.7	50
Pyrene	1.3	50

NOTES:

~ = this indicates that no regulatory limit has been established for this analyte

ND = Not detected

GQS = NYSDEC 6NYCRR Part 703.5 Class GA groundwater quality standards

▨ = indicates concentration exceeds GQS

Table 8
Soil Vapor Samples Analytical Results
3083 Webster Avenue, Bronx, NY

Sample ID	SV-1		SV-2A		SV-2B		SV-3		SV-4A		SV-4B		SV-5	
Sample Depth	12 feet		6 feet		12 feet		12 feet		6 feet		12 feet		12 feet	
Sampling Date	7/30/2024		7/30/2024		7/30/2024		7/30/2024		7/30/2024		7/30/2024		7/30/2024	
Client Matrix	Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor	
Unit	ug/m3		ug/m3		ug/m3		ug/m3		ug/m3		ug/m3		ug/m3	
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
1,1,1,2-Tetrachloroethane	1.2	U	2.6	U	2.5	U	1.2	U	4.4	U	1.1	U	2.3	U
1,1,1-Trichloroethane	**1.6**	D	2	U	2	U	0.96	U	3.5	U	0.87	U	1.8	U
1,1,2,2-Tetrachloroethane	1.2	U	2.6	U	2.5	U	1.2	U	4.4	U	1.1	U	2.3	U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	1.4	U	2.9	U	2.8	U	1.4	U	5	U	1.2	U	2.6	U
1,1,2-Trichloroethane	0.98	U	2	U	2	U	0.96	U	3.5	U	0.87	U	1.8	U
1,1-Dichloroethane	0.73	U	1.5	U	1.5	U	0.71	U	2.6	U	0.65	U	1.3	U
1,1-Dichloroethylene	0.18	U	0.37	U	0.37	U	0.17	U	0.6	U	0.16	U	0.33	U
1,2,4-Trichlorobenzene	1.3	U	2.8	U	2.7	U	1.3	U	4.8	U	1.2	U	2.5	U
1,2,4-Trimethylbenzene	**9**	D	**8.7**	D	**6.9**	D	**8.6**	D	**6.7**	D	**8.7**	D	**11**	D
1,2-Dibromoethane	1.4	U	2.9	U	2.8	U	1.4	U	5	U	1.2	U	2.6	U
1,2-Dichlorobenzene	1.1	U	2.3	U	2.2	U	1.1	U	3.9	U	0.96	U	2	U
1,2-Dichloroethane	0.73	U	1.5	U	1.5	U	0.71	U	2.6	U	0.65	U	1.3	U
1,2-Dichloropropane	0.83	U	1.7	U	1.7	U	0.82	U	3	U	0.74	U	1.5	U
1,2-Dichlorotetrafluoroethane	1.3	U	2.6	U	2.6	U	1.2	U	4.5	U	1.1	U	2.3	U
1,3,5-Trimethylbenzene	**3.3**	D	**3.1**	D	**2.5**	D	**3.3**	D	3.2	U	**3**	D	**3.9**	D
1,3-Butadiene	1.2	U	2.5	U	2.5	U	1.2	U	4.3	U	1.1	U	2.2	U
1,3-Dichlorobenzene	1.1	U	2.3	U	2.2	U	1.1	U	3.9	U	0.96	U	2	U
1,3-Dichloropropane	0.83	U	1.7	U	1.7	U	0.82	U	3	U	0.74	U	1.5	U
1,4-Dichlorobenzene	1.1	U	2.3	U	2.2	U	1.1	U	3.9	U	0.96	U	2	U
1,4-Dioxane	1.3	U	2.7	U	2.7	U	1.3	U	4.7	U	1.2	U	2.4	U
2,2,4-Trimethylpentane	**0.67**	D	**1.1**	D	0.86	U	**0.99**	D	**1.5**	J	**0.52**	D	**1.2**	D
2-Butanone	**5.6**	D	**9.5**	D	**6.7**	D	**8.2**	D	**11**	D	**3**	D	**7.4**	D
2-Hexanone	**1.6**	D	3.1	U	3	U	**2.5**	D	5.3	U	1.3	U	2.7	U
3-Chloropropene	2.8	U	5.9	U	5.8	U	2.8	U	10	U	2.5	U	5.2	U
4-Methyl-2-pentanone	0.74	U	1.5	U	1.5	U	**1.9**	D	2.7	U	0.66	U	1.4	U
Acetone	**180**	BD	**200**	BD	**160**	BD	**190**	BD	**300**	BD	**45**	BD	**90**	BD
Acrylonitrile	0.39	U	**10**	D	**10**	D	0.38	U	1.4	U	0.35	U	0.72	U
Benzene	**1.2**	D	**1.7**	D	**1.8**	D	**0.62**	D	2.1	U	**0.51**	D	**1.2**	D
Benzyl chloride	0.93	U	1.9	U	1.9	U	0.91	U	3.4	U	0.83	U	1.7	U
Bromodichloromethane	1.2	U	**14**	D	2.5	U	1.2	U	4.3	U	1.1	U	2.2	U
Bromoform	1.9	U	3.9	U	3.8	U	1.8	U	6.7	U	1.7	U	3.4	U
Bromomethane	0.7	U	1.5	U	1.4	U	0.69	U	2.5	U	0.62	U	1.3	U
Carbon disulfide	0.56	U	**3.4**	D	**1.7**	D	**7.5**	D	2	U	**0.5**	D	**1.6**	D
Carbon tetrachloride	0.28	U	0.59	U	0.6	U	0.28	U	1	U	0.25	U	0.52	U
Chlorobenzene	0.83	U	1.7	U	1.7	U	0.81	U	3	U	0.74	U	1.5	U
Chloroethane	0.48	U	0.99	U	1.0	U	0.47	U	1.7	U	0.42	U	0.88	U
Chloroform	0.88	U	**590**	D	**23**	D	0.86	U	3.2	U	0.78	U	1.6	U
Chloromethane	**1.4**	D	**0.78**	D	0.76	U	**0.73**	D	1.3	U	0.33	U	**1**	D
cis-1,2-Dichloroethylene	0.18	U	**0.6**	D	0.37	U	0.17	U	0.6	U	0.16	U	0.33	U
cis-1,3-Dichloropropylene	0.82	U	1.7	U	1.7	U	0.8	U	2.9	U	0.73	U	1.5	U
Cyclohexane	0.62	U	1.3	U	1.3	U	0.61	U	2.2	U	0.55	U	1.1	U
Dibromochloromethane	1.5	U	3.2	U	3.2	U	1.5	U	5.5	U	1.4	U	2.8	U
Dichlorodifluoromethane	**2.6**	D	**3**	D	**2.7**	D	**3**	D	3.2	U	**2.7**	D	**2.8**	D
Ethyl acetate	1.3	U	2.7	U	2.7	U	1.3	U	4.7	U	1.2	U	2.4	U
Ethyl Benzene	**2.6**	D	**3.1**	D	**2.1**	D	**6.7**	D	**2.8**	D	**1.6**	D	**3.8**	D
Hexachlorobutadiene	1.9	U	4	U	3.9	U	1.9	U	6.9	U	1.7	U	3.6	U
Isopropanol	**3.6**	D	**2.7**	D	**3.3**	D	**3**	D	**4.1**	D	**1**	D	**1.7**	D
Methyl Methacrylate	0.74	U	1.5	U	1.5	U	0.72	U	2.7	U	0.66	U	1.4	U
Methyl tert-butyl ether (MTBE)	0.65	U	1.4	U	1.3	U	0.64	U	2.3	U	0.58	U	1.2	U
Methylene chloride	1.3	U	2.6	U	2.6	U	1.2	U	4.5	U	1.1	U	2.3	U
Naphthalene	1.9	U	3.9	U	3.9	U	1.9	U	6.8	U	1.7	U	3.5	U
n-Heptane	**0.81**	D	**1.5**	D	1.5	U	**0.87**	D	2.7	U	0.66	U	1.4	U
n-Hexane	0.64	U	**1.7**	D	1.3	U	0.62	U	2.3	U	0.56	U	1.2	U
o-Xylene	**7**	D	**8.3**	D	**6.4**	D	**15**	D	**7.6**	D	**5.2**	D	**10**	D
p- & m- Xylenes	**13**	D	**16**	D	**10**	D	**30**	D	**13**	D	**8.2**	D	**18**	D
p-Ethyltoluene	**8.7**	D	**8.1**	D	**5.5**	D	**7.5**	D	**5.7**	D	**6.5**	D	**9.2**	D
Propylene	**1.2**	D	**3.2**	D	**2.7**	D	**1.5**	D	**1.7**	D	**3.9**	D	**4.4**	D
Styrene	**0.84**	D	1.6	U	1.6	U	**0.75**	D	2.8	U	0.68	U	1.4	U
Tetrachloroethylene	**260**	D	**1,100**	D	**970**	D	**160**	D	**150**	D	**86**	D	**890**	D
Tetrahydrofuran	**1.2**	D	**3.3**	D	2.2	U	**2.2**	D	3.8	U	**1.6**	D	**2.3**	D
Toluene	**4.5**	D	6.2	D	**4.5**	D	**4.8**	D	**6.1**	D	**2.5**	D	**7.7**	D
trans-1,2-Dichloroethylene	0.71	U	1.5	U	1.5	U	0.7	U	2.6	U	0.63	U	1.3	U
trans-1,3-Dichloropropylene	0.82	U	1.7	U	1.7	U	0.8	U	2.9	U	0.73	U	1.5	U
Trichloroethylene	0.24	U	**0.61**	D	0.5	U	0.24	U	0.87	U	0.22	U	**1.3**	D
Trichlorofluoromethane (Freon 11)	**1.8**	D	2.1	U	2.1	U	**1.9**	D	3.6	U	**1.6**	D	1.9	U
Vinyl acetate	0.63	U	1.3	U	1.3	U	0.62	U	2.3	U	0.56	U	1.2	U
Vinyl bromide	0.79	U	1.6	U	1.6	U	0.77	U	2.8	U	0.7	U	1.5	U
Vinyl Chloride	0.23	U	0.48	U	0.47	U	0.23	U	0.83	U	0.2	U	0.43	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

~=this indicates that no regulatory limit has been established for this analyte

Bolded indicates concentration is greater than MDL

APPENDICES

APPENDIX A

HASP

HEALTH & SAFETY PLAN

3083 Webster Ave BCP Site
3083 Webster Avenue
Bronx NY 10467
Block 3331, Lot 47

NYSDEC BCP Site Number: TBD

Table of Content

Figure

Attachment

1.0 Introduction

The HASP has been prepared in conformance with applicable regulations, safe work practices and the project's requirements. It addresses those activities associated with the Phase II Investigation Work Plan (IWP) developed for 3083 Webster Ave BCP Site located at 3083 Webster Avenue in Bronx, New York. These activities consist of the installation and sampling of soil probes and monitoring wells and the in-field characterization of soil samples. The Project Manager (PM), Site Safety Officer (SSO) and HydroTech field staff will implement the Plan during site work. Compliance with this HASP is required of all persons and third parties who perform fieldwork for this project. Assistance in implementing this HASP can be obtained from the Hydro Tech's SSO. The content of this HASP may change or undergo revision based upon additional information that is made available to health and safety personnel, monitoring results or changes in the technical scope of work. Any changes proposed must be reviewed by the SSO.

SCOPE OF WORK

The Scope of Work activities will include the following:

- Installation of soil probes and monitoring wells
- Characterization and collection of soil and groundwater samples

EMERGENCY NUMBERS

Contact	Phone Number
NYC Health/North Central Bronx Hospital	718-519-5000
New York City EMS	911
NYPD	911
NYFD	911
National Response Center	800-424-8802
Poison Information Center	800-562-8816
Chemtree	800-424-9555

Project Management/Health and Safety Personnel

Title	Contact	Phone Number	Cell Phone
PM	Paul I. Matli	(718) 636-0800	(631) 241-7165
QAO	Ruijie Xu	(718) 636-0800	(631) 229-7090
Site Safety Officer	Jason Alvarez		(914) 450-8098

Directions to NYC Health/North Central Bronx Hospital (See Figure 1)

Upon leaving the Site, head southwest on Webster Avenue toward East 202nd Street. Turn right onto East Mosholu Parkway North and then turn right onto Steuben Avenue. Turn left onto East 210 Street and then right onto Kossuth Avenue. Arrive to the hospital on the right.

2.0 Health and Safety Staff

This section briefly describes the personnel and their health and safety responsibilities for the:

Project Manager (PM)

- Has the overall responsibility for the health and safety of site personnel
- Ensures that adequate resources are provided to the field health and safety staff to carry out their responsibilities as outlined below.
- Ensures that fieldwork is scheduled with adequate personnel and equipment resources to complete the job safely.
- Ensures that adequate telephone communication between field crews and emergency response personnel is maintained.
- Ensures that field site personnel are adequately trained and qualified to work at the Site.

SITE SAFETY OFFICER (SSO)

- Documents individual temperature screening and any other observations for every field personnel in a daily log.
- Directs and coordinates health and safety monitoring activities pertaining to the performance of all aspects of fieldwork.
- Conduct a briefing on social distancing and other specific field training prior to personnel and/or subcontractors proceeding to work.
- Ensures that field teams utilize proper personal protective equipment (PPE).
- Conduct and document periodic safety briefings; ensures that field team members comply with this HASP.
- Completes and maintains Accident/Incident Report Forms.
- Notifies Hydro Tech corporate administration of all accidents/incidents.
- Determines upgrade or downgrade of PPE based on site conditions and/or downgrade of PPE based on site conditions and/or real-time monitoring results.
- Ensures that monitoring instruments are calibrated daily or as determined by manufactured suggested instructions.
- Maintains health and safety field logbooks.
- Develops and ensures implementation of the HASP.
- Approves revised or new safety protocols for field operations.
- Coordinates revisions of this HASP with field personnel and the SSO Division Contracting Officer.

- Responsible for the development of new company safety protocols and procedures and resolution of any outstanding safety issues which may arise during the conduction of site work.
- Reviews personnel and subcontractors current and up-to-date medical examination and acceptability of health and safety training.

FIELD PERSONNEL AND SUBCONTRACTORS (IF ANY)

- Reports any unsafe or potentially hazardous conditions to the SSO.
- Maintains knowledge of the information, instructions and emergency response actions contained in this HASP.
- Comply with rules, regulations and procedures as set forth in this HASP and any revisions that are instituted.
- Prevents admittance to work sites by unauthorized personnel.

3.0 Chemical & Waste Description/Characterization

The following list of chemicals is based on the materials that are believed to be formerly stored onsite:

- Gasoline
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Arsenic
- Lead
- Mercury
- Tetrachloroethylene
- Trichloroethylene
- Cis-1,2-Dichloroethyelene
- Vinyl Chloride

Attachment A contains information regarding assessing health risks from contaminants of concern.

The following information references are presented in order to identify the properties and hazards of the materials that may/will be encountered at the Site.

- Dangerous Properties of Industrial Materials - Sax
- Chemical Hazards of the Workplace - Proctor/Hughes
- Condensed Chemical Dictionary – Hawley
- Rapid Guide to Hazardous Chemical in the Workplace - Lewis 1990.
- NIOSH Guide to Chemical Hazards - 1990
- ACGIH TLV Values and Biological Exposure Indices - 1991-1992

4.0 Hazard Assessment

The potential hazards associated with planned site activities include chemical, physical and biological hazards. This section discusses those hazards that are anticipated to be encountered during the activities listed in the scope of work.

The potential to encounter chemical hazards is dependent upon the work activity performed (invasive or non-invasive), the duration and location of the work activity. Such hazards could include inhalation or skin contact with chemicals that could cause dermatitis, skin burn, being overcome by vapors or asphyxiation. In addition, the handling of contaminated materials and chemicals could result in fire and/or explosion.

The potential to encounter physical hazards during site work includes heat stress, exposure to excessive noise, loss of limbs, being crushed, head injuries, cuts and bruises and other physical hazards due to motor vehicle operation, heavy equipment and power tools.

CHEMICAL HAZARDS

The potential for personnel and subcontractors to come in contact with chemical hazards may occur during the following tasks:

- Installation of soil probes, monitoring wells
- Removal of any contaminated materials during sampling

Exposure Pathways
Exposure to these compounds during ongoing activities may occur through inhalation of contaminated dust particles, inhalation of volatile (VOC) and semi-volatile (SVOC) vapor fume compounds, by way of dermal absorption, and accidental ingestion of the contaminant by either direct or indirect cross contamination activities (eating, smoking, poor hygiene). Indirectly, inhalation of contaminated dust particles (VOCs, SVOCs) can occur during adverse weather conditions (high or changing wind directions) or during operations that may generate airborne dust such as excavation, and sampling activities. Dust control measures such as applying water to roadways and work sites will be implemented, where visible dust is generated from non-contaminated and contaminated soils. Where dust control measures are not feasible or effective, respiratory protection will be used.

Additional Precautions
Dermal absorption or skin contact with chemical compounds is possible during invasive activities at the Site, including removal of product, excavation of tanks, and handling of contaminated soils. The use of PPE in accordance with Section 9.2 and strict adherence to proper decontamination procedures should significantly reduce the risk of skin contact.

The potential for accidental ingestion of potentially hazardous chemicals is expected to be remote, when good hygiene practices are used.

PHYSICAL HAZARDS

A variety of physical hazards may be present during Site activities. These hazards are similar to those associated with any construction type project. These physical hazards are due to motor vehicles, and heavy equipment operation, the use of improper use of power and hand tools, misuse of pressurized cylinders, walking on objects, tripping over objects, working on surfaces which have the potential to promote falling, mishandling and improper storage of solid and hazardous materials, skin burns, crushing of fingers, toes, limbs, hit on the head by falling objects or hit one's head due to not seeing the object of concern, temporary loss of one's hearing and/or eyesight. Theses hazards are not unique and are generally familiarly to most hazardous waste site workers at construction sites. Additional task specific safety requirements will be covered during safety briefings.

Noise

Noise is a potential hazard associated with operation of heavy equipment, power tools, pumps and generators. High noise operators will be evaluated at the discretion of the SSO. Employees with an 8-hour time weighted average exposure exceeding 85 decibels (db) will be included in the hearing conservation program in accordance with 29 CFR 1910.85.

It is mandated that employees working around heavy equipment or using power tools that dispense noise levels exceeding 95 db are to wear hearing protection that shall consist of earplugs and earphones. This is particularly relevant as the jet engines of modern airplanes can give sound level readings of greater than 110 db.

Heat/Cold Stress

Extremes in temperature and the effects of hard work in impervious clothing can result in heat stress and/or hypothermia. The human body is designed to function at a certain internal temperature. When metabolism or external sources (fire, hot summer day, winter weather, etc.) cause the body temperature to rise or fall excessively, the body seeks to protect itself by triggering cooling/warming mechanisms. Profuse sweating is an example of a cooling mechanism, while uncontrollable shivering is an example of a warming mechanism. The SSO monitor the temperature to determine potential adverse effects the weather can cause on site personnel.

Protective clothing worn to guard against chemical contact effectively stops the evaporation of perspiration. Thus, the use of protective clothing increases heat stress problems. Cold stress can easily occur in winter with sub-freezing ambient temperatures. Workers in protective garments may heat-up and sweat, only to rapidly cool once out of the tank and the PPE. The major disorders due to heat stress are heat

cramps, heat exhaustion and heat stroke.
HEAT CRAMPS are painful spasms that occur in the skeletal muscles of workers who sweat profusely in the heat and drink large quantities of water but fail to replace the body's lost salts or electrolytes. Drinking water while continuing to lose salt tends to dilute the body's extra cellular fluids. Soon water seeps by osmosis into active muscles and causes pain. Muscles fatigued from work as usually most susceptible to cramps.

HEAT EXHAUSTION is characterized by extreme weakness or fatigue, dizziness, nausea, and headache. In serious cases, a person may vomit or lose consciousness. The skin is clammy and moist, complexion pale or flushed, and body temperature normal or slightly higher than normal. Treatment is rest in a cool place and replacement of body water lost by perspiration. Mild cases may recover spontaneously with this treatment; severe cases may require care for several days. There are no permanent effects.

HEAT STROKE is a very serious condition caused by the breakdown of the body's heat regulating mechanisms. The skin is very dry and hot with red mottled or bluish appearance. Unconsciousness, mental confusion or convulsions may occur. Without quick and adequate treatment, the result can be death or permanent brain damage. Get medical assistance quickly! As first aid treatment, the person should be moved to a cool place. Soaking the person's clothes with water and fanning them should reduce body heat artificially, but not too rapidly.

Steps that can be taken to reduce heat stress are:

- Acclimatize the body. Allow a period of adjustment to make further heat exposure endurable.
- Drink more liquids to replace body water lost during sweating.
- Rest is necessary and should be conducted under the monitoring condition from the SSO and the effect personnel physiological state.
- Wearing personal cooling devices. There are two basic designs; units with pockets for holding frozen packets and units that circulate a cooling fluid from a reservoir through tubes to different parts of the body. Both designs can be in the form of a vest, jacket or coverall. Some circulating units also have a copy for cooling the head.

Cold temperatures can cause problems. The severe effects are FROSTBITE and HYPOTHERMIA.

FROSTBITE is the most common injury resulting from exposure to cold. The extremities of the body are often affected. The signs of frostbite are:

- The skin turns white or grayish-yellow
    A. Pain is sometimes felt early but subsides later. Often there is no pain

- The affected part feels intensely cold and numb

Shivering, numbness, drowsiness, muscular weakness and a low internal body temperature characterize the condition known as HYPOTHERMIA. This can lead to unconsciousness and death. With both frostbite and hypothermia, the affected areas need to be warmed quickly. Immersing in warm, not hot, water best does this. In such cases medical assistance will be sought.

To prevent these effects from occurring, persons working in the cold should wear adequate clothing and reduce the time spent in the cold area. The field SSO, to determine appropriate time personnel may spend in adverse weather conditions, will monitor this.

Lockout/Tagout

PURPOSE -- This program establishes procedures for de-energizing, isolating and ensuring the energy isolation of equipment and machinery. The program will be used to ensure that equipment and machinery is de-energizing and isolated from unexpected energization by physically locking (Lockout) energy isolation devices or, in the absence of locking capabilities, tagout (Tagout) the device to warn against energization. These procedures will provide the means of achieving the purpose of this program, prevention of injury to Hydro Tech employees from the unexpected energization or start-up of equipment and machinery, or from the release of stored energy.

APPLICATION -- This program applies to the control of energy during the servicing and/or maintenance of equipment and machinery. This program covers normal operations only if a guard or other safety device is removed or bypassed, or any part of the body is placed into an area of the equipment or machinery where work is performed on the material, or a danger zone exists during the operating cycle. Minor tool changes, adjustments, and other minor servicing activities which take place during normal production operations do not require isolation and lockout/tagout if they are routine and integral to the use of the equipment.

SCOPE -- This program will include all employees whose duties require them to service, install, repair, adjust, lubricate, inspect or perform work on powered equipment or machinery that may also have the potential for stored energy.

PROGRAM RESPONSIBILITIES -- The SSO will have the overall responsibility of the program to ensure that; authorized and affected employees receive adequate training and information, the program is evaluated annually, and the lockout/tagout equipment is properly used and the procedures of this program are followed.

The program evaluation will be conducted to ensure that the procedures and requirements of the program are being followed and will be utilized to correct any deviations or inadequacies that may be discovered. The evaluation will consist of one or more inspections or audits of actual lockout/tagout procedures being used to isolate equipment. A review of the authorized and affected employee's responsibilities will be conducted at the time of the inspection /audit. Any authorized employee, except the one(s) utilizing the energy isolation procedure being inspected, may perform the inspection/audit.

A record will be maintained of program evaluation inspections and will include:

1. The identity of the equipment or machine on which energy control procedures were being utilized.
2. The date(s) of the inspection(s).
3. The employee(s) included in the inspection(s).
4. The person performing the inspection.

Authorized employees (persons who implement lockout/tagout procedures) will be responsible for following the procedures established by this program.

Affected employees are responsible for understanding the significance of a lockout/tagout device and the prohibition relating to attempts to restart or re-energize equipment or machinery that is locked out or tagged out.

TRAINING – Where applicable, Hydro Tech employees will be provided instruction in the purpose and functions of the energy control program to ensure that they understand the significance of locked or tagged out equipment and also have the knowledge and skill to correctly apply and remove energy controls. Training will include:

The recognition of applicable hazardous energy source(s), the type and magnitude of energy available, and the policies and procedures of the Hydro Tech energy control program.

1. Affected employees will be made aware of the purpose and use of energy control procedures and the prohibition relating to attempts to remove lockout or tagout devices.
2. Instruction in the limitations of tagout as a sole means of energy control.
    a. Tags are warning devices and do not provide the physical restraint that a lock would.
    b. Tags may provide a false sense of security.
    c. Tags may become detached during use.

Initial training will be provided during to energy control program implementation, when new employees are hired or when job responsibilities change to include utilization of energy control procedures.

Retraining will be conducted whenever there is a change in job assignments that require the employee to utilize energy control procedures, a change in equipment that presents a new hazard, a change in the energy control procedures or when the program evaluation identifies inadequacies in the energy control program procedures.

Records of employee training will be maintained and will include the employee's name and date(s) of training.

STANDARD OPERATING PROCEDURES –where necessary, Hydro Tech will provide the necessary devices to effectively lockout or tagout energy isolating devices. Lockout/tagout devices will be the only devices used for controlling energy and shall not be used for other purposes. Any device used for lockout/tagout will be capable of withstanding the environment to which they are exposed for the maximum period they are to be exposed. The devices will be substantial enough to prevent removal without excessive force. Excessive force for a locking device would be bolt cutters or other metal cuttings tools. Tagout devices will be attached by a non-reusable method, attachable by hand, and very difficult to remove by hand. A nylon cable tie or equivalent will be used.

Lockout/tagout devices will indicate the identity of the employee who applied the device, and the tagout device will warn against the hazards if the equipment is energized.

Lockout is the preferred method of energy isolation. When physical lockout is not possible, the energy isolation will be tagged out of service with a warning tag attached at the power source. In the case of plug-in power source, the tag will be attached at the male plug. To ensure full employee protection using tagout instead of lockout, additional steps should be taken to guard against accidental or inadvertent energization. These steps may include, where applicable: removal of fuses, blocking switches, removal of a valve handle.

STANDARD OPERATING PROCEDURES

I. APPLICATION OF CONTROLS

A. Preparing to Shut Down Equipment

1. Prior to equipment shutdown, the authorized employee(s) must have knowledge of:
    a. The type(s) and magnitude of power.
    b. The hazards of the energy to be controlled.
    c. The method(s) to control the energy.
    d. The location and identity of all isolating devices that control or feed the equipment to be locked/tagged out.
2. Notify all affected employees that the lockout/tagout system will be in effect.
3. Assemble applicable lockout/tagout devices, i.e., padlocks, tags, multiple lock hasps, etc.

B. Equipment Shutdown and Isolation

1. If equipment is in operation, shut it down by the normal stopping procedure (stop button, switch).

2. Operate disconnects, switches, valves, or other energy isolating devices so that the equipment is de-energizing and isolated from its energy source(s).
3. Verify that equipment is shut down by operating equipment from the normal operating location and any remote locations.

C. Installation of Lockout/Tagout Device, Release of Stored Energy, and Verification

1. Attach individually assigned lock(s) or tag(s) to energy isolating device(s). Where it is not possible to lock a switch, valve or other isolating device, electrical fuses must be removed, blank flanges installed in piping, lines disconnected, or other suitable methods used to ensure that equipment is isolated from energy sources. A tag must be installed at the point of power interruption to warn against energizing.
    a. Each lock or tag must positively identify the person who applied it and locks must be individually keyed.
    b. If more than one person is involved in the task, employees will place their own lock and tag. Multiple lock hasps are available for this.
2. Release, restrain, or dissipate stored energy such spring tension, elevated machine members, rotating flywheels, hydraulic pressure, pistons and air, gas, steam, water pressure, etc. by repositioning, blocking bleeding, or other suitable means.
3. Prior to starting work on equipment and after ensuring that no personnel are exposed, the authorized employee will verify that isolation and de-energization have been accomplished by:
    a. Attempting, through normal effort, to operate energy isolating devices such as switches, valves, or circuit breaker with locks or tags installed.
    b. Attempting to operate the equipment or machinery that is locked or tagged out. This includes all sources of energy, i.e. electrical, hydraulic, gravity, air, water, stream pressure, etc.
    c. Verifying the presence and effectiveness of restraint (blocking) and energy dissipation or release (bleeding).
4. If there is a possibility of the re-accumulation of stored energy to a hazardous level, verification of isolation will be contained until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists.

D. Group Lockout/Tagout

1. When more than one individual is involved in locking or tagging equipment out of operation, each individual will attach their individual lock or tag, or the equivalent, to the energy isolating device(s).
    a. An equivalent lockout device may be in the form of a group lockout device such as a multiple lock hasp or lock box.
    b. Primary responsibility for a group of authorized employees working under a group lockout device will be vested in a designated authorized employee.

c. Group lockout methods will provide a level of protection equal to that afforded by a personal lockout/tagout device.

II. RETURNING EQUIPMENT TO SERVICE

A. Restore Equipment to Normal Operating Status

1. Re-install all parts or subassemblies removed for servicing or maintenance.
2. Re-install all tools, rests, or other operating devices
3. Re-install all guards and protective devices (i.e. limit switches).
4. Remove all blocks, wedges, or other restraints from the operating area of the equipment (ways, slides, etc.).
5. Remove all tools, equipment, and shop towels from the operating area of the equipment.

B. Verify Equipment Ready for Operation

1. Inspect area for non-essential items
2. Ensure that all employees are safely positioned clear of the operating areas of the equipment. Post a watch if energy isolation devices are not in line of sight of the equipment.

C. Notify Affected Employees of Impending Start-up

1. The sudden noise of start-up may startle nearby employees.
2. Equipment may need to be tested to determine operational safety by a qualified operator.

D. Remove Energy Isolation Devices - Only by authorized employee(s) who installed it/them.

1. Remove line blanks, reconnect piping (if applicable), and remove warning tag.
2. Close bleeder valves, remove warning tag.
3. Replace fuse(s), close circuit breaker(s) and remove warning tag.
4. Remove lock and tag from control panel, valve, etc.

Employee(s) who installed them may make an exception for removal of lockout/tagout devices. If it is necessary to operate a piece of equipment that is locked/tagged out, <u>every</u> effort must be made to locate the employee whose lock or tag is on the equipment. If he or she cannot be located and only after positive assurance is made that no one is working on the locked-out equipment, the <u>supervisor</u> may personally remove the lock. The supervisor must assure that the equipment is once again locked out, or the employee notified that the equipment has been re-energized, before the employee resumes work. Employees will recheck locked out equipment if they have left the equipment (breaks, lunch, and end of shift) to make sure it is still de-energized and locked out.

III. TEMPORARY REMOVAL OF LOCKOUT/TAGOUT PROTECTION

A. In situations when the equipment must be temporarily energized to test or position the equipment or its components, the following steps will be followed:

1. Clear the equipment of tools and materials that are non-essential to the operation.

2. Ensure the equipment components are operationally intact.
3. Remove employees from the equipment area.
4. Remove the lockout/tagout devices by the employee who installed in/them.
5. Energize and proceed with testing or positioning.
6. De-energize all systems and re-install all energy control measures.
7. Verify re-installed energy control measures are effective.

IV. SHIFT OR PERSONNEL CHANGES

A. The following steps will be followed to ensure continuity of employee protection during personnel changes.

1. All personnel involved in the maintenance or servicing activity will be notified that a transfer of personal locks/tags is about to occur.
2. Clear all personnel from hazardous area(s) of equipment.
3. Under the supervision of the shift supervisor or group designee, the off-going employee will immediately install theirs.
    a. If an entire group or more than one employee will be transferring work responsibility, locks/tags will be removed and replaced one at a time in order of installation.
4. When the transfer of lockout/tagout devices is complete, the effectiveness of all energy isolation devices will be verified to the satisfaction of all personnel involved.
5. Once the effectiveness of energy isolation protection is confirmed, the service/maintenance operation may continue.

V. CONTRACTOR NOTIFICATION

A. Whenever outside personnel may be engaged in activities covered by this program, they will inform the contractor of applicable lockout/tagout procedures used to protect Hydro Tech employees from the hazards of working near energized equipment.

1. The contractor will be expected to ensure that his/her employees understand and comply with the restrictions and prohibitions of this program.
2. Hydro Tech requires, under these circumstances, the contractor to inform us of their lockout/tagout procedures so that HTE employees can comply with the restrictions and prohibitions of the contractor's program.
3. Hydro Tech also requires the contractor to notify the program administrator, the area supervisor, and affected Hydro Tech employees prior to de-energizing, isolating and locking out Hydro Tech equipment. Conversely, notification is also required when this equipment will be returned to service.

DEFINITIONS

Affected employee - An employee whose job requires him/her to operate or use a machine or equipment on which servicing, or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Authorized employee(s) - A person or persons who locks or implements a tagout system procedure to perform servicing or maintenance on a machine or equipment. An authorized employee and an affected employee may be the same person when the affected employee's duties also include performing maintenance or service on a machine or equipment that must be locked or tagged out.

"Capable of being locked out" - An energy isolating device will be considered to be capable of being locked out either if it is designed with a hasp or other attachment or integral part to which, or through which, a lock can be affixed, or if it has a locking mechanism built into it. Other energy isolating devices will also be considered to be capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy-isolating device or permanently alter its energy control capability.

Energized - Connected to an energy source or containing residual or stored energy.

Energy isolating device - A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: a manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition, no pole can be operated independently; a slide gate; a slip blind; a line valve; a block; and any similar device used to block or isolate energy. The term does not include a push button, selector switch, and other control circuit type devices.

Energy source - any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other type of energy.

Lockout - The placement of lockout device on an energy-isolating device, in accordance with an established procedure, is ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout device - A device that utilizes positive means such as a lock, either key or combination type, to hold an energy isolating device in the safety position and prevent the energizing of a machine or equipment.

Normal production operations - The utilization of a machine or equipment to perform its intended production function.

Servicing and/or maintenance - Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.

Setting up - Any work performed to prepare a machine or equipment to perform its normal production operation.

Stored energy - Energy that is available and may cause movement even after energy sources have been isolated. Stored energy may be in the form of compressed springs, elevated equipment components, hydraulic oil pressure, pressurized water, air, steam, or gas, or rotating flywheels, shafts or cams.

Tagout - The placement of a tagout device on an energy-isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Tagout device - A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

GENERAL MACHINERY AND EQUIPMENT LIST

EQUIPMENT/LOCATION	ENERGY SOURCES/LOCATION
B. Backhoe Machine	Diesel Engine

5.0 Training

GENERAL HEALTH AND SAFETY TRAINING

In accordance with Hydro Tech corporate policy, and pursuant to 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations. As a minimum, the training shall have consisted of instruction in the topics outlined in the above reference. Personnel who have not met the requirements for initial training will not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical).

Completion of the Hydro Tech Health and Safety Training Course for Hazardous Waste Operations or an approved equivalent will fulfill the requirements of this section. In addition to the required initial training, each employee shall have received 3 days of directly supervised on-the-job training. This training will address the duties the employees are expected to perform.

The Hydro Tech SSO the responsibility of ensuring that personnel assigned to this project complies with these requirements. Written certification of completion of the required training will be provided to the SSO.

MANAGER/SUPERVISOR TRAINING

In accordance with 29 CFR 1910.120, onsite management and supervisors who will be directly responsible for, or who supervise employees engaged in hazardous waste operation shall receive training as required in this HASP and at least eight (8) additional hours of specialized training on managing such operations at the time of job assignment.

ANNUAL 8-HOUR REFRESHER TRAINING

Annual 8-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualification for fieldwork. The following topics will be reviewed: toxicology, respiratory protection, including air purifying devices and self-contained breathing apparatus (SCBA), medical surveillance, decontamination procedures and personnel protective clothing. In addition, topics deemed necessary by the SSO may be added to the above list.

SITE SPECIFIC TRAINING

Prior to commencement of field activities, all personnel assigned to the project will be provided training that will specifically address the activities, procedures, monitoring and equipment for the site operations. It will include Site and facility layout, hazards, and emergency services at the Site, and will highlight all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity.

ONSITE SAFETY BRIEFINGS

Project personnel and visitors will be given periodic onsite health and safety briefings by the SSO, or their designee, to assist site personnel in safely conducting their work activities. The briefings will include information on new operations to be conducted, changes in work practices or changes in the Site's environmental conditions. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety audits.

ADDITIONAL TRAINING

Additional training may be required by the SSO for participation in certain field tasks during the course of the project. Such additional training could be in the safe operation of heavy or power tool equipment or hazard communication training.

SUBCONTRACTOR TRAINING

Subcontractor personnel who work onsite, only occasionally, for a specific limited task and who are unlikely to be exposed over permissible exposure limits, may be exempted from the initial 40-hour training requirement. The SSO will determine if this exemption is allowed. In any case, the subcontractor personnel who are exposed to hazards are not

exempted from the 40-hours training requirement nor medical surveillance requirements found in Section 8.1.

6.0 Medical Surveillance

GENERAL

All contractor and subcontractor personnel performing field work at the Site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120 (f). A physician's medical release for work will be confirmed by the SSO before an employee can begin site activities. Such examinations shall include a statement as to the worker's present health status, the ability to work in a hazardous environment (including any required PPE which may be used during temperature extremes), and the worker's ability to wear respiratory protection.

A medical data sheet will be completed by all onsite personnel and kept at the Site. Where possible, this medical data sheet will accompany the personnel needing medical assistance or transport to hospital facilities.

MEDICAL SURVEILLANCE PROTOCOL

The medical surveillance protocol to be implemented is the occupational physicians' responsibility but shall meet the requirements of CFR 1910.120 and ANSI Z88.2 (1980). The medical surveillance protocol shall, as a minimum, cover the following:

a. Medical and Occupational History
b. General physical examination (including evaluation of major organ system)
c. Serum lead and ZPP
d. Chest X-ray (performed no more frequently that every four years, except when otherwise indicated).
e. Pulmonary Function Testing (FVC and FEV1.0).
f. Ability to wear respirator
g. Audiometric testing.

Additional clinical tests may be included at the discretion of the occupational physician.

7.0 Site Control, PPE & Communications

SITE CONTROL

A Support Zone (SZ) is an uncontaminated area that will be the field support area for most operations. The SZ provides for field team communications and staging for emergency response. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel or materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples. A contamination reduction corridor will be established. This is the route of entry and egress to the Site, and it provides an area for decontamination of personnel and portable equipment as well.

The area where contamination exists is considered to be the Exclusion Zone (EZ). All areas where excavation and handling of contaminated materials take place are considered the EZ. This zone will be clearly delineated by cones, tape or other means. The SSO may establish more than one EZ where different levels of protection may be employed or where different hazards exist. Personnel are not allowed in the EZ without:

- A buddy
- Appropriate personal protective equipment
- Medical authorization
- Training certification

PERSONAL PROTECTIVE EQUIPMENT

GENERAL

The level of protection worn by field personnel will be enforced by the SSO. Levels of protection for general operations are provided below and are defined in this section. Levels of protection may be upgraded or downgraded at the discretion of the SSO. The decision shall be based on real-time air monitoring, site history data, and prior site experience. Any changes in the level of protection shall be recorded in the health and safety field logbook.

PERSONAL PROTECTIVE EQUIPMENT SPECIFICATIONS

For tasks requiring Level B PPE, the following equipment shall be used:
- Cotton or disposable coveralls
- Chemical protective suit (e.g. Saran-coated Tyvek®)
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC), steel toe/shank

- Boot Covers (as needed)
- Hard Hat
- Hearing protection (as needed)

For tasks requiring Level C PPE, the following equipment shall be used:

- Cotton or disposable coveralls
- Disposable outer coveralls (Poly-coated Tyvek)
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC), steel toe/shank
- Boot covers (as needed)
- Hard Hat
- Hearing protection (as needed)
- Splash suit and face shield for decontamination operations (as needed)

For tasks requiring Level D PPE, the following equipment shall be used:

- Cotton or disposable coveralls
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC) steel toe/shank
- Boot covers (as needed)
- Hard hat
- Hearing protection (as needed)
- Safety glasses

For tasks requiring respiratory protection, the following equipment shall be used:

Level D - No respiratory protective equipment necessary except for a dust mask
Level C - A full-face air-purifying respirator equipped with organic vapor/pesticide-HEPA cartridges
Level B - An airline respirator or a self-contained breathing apparatus (SCBA)

INITIAL LEVELS OF PROTECTION

Levels of protection for the activities may be upgraded or downgraded depending on direct-reading instruments or personnel monitoring. The following are the initial levels of protection that shall be used for each planned field activity.

LEVEL OF PERSONAL PROTECTIVE EQUIPMENT REQUIRED

Activity	**Level of Protection Respiratory/PPE**
Drilling/Coring	C/D
Sampling	C/D

Ground-Penetrating Radar/Magnetometer	C/D

COMMUNICATIONS

Communications is the ability to talk with others. While working in Level C/B Protection, personnel may find that communication becomes a more difficult task and process to accomplish. This is further complicated by distance and space. In order to address this problem, electronic instruments, mechanical devices or hand signals will be used as follows:

- Walkie-Talkies - Hand held radios would be utilized as much as possible by field teams for communication between downrange operations and the Command Post base station.
- Telephones - A mobile telephone will be located in the Command Post vehicle in the Support Zone for communication with emergency support services/facilities. If a telephone is demobilized, the nearest public phones will be identified.
- Air Horns - A member of the downrange field team will carry an air horn, and another will be evident in the Support Zone to alert field personnel to an emergency situation.
- Hand Signals - Members of the field team long with use of the buddy system will employ this communication method. Signals become especially important when in the vicinity of heavy moving equipment and when using Level B respiratory equipment. The signals shall become familiar to the entire field team before site operations commence and they will be reinforced and reviewed during site-specific training.

HAND SIGNALS FOR ONSITE COMMUNICATION

Signal	**Meaning**
Hand gripping throat	Out of air, can't breathe
Grip partners' wrist	Leave area immediately; no debate
Hands on top of head	Need assistance
Thumbs up	OK, I'm all right; I understand
Thumbs down	No; negative, unable to understand you. I'm not all right

8.0 Air Monitoring Plan

GENERAL

Continuous air monitoring in the EZ during invasive tasks will accompany site operations, as indicated in this HASP or as required by the SSO. Monitoring will be performed to verify the adequacy of respiratory protection, to aid in site layout and to document work exposure. All monitoring instruments shall be operated by qualified personnel only and will be calibrated daily prior to use, or more often as necessary.

REAL-TIME MONITORING

INSTRUMENTATION

At least one (1) of the following monitoring instruments will be available for use during field operations as necessary:

- Photoionization Detector (PID), Rae Instruments with 10.2 EV probe or equivalent
- Flame Ionization Detector (FID), Foxboro Model 128 or equivalent
- Combustible Gas Indicator (CGI)/Oxygen (O_2) Meter, MSA or equivalent.

A FID or PID shall be used to monitor the organic vapor concentrations in active work areas. Organic vapor concentrations shall be measured upwind of the work areas to determine background concentrations. The SSO will interpret monitoring results using professional judgment. The PPE utilized shall always be the most protective, thus the action level criteria are flexible guidelines.

A CGI/O_2 meter shall be used to monitor for combustible gases and oxygen content in the boreholes during drilling activities.

Calibration records shall be documented and included in the health and safety logbook or instrument calibration logbook. All instruments shall be calibrated before and after each daily use in accordance with the manufacturers' procedures.

ACTION LEVELS

Action levels for upgrading of PPE in this HASP will apply to all site work during the duration of field activities at the Site. Action levels are for unknown contaminants using direct reading in the Breathing Zone (BZ) for organic vapors and dusts, and at the source for combustible gases.

MONITORING DURING FIELD ACTIVITIES

Hydro Tech shall perform real time air monitoring prior to the commencement of work to establish baseline conditions. Baseline conditions will be established at the approximate center of the Site and at the perimeter of the Site both upwind and downwind.

During all work activities real time monitoring will occur. As necessary, Hydro Tech shall have at each applicable workstation a PID, explosimeter and oxygen deficiency meter. The real time monitoring for remedial activities will be conducted approximating the Breathing Zone of the workers. The monitoring will be continuous during working operations.

The air-monitoring instrument may indicate that personnel working in the exclusion zone increase their level of protection. All personnel will be trained in the action levels. When conditions warrant an increase in protection, all personnel will stop working and immediately leave the exclusion zone. They will then don the appropriate safety equipment necessary and return to their current workstation. All of this activity will be monitored by the SSO. The SSO will keep the Hydro Tech Project Manager aware of any extraordinary situations and conditions that may occur. Working conditions and monitoring levels will be noted in the Field Notebook along with the time, date and page number. Verbal reports will be given to the Project Manager when there is a change in the PPE level.

The previous day's results shall be reviewed each morning to determine what actions are necessary and the general conditions resulting from and around the Site.

The record keeping will include:

- Date & Time of Monitoring
- Air Monitoring Location
- Instrument, Model #, Serial #
- Calibration/Background Levels
- Results of Monitoring
- SSO Signature
- Comments

Excavation Operations - Monitoring will be performed continuously during all excavation and demolition operations. A PID and/or FID shall be utilized to monitor the breathing zone, the excavated area and any material taken from the excavation. A CGI/O_2 meter shall be used to monitor the excavation for the presence of combustible gases.

ACTION LEVELS OF AIRBORNE CONTAMINANTS

Instrument	Action Level	Action to be taken
FID/PID	< 100 ppm, for a 15-minute average	Stop work & initiate vapor control
	> 100 ppm, for a 15-minute average	Stop work & initiate evacuation procedure
CGI	10% LEL	Stop work, initiate ventilating
	50% LEL	Stop work, initiate evacuation procedure and contact fire dept.

PERSONNEL MONITORING PROCEDURE

The Site SSO, concurrent with activities that may generate the contaminants in excess of OSHA PEL's, may perform assessment and evaluation of field personnel exposures to airborne contaminants.

Procedures to be followed include:

The SSO may select high-risk individuals who may be subject to contaminant exposure based on job assignment.

The Personal Sampling is being conducted to determine the proper levels of respiratory protection required, to document potential exposures to compounds, and to assure compliance with OSHA standards. Therefore, it is important that the data collected be from "worst case" locations and personnel.

For example: when work is being conducted to excavate at an underground tank location, those persons closest to the excavation and most intimately involved with the work should be sampled. If a backhoe operator solely conducted the excavation, then that employee should be monitored. However, if there are additional workers who must enter the excavation and work with the freshly excavated soil, these persons would be closer to the potential contaminants and they should be sampled.

To meet the intent of the sampling will require sampling at periods of the most disturbances. To be accurate in determining potential exposures, as many tasks/trades shall be sampled as possible during the course of this project. At completion of the project, a goal of 20% of all workers who must perform their duties in or around the contaminated soil, tanks and excavations is sought.

Hydro Tech must provide all sampling data in writing to the employees within three (3) days of receipt of results.

Air sampling pumps used to collect employee exposure samples shall be calibrated before and after use each day. Calibration shall be accomplished using a primary standard calibration system, e.g. the bubble tube method. Results of the calibrations shall be included in the health and safety field logbook and with the exposure report.

Chemical analysis of samples collected for assessment of employee exposures shall be performed in accordance with NIOSH or OSHA analytical methods only by laboratories accredited by the American Industrial Hygiene Association.

Results of the personal exposure assessment shall be provided to the individual, in writing within fifteen (15) working days after receipt of laboratory reports. Reports to field personnel shall provide calculated time-weighted average exposures and shall provide comparative information relative to established permissible exposure limits. The air sampling data sheet and laboratory report is considered a part of the employee exposure report. A copy of the employee personal exposure assessment report shall also be included in the project file and the employees' medical record for Hydro Tech employees. Reports for subcontractor employees will be sent directly to the subcontractors' employer.

AIR MONITORING REPORTS

Air Monitoring Reports will be completed by the SSO and/or authorized personnel and submitted to the Project Manager in the daily safety logs and will include the following:

- Date of monitoring
- Equipment utilized for air monitoring
- Real-time air monitoring results from each work location
- Calibration method of equipment and results

9.0 Safety Considerations

GENERAL

In addition to the specific requirements of this HASP, common sense should be used at all times. The general safety rules and practices below will be in effect at the Site at the discretion of the Project Manager, SSO or other authorized personnel.

- The site will be suitably marked or barricaded as necessary to prevent unauthorized visitors but not hinder emergency services if needed.

- As needed, all open holes, trenches and obstacles will be properly barricaded in accordance with local site requirements. These requirements will be determined by proximity to traffic ways, both pedestrian and vehicular, and site of the hole, trench or obstacle. If holes are required to be left open during non-working hours, they will be adequately decked over or barricaded and sufficiently lighted.

- Before any digging or boring operations are conducted, underground utility locations will be identified. All boring, excavation and other site work will be planned and performed with consideration for underground lines. Any excavation work will be performed in accordance with Hydro Tech's Standard Operating Procedures for Excavations.

- Either workers or other people will enact dust-mitigating procedures when there exists the potential for the inhalation of dust particles.

- The act of smoking and ignition sources in the vicinity of potentially flammable or contaminated material is strictly prohibited.

- Drilling, boring, and use of cranes and drilling rigs, erection of towers, movement of vehicles and equipment and other activities will be planned and performed with consideration for the location, height, and relative position of aboveground utilities and fixtures, including signs; canopies; building and other structures and construction; and natural features such as trees, boulders, bodies of water, and terrain.

- When working in areas where flammable vapors may be present, particular care shall be exercised with tools and equipment that may be sources of ignition. All tools and equipment provided must be properly bonded and/or grounded. Metal buttons and zippers are prohibited on safety clothing for areas that may contain a flammable or explosive atmosphere.

- Approved and appropriate safety equipment (as specified in this HASP), such as eye protection, hard hats, foot protection, and respirators, must be worn in areas where required. In addition, eye protection must be worn when sampling soil or water that may be contaminated.

- Beards interfere with respirator fit and are not allowed within the site boundaries because all site personnel may be called upon to use respirator protection is some situations.

- No smoking, eating, chewing tobacco, gum chewing, or drinking will be allowed in the contaminated areas.

- Contaminated tools and hands must be kept away from the face.

- Personnel must use personal hygiene safeguards (washing up) at the end of the shift or as soon as possible after leaving the Site.

- Each sample must be treated and handled as though it were contaminated.

- Persons with long hair and/or loose-fitting clothing that could become entangled in power equipment must take adequate precautions.

- Horseplay is prohibited in the work area.

- Work while under the influence of intoxicants, narcotics or controlled substances is prohibited.

POSTED SIGNS

Posted danger signs will be used where an immediate hazard exists. Caution signs will be posted to warn against potential hazards and to caution against unsafe practices. Traffic control methods and barricades will be used as needed. Wooden stakes and flagging tape, or equally effective material will be used to demarcate all restricted areas.

Other postings may include the OSHA poster, emergency hospital route and telephone numbers of contact personnel.

INVASIVE OPERATIONS

The SSO will be present onsite during all invasive work (e.g. demolition, excavations). The SSO will ensure that appropriate levels of protection and safety procedures are followed. No personnel will enter any excavations for any reasons. All personnel will stay at least 10 feet back from the edge of the excavation and out of the swing radius of the backhoe. No drums or other potential sources will be sampled or removed during this phase without further additions to the HASP.

The proximity of water, sewer and electrical lines will be identified prior to invasive operations. The possibility of the presence of underground conduits or vessels containing materials under pressure will also be investigated prior to invasive operations. Properly sized containment systems will be utilized, and consideration of the potential volume of liquid or waste released during operations will be discussed with members of the field team to minimize the potential for spills and provide a method for collection of waste materials. Emergency evacuation procedures and the location of safety equipment will be established prior to start up operations. The use of protective clothing, especially hard hats, boots, and gloves will be required during drilling and other heavy equipment work.

SOIL AND GROUNDWATER SAMPLING

Personnel must wear prescribed protective clothing and equipment including eye protection, chemical resistant gloves and splash aprons (where appropriate) when sampling solids and liquids. Sample bottles are to be bagged prior to sampling to ease decontamination. Personnel must be aware of the location of emergency equipment, including spill containment materials prior to sampling. Personnel are to practice contamination avoidance at all times, as well as to utilize the buddy system and maintain communications with the Command Post.

SAMPLE HANDLING

Personnel responsible for the handling of samples will wear the prescribed level of protection. Samples are to be identified as to their hazard and packaged as to prevent spillage or breakage. Any unusual sample conditions shall be noted. Laboratory personnel and all field personnel shall be advised of sample hazard levels and the potential contaminants present. This can be accomplished by a phone call to the lab coordinator and/or including a written statement with the samples reviewing lab safety procedures in handling in order to assure that the practices are appropriate for the suspected contaminants in the sample.

HEAVY EQUIPMENT DECONTAMINATION

Personnel steam cleaning heavy equipment shall use the prescribed level of protection and adhere to the buddy system. Initially this task usually employs level C. The heavy equipment decontamination shall be restricted to authorized personnel only. Special consideration will be given to wind speed and direction. Downwind areas are to be kept free of personnel to avoid unnecessary exposure to potential airborne contamination.

ADDITIONAL SAFETY CONSIDERATIONS

No other additional safety considerations at this time.

10.0 Decontamination and Disposal Procedures

CONTAMINATION PREVENTION

One of the most important aspects of decontamination is the prevention of contamination. Good contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

Personnel:
Do not walk through areas of obvious or known contamination
Do not directly handle or touch contaminated materials
Make sure that there are no cuts or tears on PPE
Fasten all closures in suits; cover with tape if necessary
Particular care should be taken to prevent any skin injuries
Stay upwind of airborne contaminants
Do not carry cigarettes, cosmetics, gum, etc. into contaminated areas

Sampling and Monitoring:
When required by the SSO, cover instruments with clear plastic, leaving openings for sampling ports and bag sample containers prior to emplacement of sample material.

Heavy Equipment:
Care should be taken to limit the amount of contamination that comes in contact with heavy equipment (tires, contaminated augers). Dust control measures may be needed on roads inside the site boundaries.

PERSONNEL DECONTAMINATION

All personnel shall pass through an outlined decontamination procedure when exiting the hot zone at each location. Field washes for equipment and PPE shall be set up at each drilling location. The system will include a gross wash and rinse for all disposable clothing and boots worn in the EZ. Upon exiting the EZ, all personnel will wash their hands, arms, neck, and face before entering the Support Zone.

EQUIPMENT DECONTAMINATION

Equipment used at the Site that is potentially contaminated shall be decontaminated to prevent hazardous materials from leaving the Site. All heavy equipment will be decontaminated at the decontamination pad and inspected by the SSO and Project Manager before it leaves the Site. The decontamination area will

provide for the containment of all wastewater from the decontamination process. Respirators, airline and any other personnel equipment that comes in contact with contaminated soils shall pass through a field wash.

DECONTAMINATION DURING MEDICAL EMERGENCIES

If emergency lifesaving first aid and/or medical treatment are required, normal decontamination procedures may need to be abbreviated or omitted. The Site SSO or desigee will accompany contaminated victims to the medical facility to advice on matters involving decontamination, when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances and /or medical personnel. Outer garments are then removed at the medical facility.

No attempt will be made to wash or rinse the victim, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material that could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed. Note that heat stroke requires prompt treatment to prevent irreversible damage or death. Protective clothing must be promptly removed. Less serious forms of heat stress also require prompt attention and removal of protective clothing immediately; unless the victim is obviously contaminated, decontamination should be omitted or minimized, and treatment begun immediately.

DISPOSAL PROCEDURES

A segregating system of non-hazardous waste and hazardous waste will be developed by the SSO and PM. All discarded material, waste materials or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating sanitary hazards, or causing litter to be left on site. All potentially contaminated materials, e.g. clothing, gloves, etc., will be bagged or drummed as necessary, labeled and segregated for disposal. All non-contaminated materials shall be collected and bagged for appropriate disposal as normal domestic waste.

11.0 Emergency Plan

The potential for the development of an emergency situation is low considering the low concentrations of hazardous substances at the work site. Nevertheless, an emergency situation could occur. All Hydro Tech and subcontractor field team members prior to the start of work will know the emergency plan outlined in this section. The emergency plan will be available for use at all times during site work.

Various individual site characteristics will determine preliminary actions taken to assure that this emergency plan is successfully implemented in the event of a site emergency. Careful consideration must be given to the proximity of neighborhood housing or places of employment, and to the relative possibility of site fire, explosion or release of vapors or gases that could affect the surrounding community.

The Project Manager shall make contact with local fire, police and other emergency units prior to beginning work on site. In these contacts, the Project Manager will inform the emergency units about the nature and duration of work expected to the Site and the type of contaminants and the possible health or safety effects of emergencies involving these contaminants. At this time, the Project Manager and the emergency response units shall make the necessary arrangements to be prepared for any emergencies that could occur.

The Project Manager shall implement the contingency plan whenever conditions at the Site warrant such action. The Project Manager will be responsible for coordination of the evacuation emergency treatment, and transportation of site personnel as necessary, and notification of emergency response units and the appropriate management staff.

The cases where the PM is not available, the SSO shall serve as the alternate emergency coordinator.

EVACUATION

In the event of an emergency situation, such as fire, explosion, or significant release of toxic gases, an air horn or other appropriate device will be sounded for approximately

10 second intervals indicating the initiation of evacuation procedures. All personnel will evacuate and assemble near the entrance to the site. The location shall be upwind of the Site where possible.

For efficient and safe site evacuation and assessment of the emergency situation, the Project Manager will have authority to initiate action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The SSO or designated SSO must ensure that access for emergency equipment is provided and that all combustion apparatuses have been shut down once the alarm has been sounded. Once the safety of all personnel is established, the Fire Department and other emergency response groups as necessary will be notified by telephone of the emergency.

POTENTIAL OR ACTUAL FIRE OR EXPLOSION

Immediately evacuate the Site (air horn will sound for 10-second intervals), notify the local fire and police departments, and other appropriate emergency response groups if an actual fire or explosion has taken place.

PERSONNEL INJURY

Emergency first aid shall be applied on site as deemed necessary. If necessary, the individual shall be decontaminated and transported to the nearest medical facility.

The ambulance/rescue squad shall be contacted for transport as necessary in an emergency. However, since some situations may require transport of an injured party by other means, the hospital route is identified below. A map to this facility provided with this HASP in Section 2.2.3.

ACCIDENT/INCIDENT REPORTING

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by telephone:

1. Mark E. Robbins-Cell phone (631) 457-0030
2. The employer of any injured worker if not a HydroTech employee

Written confirmation of verbal reports is to be submitted within 24 hours. The report form entitled "Accident Data Report" is to be used for this purpose. All Hydro Tech representatives contacted by telephone are to receive a copy of this report. If the employee involved is not a Hydro Tech employee, his employer shall receive a copy of this report.

For reporting purposes, the term accident refers to fatalities, lost time injuries, spill or exposure to hazardous materials (toxic materials, explosive or flammable materials). Any information released from the health care provider, which is not deemed confidential patient information, is to be attached to the appropriate form. Any medical information that is released by patient consent is to be filed in the individuals' medical records and treated as confidential.

OVERT PERSONNEL EXPOSURE

SKIN CONTACT:	Use copious amounts of soap and water. Wash/rinse affected area thoroughly, and then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination.
INHALATION:	Move personnel to fresh air and if necessary, decontaminate and transport to hospital.
INGESTION:	Decontamination and transport to emergency medical facility.
PUNCTURE WOUND OR LACERATION:	Decontaminate and transport to emergency medical facility.

ADVERSE WEATHER CONDITIONS

In the event of adverse weather conditions, the SSO or designee will determine if work can continue without sacrificing the health and safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries
- Potential for cold stress and cold-related injuries
- Treacherous weather-related conditions
- Limited visibility
- Potential for electrical storms

Site activities will be limited to daylight hours and acceptable weather conditions. Inclement working conditions include heavy rain, fog, high winds, and lighting. Observe daily weather reports and evacuate if necessary, in case of inclement weather conditions.

EMERGENCY RESPONSE EQUIPMENT LIST

Some or all of the following will either be available onsite or be able to be brought to the Site within a 2-hour period:

- 55 Gallon Drums
- 85 Gallon Drums
- Absorbent Pads
- Absorbent Booms
- Speedy-Dry
- Plastic Sheeting
- Hay Bales
- Pneumatic Nibbler
- Backhoe
- Pressure Washer
- Air Compressor
- Wilden Pumps
- Equipment Storage Trailer
- Submersible Pumps
- Miscellaneous Hand Tools
- Portable Lighting

LARGE EQUIPMENT

If necessary, Hydro Tech can have the following large equipment brought to the Site within 2-hours:

- Large Vacuum Truck
- Super Sucker
- Dump Trucks
- Drill Rig
- Utility Vehicle

12.0 Logs, Reports and Record Keeping

MEDICAL AND TRAINING RECORDS

The employer keeps medical and training records. All subcontractors must provide verification of training and medical qualifications to the SSO. The SSO will keep a log of personnel meeting appropriate training and medical qualifications for site work. The log will be kept in the project file. Medical records will be maintained in accordance with 29 CFR 1910.20.

ONSITE LOG

A log of personnel onsite each day will be kept by the SSO or designee. A copy of these logs will be sent to the Hydro Tech records coordinator for data entry. Originals will be kept in the project file.

EXPOSURE RECORDS

Any personal monitoring results, laboratory reports, calculations and air sampling data sheets are part of an employee exposure record. These records will be kept in accordance with 29 CFR 1910.20. For Hydro Tech employees, the originals will be sent to the Hydro Tech records coordinator. For subcontractor employees, the original will be sent to the subcontractor employer and a copy kept in the project file.

ACCIDENT/INCIDENT REPORTS

An accident/incident report must be completed for all accidents and incidents. Hydro Tech will send the originals to the appropriate Hydro Tech records coordinator for maintenance. Copies will be distributed as stated. A copy of the forms will be kept in the project file.

OSHA FORM 200

An OSHA Form 200 (Log of Occupational Injuries and Illnesses) will be kept at the Site. All recordable injuries or illnesses will be recorded on this form. At the end of the project, the original will be sent to the Hydro Tech corporate records administrator for maintenance. Subcontractor employers must also meet the requirements of maintaining an OSHA 200 form.

The Hydro Tech accident/incident report meets the requirements of the OSHA Form 101 (Supplemental Record) and must be maintained with the OSHA Form 200 for all recordable injuries or illnesses.

HEALTH AND SAFETY FIELD LOGBOOK

The SSO or designee will maintain the logbook in accordance with standard Hydro Tech procedures. Daily site conditions, activities, personnel, calibration records, monitoring results and significant events will be recorded. The original logbooks will become part of the exposure records file.

13.0 Sanitation

If sanitary sewers are not provided at the Site, provisions shall be made for access to sanitary systems by using nearby public facilities consistent with provisions of governing local ordinance codes. In the latter case, provisions are required for the removal of accumulated waste products within those units.

If a commercial/industrial laundry is used to clean or launder clothing that is potentially contaminated, they shall be informed of the potential harmful effects of exposure to hazardous substances related to the affected clothing.

Personnel and subcontractors’ sites shall follow decontamination procedures described in the HASP, or as directed by the SSO. This will generally include at a minimum site-specific training in shower usage and cleanup, personal hygiene requirements and the donning of protective equipment/clothing.

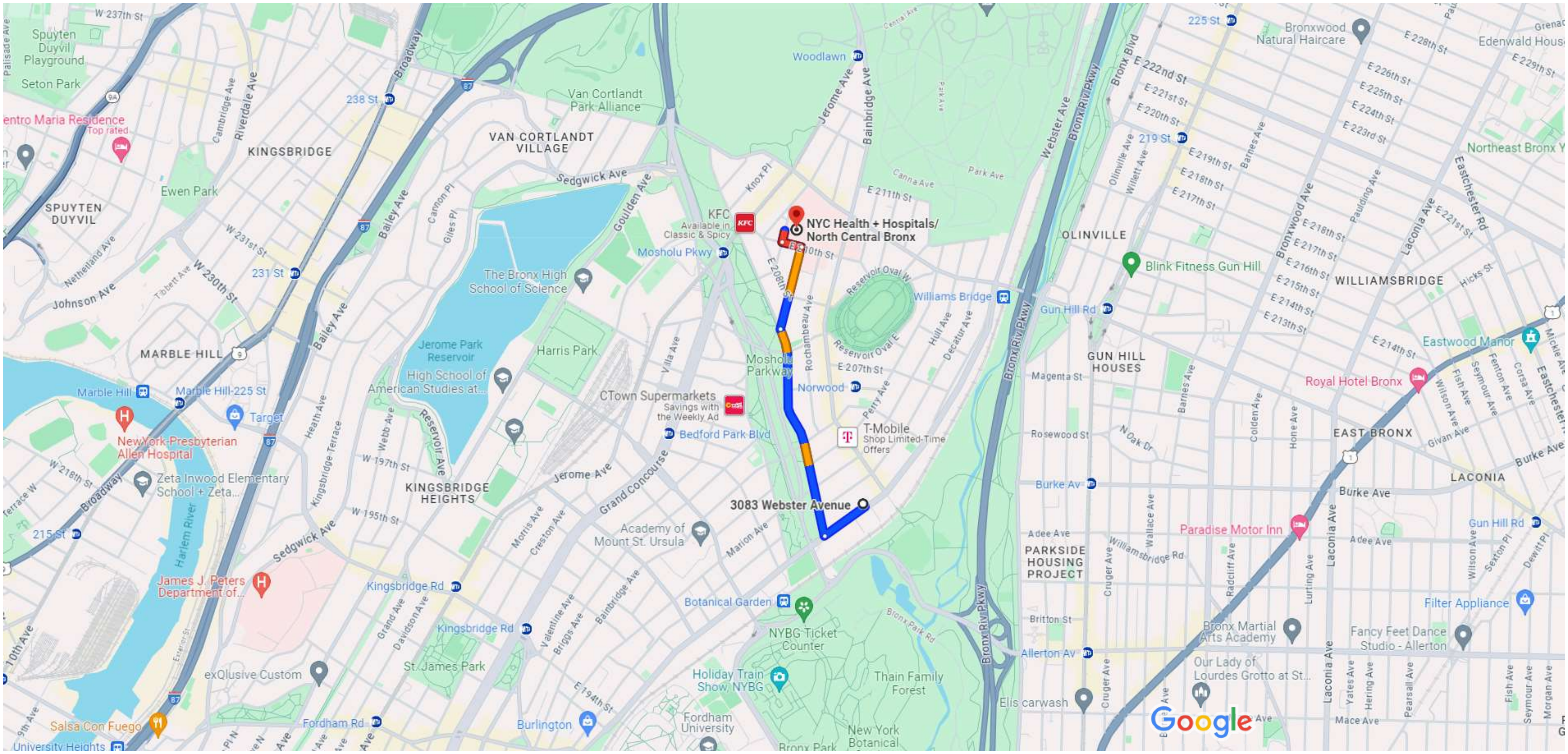
FIGURE 1

DIRECTIONS TO HOSPITAL

Google Maps

3083 Webster Ave, Bronx, NY 10467 to NYC Health + Hospitals/North Ctr'l Bronx, 3424 Kossuth Ave, Bronx, NY 10467

Drive 0.9 mile, 6 min



Map data ©2024 Google 1000 ft

3083 Webster Ave
Bronx, NY 10467

↑ 1. Head southwest on Webster Ave toward E 202nd St

0.1 mi

↱ 2. Turn right onto E Mosholu Pkwy N

0.5 mi

↱ 3. Turn right onto Steuben Ave

0.2 mi

↰ 4. Turn left onto E 210th St

259 ft

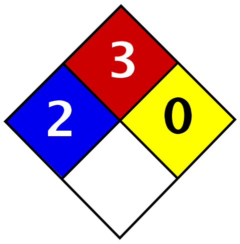
↱ 5. Turn right onto Kossuth Ave

ⓘ Destination will be on the right

154 ft

NYC Health + Hospitals/North Ctr'l Bronx
3424 Kossuth Ave, Bronx, NY 10467

ATTACHMENT A
HEALTH AND SAFETY FACT SHEETS



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
p-Xylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: p-Xylene

Catalog Codes: SLX1120

CAS#: 106-42-3

RTECS: ZE2625000

TSCA: TSCA 8(b) inventory: p-Xylene

CI#: Not applicable.

Synonym: p-Methyltoluene

Chemical Name: 1,4-Dimethylbenzene

Chemical Formula: C6H4(CH3)2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{p-}Xylene	106-42-3	100

Toxicological Data on Ingredients: p-Xylene: ORAL (LD50): Acute: 5000 mg/kg [Rat.]. DERMAL (LD50): Acute: 12400 mg/kg [Rabbit.]. VAPOR (LC50): Acute: 4550 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to blood, kidneys, the nervous system, liver.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 527°C (980.6°F)

Flash Points: CLOSED CUP: 25°C (77°F). OPEN CUP: 28.9°C (84°F) (Cleveland).

Flammable Limits: LOWER: 1.1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Toxic flammable liquid, insoluble or very slightly soluble in water.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 STEL: 150 (ppm) from ACGIH (TLV)
TWA: 434 STEL: 651 (mg/m3) from ACGIHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 138°C (280.4°F)

Melting Point: 12°C (53.6°F)

Critical Temperature: Not available.

Specific Gravity: 0.86 (Water = 1)

Vapor Pressure: 9 mm of Hg (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.62 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Solubility:
Easily soluble in methanol, diethyl ether.
Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 5000 mg/kg [Rat.].
Acute dermal toxicity (LD50): 12400 mg/kg [Rabbit.].
Acute toxicity of the vapor (LC50): 4550 ppm 4 hour(s) [Rat].

Chronic Effects on Humans: The substance is toxic to blood, kidneys, the nervous system, liver.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

0347 Animal: embryotoxic, foetotoxic, passes through the placental barrier.
0900 Detected in maternal milk in human.
Narcotic effect; may cause nervous system disturbances.

Special Remarks on other Toxic Effects on Humans: Material is irritating to mucous membranes and upper respiratory tract.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Xylene : UN1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: p-Xylene
Florida: p-Xylene
Massachusetts RTK: p-Xylene
New Jersey: p-Xylene
TSCA 8(b) inventory: p-Xylene
SARA 313 toxic chemical notification and release reporting: p-Xylene
CERCLA: Hazardous substances.: p-Xylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R10- Flammable.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.
R48/20- Harmful: danger of serious

damage to health by prolonged
exposure through inhalation.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-Material safety data sheet emitted by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du rÃ¨glement sur le transport des marchandises dangeureuses au canada. Centre de conformitÃ© internatinal LtÃ©e. 1986.

Other Special Considerations: Not available.

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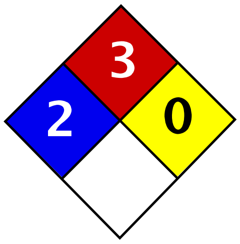

Health	2
Fire	3
Reactivity	0
Personal Protection	J

Material Safety Data Sheet

m-Xylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: m-Xylene

Catalog Codes: SLX1066

CAS#: 108-38-3

RTECS: ZE2275000

TSCA: TSCA 8(b) inventory: m-Xylene

CI#: Not applicable.

Synonym: m-Methyltoluene

Chemical Name: 1,3-Dimethylbenzene

Chemical Formula: C6H4(CH3)2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{m-}Xylene	108-38-3	100

Toxicological Data on Ingredients: m-Xylene: ORAL (LD50): Acute: 5000 mg/kg [Rat.]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit.].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to blood, kidneys, the nervous system, liver.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 527°C (980.6°F)

Flash Points: CLOSED CUP: 25°C (77°F). OPEN CUP: 28.9°C (84°F) (Cleveland).

Flammable Limits: LOWER: 1.1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO_2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid, insoluble in water.

Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection: Splash goggles. Lab coat. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 STEL: 150 (ppm) from ACGIH (TLV)
TWA: 434 STEL: 651 (mg/m3) from ACGIHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 139.3°C (282.7°F)

Melting Point: -47.87°C (-54.2°F)

Critical Temperature: Not available.

Specific Gravity: 0.86 (Water = 1)

Vapor Pressure: 6 mm of Hg (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.62 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Solubility:
Easily soluble in methanol, diethyl ether.
Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:
Acute oral toxicity (LD50): 5000 mg/kg [Rat.].
Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit.].

Chronic Effects on Humans: The substance is toxic to blood, kidneys, the nervous system, liver.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
0347 Animal: embryotoxic, foetotoxic, passes through the placental barrier.
0900 Detected in maternal milk in human.
Narcotic effect; may cause nervous system disturbances.

Special Remarks on other Toxic Effects on Humans: Material is irritating to mucous membranes and upper respiratory tract.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Xylene : UN1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: m-Xylene
Massachusetts RTK: m-Xylene
TSCA 8(b) inventory: m-Xylene
SARA 313 toxic chemical notification and release reporting: m-Xylene
CERCLA: Hazardous substances.: m-Xylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R10- Flammable.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-Material safety data sheet emitted by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du rÃ¨glement sur le transport des marchandises dangeureuses au canada. Centre de conformitÃ© internatinal LtÃ©e. 1986.

Other Special Considerations: Not available.

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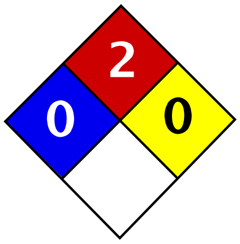

Health	0
Fire	2
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Mesitylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Mesitylene

Catalog Codes: SLM2410

CAS#: 108-67-8

RTECS: OX6825000

TSCA: TSCA 8(b) inventory: Mesitylene

CI#: Not available.

Synonym: 1,3,5-Trimethylbenzene

Chemical Formula: C_9H_{12}

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Mesitylene	108-67-8	100

Toxicological Data on Ingredients: Mesitylene: VAPOR (LC50): Acute: 4881.9 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of eye contact (irritant), of ingestion, of inhalation (lung irritant). Slightly hazardous in case of skin contact (irritant, permeator), .

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes,

keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 559°C (1038.2°F)

Flash Points: CLOSED CUP: 43°C (109.4°F).

Flammable Limits: Not available.

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Be careful that the product is not present at a

concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Avoid contact with eyes Wear suitable protective clothing If ingested, seek medical advice immediately and show the container or the label.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 25 CEIL: 35 (ppm)
TWA: 125 CEIL: 170 (mg/m3)
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Aromatic.

Taste: Not available.

Molecular Weight: 120.2 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 164.7°C (328.5°F)

Melting Point: -44.8°C (-48.6°F)

Critical Temperature: Not available.

Specific Gravity: 0.8637 (Water = 1)

Vapor Pressure: 1.86 mm of Hg (@ 20°C)

Vapor Density: 4.14 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.23 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute toxicity of the vapor (LC50): 4881.9 ppm 4 hour(s) [Rat].

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation (lung irritant).
Slightly hazardous in case of skin contact (irritant, permeator), .

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : 1,3,5-Trimethylbenzene : UN2325 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Florida: Mesitylene
New Jersey: Mesitylene
TSCA 8(b) inventory: Mesitylene

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).

DSCL (EEC):
R10- Flammable.
R36/37- Irritating to eyes and respiratory system.

HMIS (U.S.A.):

Health Hazard: 0

Fire Hazard: 2

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

BENZO(B)FLUORANTHENE
Benzo(e)acephenanthrylene
2,3-Benzofluoroanthene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 205-99-2
RTECS # CU1400000
ICSC # 0720

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• **INHALATION**		Local exhaust or breathing protection.	Fresh air, rest.
• **SKIN**	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• **EYES**		Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Tightly closed.	Unbreakable packaging; put breakable packaging into closed unbreakable container.

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0720

International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** COLOURLESS TO YELLOW CRYSTALS. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. **OCCUPATIONAL EXPOSURE LIMITS (OELs):** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and through the skin. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Melting point: 168°C Solubility in water: none	Vapour pressure, Pa at 20°C: <10 Octanol/water partition coefficient as log Pow: 6.04
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.	

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.

ADDITIONAL INFORMATION

ICSC: 0720 **BENZO(B)FLUORANTHENE**

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International Chemical Safety Cards

BENZO(K)FLUORANTHENE

ICSC: 0721

BENZO(K)FLUOROANTHENE
11,12-Benzofluoroanthene
Dibenzo(b,j,k)fluorene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 207-08-9
RTECS # DF6350000
ICSC # 0721

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• **INHALATION**		Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
• **SKIN**	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• **EYES**		Safety goggles or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Separated from strong oxidants. Tightly closed.	

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0721

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

BENZO(K)FLUORANTHENE

ICSC: 0721

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** YELLOW CRYSTALS. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. Reacts with strong oxidants. **OCCUPATIONAL EXPOSURE LIMITS (OELs):** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and through the skin. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 480°C Melting point: 215.7°C	Solubility in water: none Octanol/water partition coefficient as log Pow: 6.84
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.	
NOTES		
Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.		

ADDITIONAL INFORMATION	

ICSC: 0721 **BENZO(K)FLUORANTHENE**

IMPORTANT LEGAL NOTICE:	Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

BENZ(a)ANTHRACENE
1,2-Benzoanthracene
Benzo(a)anthracene
2,3-Benzphenanthrene
Naphthanthracene
$C_{18}H_{12}$
Molecular mass: 228.3

CAS # 56-55-3
RTECS # CV9275000
ICSC # 0385
EC # 601-033-00-9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.		Water spray, powder. In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		AVOID ALL CONTACT!	
• **INHALATION**		Local exhaust or breathing protection.	Fresh air, rest.
• **SKIN**		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• **EYES**		Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Well closed.	T symbol R: 45 S: 53-45

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0385	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** COLOURLESS TO YELLOW-BROWN FLUORESCENT FLAKES OR POWDER. **PHYSICAL DANGERS:** Dust explosion possible if in powder or granular form, mixed with air. **CHEMICAL DANGERS:** **OCCUPATIONAL EXPOSURE LIMITS (OELs):** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation, through the skin and by ingestion. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is probably carcinogenic to humans.
PHYSICAL PROPERTIES	Sublimation point: 435°C Melting point: 162°C Relative density (water = 1): 1.274	Solubility in water: none Vapour pressure, Pa at 20°C: 292 Octanol/water partition coefficient as log Pow: 5.61
ENVIRONMENTAL DATA	In the food chain important to humans, bioaccumulation takes place, specifically in seafood.	

NOTES

This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Tetraphene is a common name.

ADDITIONAL INFORMATION

ICSC: 0385 **BENZ(a)ANTHRACENE**

Material Safety Data Sheet

Benzo[a]pyrene, 98%

ACC# 37175

Section 1 - Chemical Product and Company Identification

MSDS Name: Benzo[a]pyrene, 98%
Catalog Numbers: AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000 AC377201000
Synonyms: 3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
50-32-8	Benzo[a]pyrene	>96	200-028-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: yellow to brown powder.
Danger! May cause harm to the unborn child. May impair fertility. May cause eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Cancer hazard. May cause allergic skin reaction. May cause heritable genetic damage.
Target Organs: Reproductive system, skin.

Potential Health Effects

Eye: May cause eye irritation.
Skin: May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.
Ingestion: May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated. May be harmful if swallowed.
Inhalation: May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.
Chronic: May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
Ingestion: Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.
Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: Not available.
Autoignition Temperature: Not available.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 2; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.
Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs

Benzo[a]pyrene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches).	0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches).

OSHA Vacated PELs: Benzo[a]pyrene: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Powder
Appearance: yellow to brown
Odor: faint aromatic odor
pH: Not available.
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 495 deg C @ 760 mm Hg
Freezing/Melting Point:175 - 179 deg C
Decomposition Temperature: Not available.
Solubility: 1.60x10-3 mg/l @25°C
Specific Gravity/Density: Not available.
Molecular Formula:$C_{20}H_{12}$
Molecular Weight:252.31

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Dust generation.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 50-32-8: DJ3675000
LD50/LC50:

Not available.

Carcinogenicity:
CAS# 50-32-8:

- **ACGIH:** A2 - Suspected Human Carcinogen
- **California:** carcinogen, initial date 7/1/87
- **NTP:** Suspect carcinogen
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No information found
Teratogenicity: No information found
Reproductive Effects: Adverse reproductive effects have occurred in experimental animals.
Mutagenicity: Mutagenic effects have occurred in humans.Mutagenic effects have occurred in experimental animals.
Neurotoxicity: No information found
Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 50-32-8: waste number U022.

Section 14 - Transport Information

	US DOT	**Canada TDG**
Shipping Name:	NOT REGULATED FOR DOMESTIC TRANSPORT	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOL (Benzo{a} pyrene)
Hazard Class:		9
UN Number:		UN3077
Packing Group:		III

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 50-32-8 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 50-32-8: 1 lb final RQ; 0.454 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 50-32-8: immediate, delayed.

Section 313

This material contains Benzo[a]pyrene (CAS# 50-32-8, >96%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

Clean Air Act:

This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 50-32-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Benzo[a]pyrene, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 50-32-8: 0.06 æg/day NSRL

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T N

Risk Phrases:

R 43 May cause sensitization by skin contact.
R 45 May cause cancer.
R 46 May cause heritable genetic damage.
R 60 May impair fertility.
R 61 May cause harm to the unborn child.
R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.
S 60 This material and its container must be disposed of as hazardous waste.
S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)
CAS# 50-32-8: No information available.
Canada - DSL/NDSL
CAS# 50-32-8 is listed on Canada's DSL List.
Canada - WHMIS
This product has a WHMIS classification of D2A.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.
Canadian Ingredient Disclosure List
CAS# 50-32-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 9/02/1997
Revision #7 Date: 6/30/2006

Material Safety Data Sheet

Chrysene, 98%

ACC# 95251

Section 1 - Chemical Product and Company Identification

MSDS Name: Chrysene, 98%
Catalog Numbers: AC224140000, AC224140010, AC224140050, AC224145000
Synonyms: 1,2-Benzophenanthrene; Benzo(a)phenanthrene; 1,2,5,6-Dibenzonaphthalene.
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
218-01-9	Chrysene	98	205-923-4

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: very light beige solid.
Caution! May cause eye and skin irritation. May cause respiratory tract irritation. May cause cancer in humans.
Target Organs: Liver, skin.

Potential Health Effects
Eye: May cause eye irritation.
Skin: May cause skin irritation.
Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea.
Inhalation: May cause respiratory tract irritation.
Chronic: May cause cancer according to animal studies.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
Skin: Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.
Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air

immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. This material in sufficient quantity and reduced particle size is capable of creating a dust explosion.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or chemical foam.
Flash Point: Not applicable.
Autoignition Temperature: Not available.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: ; Flammability: 1; Instability:

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Wash hands before eating. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Avoid breathing dust.
Storage: Store in a tightly closed container. Store in a cool, dry area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Chrysene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches).	0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches).

OSHA Vacated PELs: Chrysene: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance: very light beige
Odor: Not available.
pH: Not available.
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 448 deg C @ 760 mm Hg
Freezing/Melting Point:250-255 deg C
Decomposition Temperature: Not available.
Solubility: insoluble
Specific Gravity/Density: Not available.
Molecular Formula:$C_{18}H_{12}$
Molecular Weight:228.29

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Dust generation.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 218-01-9: GC0700000
LD50/LC50:
Not available.

Carcinogenicity:
CAS# 218-01-9:

- **ACGIH:** A3 - Confirmed animal carcinogen with unknown relevance to humans

- **California:** carcinogen, initial date 1/1/90
- **NTP:** Known carcinogen (listed as Coal tar pitches).
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No information found
Teratogenicity: No information found
Reproductive Effects: No information found
Mutagenicity: Chrysene was mutagenic to S. Typhimurium in the presence of an exogenous metabolic system.
Neurotoxicity: No information found
Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Water flea LC50 = 1.9 mg/L; 2 Hr.; Unspecified Fish toxicity : LC50 (96hr) Neauthes arenacedentata >1ppm.(Rossi,S.S. et al Marine Pollut. Bull. 1978) Invertebrate toxicity : lethal treshold concentration (24hr) Daphnia Magna 0,7æg/l.(* Newsted,J.L. et al Environ. Toxicol. Chem. 1987) Bioaccumulation : 24hr Daphnia Magna log bioconcentration factor 3.7845 (*)
Environmental: Degradation studies : biodegradated by white rot fungus (Proc.Annu.Meet.Am.Wood-Preserv.Assoc.1989) May be utilised by axenic cultures of microorganisms e.g. Pseudomonas pancimobilis EPA505, which may have novel degradative systems(Mueller,J.G. et al ppl.Environ.Microbiol.1990; Mueller, J.G. et al Environ.Sci.Technol.1991).
Physical: Not found.
Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 218-01-9: waste number U050.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Not regulated as a hazardous material	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 218-01-9 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 218-01-9: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
Section 313
This material contains Chrysene (CAS# 218-01-9, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 218-01-9 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 218-01-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:
WARNING: This product contains Chrysene, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 218-01-9: 0.35 æg/day NSRL (oral)

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
T
Risk Phrases:
R 45 May cause cancer.
R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.
S 60 This material and its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)

CAS# 218-01-9: No information available.

Canada - DSL/NDSL

CAS# 218-01-9 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 218-01-9 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 6/30/1999
Revision #4 Date: 10/03/2005

Material Safety Data Sheet

Fluoranthene, 98%

ACC# 80991

Section 1 - Chemical Product and Company Identification

MSDS Name: Fluoranthene, 98%
Catalog Numbers: AC119170000, AC119170250, AC119171000, AC119175000
Synonyms: 1,2-(1,8-Naphthalenediyl)benzene; 1,2-(1,8-Naphthylene)benzene; 1,2-Benzacenaphthene; Benzene, 1,2-(1,8-naphthylene)-; Benzo(j,k)fluorene; Benzo(jk)fluoranthene; Benzo(jk)fluorene
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
206-44-0	Fluoranthene	98	205-912-4

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: yellow needles.
Caution! Harmful. Causes eye and skin irritation and possible burns. May be harmful if absorbed through the skin. May be harmful if swallowed. May cause heart and liver injury.
Target Organs: Heart, liver, lungs.

Potential Health Effects

Eye: Causes eye irritation and possible burns.
Skin: May be harmful if absorbed through the skin. Causes severe skin irritation and possible burns.
Ingestion: May be harmful if swallowed. May cause rapid heartbeat and cardiac arrythmias. May cause liver injury, pulmonary edema, and respiratory arrest. May cause gastrointestinal disturbances such as nausea.
Inhalation: May cause effects similar to those described for ingestion. May produce cardiac failure and pulmonary edema.
Chronic: Prolonged or repeated skin contact may cause defatting and dermatitis.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the

upper and lower eyelids. Get medical aid immediately. Do NOT allow victim to rub eyes or keep eyes closed. Extensive irrigation with water is required (at least 30 minutes).
Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes.
Ingestion: Never give anything by mouth to an unconscious person. Get medical aid immediately. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
Extinguishing Media: In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.
Flash Point: Not applicable.
Autoignition Temperature: Not applicable.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 2; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Do not get in eyes, on skin, or on clothing. Do not ingest or inhale. Use only in a chemical fume hood. Do not breathe dust.
Storage: Keep containers tightly closed. Store in a cool, dry area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Fluoranthene	none listed	none listed	none listed

OSHA Vacated PELs: Fluoranthene: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves and clothing to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Needles
Appearance: yellow
Odor: None reported.
pH: Not available.
Vapor Pressure: 0.01 mm Hg @ 20 deg C
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 384 deg C @ 760.00mmHg
Freezing/Melting Point:107.00 - 110.00 deg C
Decomposition Temperature: Not available.
Solubility: insoluble
Specific Gravity/Density:1.252 g/cm3
Molecular Formula:$C_{16}H_{10}$
Molecular Weight:202.25

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Incompatible materials, strong oxidants.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide, acrid smoke and fumes.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 206-44-0: LL4025000
LD50/LC50:
CAS# 206-44-0:
Oral, rat: LD50 = 2 gm/kg;

Skin, rabbit: LD50 = 3180 mg/kg;
.

Carcinogenicity:
CAS# 206-44-0: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: IARC Group 3: Limited or insufficient evidence for carcinogenicity in both animals and humans.Experimental tumorigenic data has been reported.
Teratogenicity: No information found
Reproductive Effects: No information found
Mutagenicity: Mutation in microorganisms: Salmonella typhimurium = 5ug/plate.Mutation in mammalian somatic cells: Human Lymphocyte = 2 umol/L.
Neurotoxicity: No information found
Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Bluegill/Sunfish: 3980 um/L; 96 H; (not specified) No data available.
Environmental: Remains in the upper few cm of soil, but can be transported to groundwater. Biodegrades from soil in a few years. Will not volatilize from soil or water. Rapidly absorbed to sediment and particulates and will readily bioconcentrate. Unadsorbed substance in water will degrade by photolysis in a days to weeks. Stable in sediment for decades or more. In the atmostphere, photodegrades with half life of 4 - 5 days, but may transport long distances without settling or raining out.
Physical: No information available.
Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 206-44-0: waste number U120.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Not regulated as a hazardous material	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 206-44-0 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 206-44-0: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 206-44-0: immediate.
Section 313
This material contains Fluoranthene (CAS# 206-44-0, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 206-44-0 is listed as a Priority Pollutant under the Clean Water Act. CAS# 206-44-0 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 206-44-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
XN
Risk Phrases:
R 21/22 Harmful in contact with skin and if swallowed.

Safety Phrases:
S 22 Do not breathe dust.
S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)
CAS# 206-44-0: No information available.
Canada - DSL/NDSL
CAS# 206-44-0 is listed on Canada's NDSL List.
Canada - WHMIS

This product has a WHMIS classification of D2B.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 206-44-0 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 9/02/1997
Revision #5 Date: 10/03/2005

MSDS Number: **L2347** * * * * * *Effective Date:* ***08/10/04*** * * * * * *Supercedes:* ***11/02/01***

MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

LEAD METAL

1. Product Identification

Synonyms: Granular lead, pigment metal; C.I. 77575
CAS No.: 7439-92-1
Molecular Weight: 207.19
Chemical Formula: Pb
Product Codes:
J.T. Baker: 2256, 2266
Mallinckrodt: 5668

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Lead	7439-92-1	95 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)
Flammability Rating: 0 - None
Reactivity Rating: 0 - None
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:

Lead can be absorbed through the respiratory system. Local irritation of bronchia and lungs can occur and, in cases of acute exposure, symptoms such as metallic taste, chest and abdominal pain, and increased lead blood levels may follow. See also Ingestion.

Ingestion:
POISON! The symptoms of lead poisoning include abdominal pain and spasms, nausea, vomiting, headache. Acute poisoning can lead to muscle weakness, "lead line" on the gums, metallic taste, definite loss of appetite, insomnia, dizziness, high lead levels in blood and urine with shock, coma and death in extreme cases.

Skin Contact:
Lead and lead compounds may be absorbed through the skin on prolonged exposure; the symptoms of lead poisoning described for ingestion exposure may occur. Contact over short periods may cause local irritation, redness and pain.

Eye Contact:
Absorption can occur through eye tissues but the more common hazards are local irritation or abrasion.

Chronic Exposure:
Lead is a cumulative poison and exposure even to small amounts can raise the body's content to toxic levels. The symptoms of chronic exposure are like those of ingestion poisoning; restlessness, irritability, visual disturbances, hypertension and gray facial color may also be noted.

Aggravation of Pre-existing Conditions:
Persons with pre-existing kidney, nerve or circulatory disorders or with skin or eye problems may be more susceptible to the effects of this substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard. Powder/dust is flammable when heated or exposed to flame.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Can produce toxic lead fumes at elevated temperatures and also react with oxidizing materials.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances. Areas in which exposure to lead metal or lead compounds may occur should be identified by signs or appropriate means, and access to the area should be limited to authorized persons. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

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8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For lead, metal and inorganic dusts and fumes, as Pb:
-OSHA Permissible Exposure Limit (PEL): 0.05 mg/m3 (TWA)
For lead, elemental and inorganic compounds, as Pb:
-ACGIH Threshold Limit Value (TLV): 0.05 mg/m3 (TWA), A3 animal carcinogen
ACGIH Biological Exposure Indices (BEI): 30 ug/100ml, notation B (see actual Indices for more information).
For lead, inorganic:
-NIOSH Recommended Exposure Limit (REL): 0.1 mg/m3 (TWA)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half-face high efficiency particulate respirator (NIOSH type N100 filter) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece high efficiency particulate respirator (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:
Eating, drinking, and smoking should not be permitted in areas where solids or liquids containing lead compounds are handled, processed, or stored. See OSHA substance-specific standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1025).

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9. Physical and Chemical Properties

Appearance:
Small, white to blue-gray metallic shot or granules.
Odor:
Odorless.
Solubility:
Insoluble in water.
Density:
11.34
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
1740C (3164F)
Melting Point:
327.5C (622F)
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
1.77 @ 1000C (1832F)
Evaporation Rate (BuAc=1):
No information found.

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Does not decompose but toxic lead or lead oxide fumes may form at elevated temperatures.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Ammonium nitrate, chlorine trifluoride, hydrogen peroxide, sodium azide, zirconium, disodium acetylide, sodium acetylide and oxidants.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

---

11. Toxicological Information

Toxicological Data:
Investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
Lead and other smelter emissions are human reproductive hazards. (Chemical Council on

Environmental Quality; Chemical Hazards to Human Reproduction, 1981).

Carcinogenicity:

EPA / IRIS classification: Group B2 - Probable human carcinogen, sufficient animal evidence.

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--------\Cancer Lists\------------------------------------------------------
                                       ---NTP Carcinogen---
Ingredient                             Known    Anticipated    IARC Category
------------------------------------   -----    -----------    -------------
Lead (7439-92-1)                        No          No              2B
```

12. Ecological Information

Environmental Fate:

When released into the soil, this material is not expected to leach into groundwater. This material may bioaccumulate to some extent.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

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--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                        TSCA  EC   Japan  Australia
-----------------------------------------------   ----  ---  -----  ---------
Lead (7439-92-1)                                   Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                                --Canada--
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Ingredient	Korea	DSL	NDSL	Phil.
Lead (7439-92-1)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

Ingredient	-SARA 302- RQ	 TPQ	------SARA 313------ List	 Chemical Catg.
Lead (7439-92-1)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Lead (7439-92-1)	10	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

WARNING:
THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: None allocated.
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **1** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not

breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

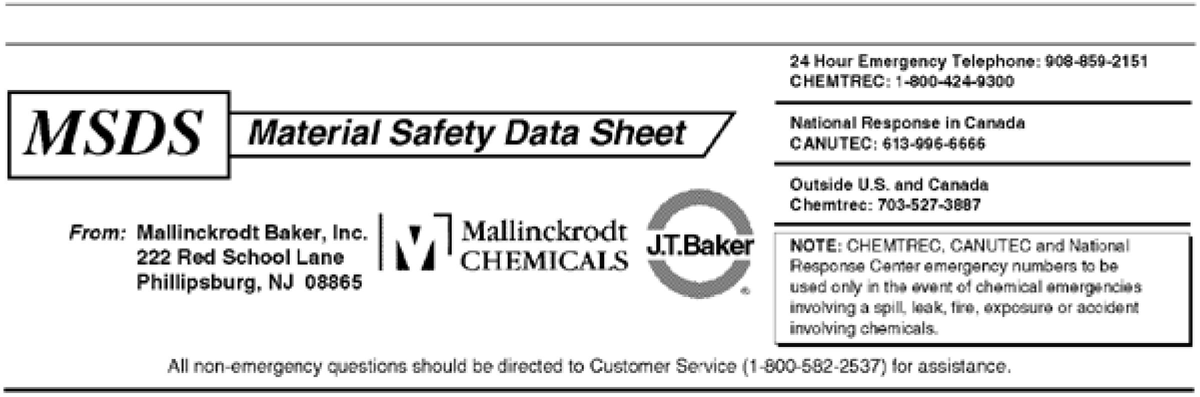
Revision Information:

No Changes.

Disclaimer:

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **M1599** * * * * * *Effective Date:* ***12/19/05*** * * * * * *Supercedes:* ***08/10/04***



MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS
J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

MERCURY

1. Product Identification

Synonyms: Quicksilver; hydrargyrum; Liquid Silver
CAS No.: 7439-97-6
Molecular Weight: 200.59
Chemical Formula: Hg
Product Codes:
J.T. Baker: 2564, 2567, 2569
Mallinckrodt: 1278, 1280, 1288

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Mercury	7439-97-6	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM. MAY CAUSE ALLERGIC SKIN REACTION.

SAF-T-DATA$^{\mathbf{(tm)}}$ Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Life)
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:
Mercury vapor is highly toxic via this route. Causes severe respiratory tract damage. Symptoms include sore throat, coughing, pain, tightness in chest, breathing difficulties, shortness of breath, headache, muscle weakness, anorexia, gastrointestinal disturbance, ringing in the ear, liver changes, fever, bronchitis and pneumonitis. Can be absorbed through inhalation with symptoms similar to ingestion.
Ingestion:
May cause burning of the mouth and pharynx, abdominal pain, vomiting, corrosive ulceration, bloody diarrhea. May be followed by a rapid and weak pulse, shallow breathing, paleness, exhaustion, tremors and collapse. Delayed death may occur from renal failure. Gastrointenstinal uptake of mercury is less than 5% but its ability to penetrate tissues presents some hazard. Initial symptoms may be thirst, possible abdominal discomfort.
Skin Contact:
Causes irritaton and burns to skin. Symptoms include redness and pain. May cause skin allergy and sensitization. Can be absorbed through the skin with symptoms to parallel ingestion.
Eye Contact:
Causes irritation and burns to eyes. Symptoms include redness, pain, blurred vision; may cause serious and permanent eye damage.
Chronic Exposure:
Chronic exposure through any route can produce central nervous system damage. May cause muscle tremors, personality and behavior changes, memory loss, metallic taste, loosening of the teeth, digestive disorders, skin rashes, brain damage and kidney damage. Can cause skin allergies and accumulate in the body. Repeated skin contact can cause the skin to turn gray in color. A suspected reproductive hazard; may damage the developing fetus and decrease fertility in males and females.
Aggravation of Pre-existing Conditions:
Persons with nervous disorders, or impaired kidney or respiratory function, or a history of allergies or a known sensitization to mercury may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Undergoes hazardous reactions in the presence of heat and sparks or ignition. Smoke may contain toxic mercury or mercuric oxide. Smoke may contain toxic mercury or mercuric oxide.

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6. Accidental Release Measures

Ventilate area of leak or spill. Clean-up personnel require protective clothing and respiratory protection from vapor.

Spills: Pick up and place in a suitable container for reclamation or disposal in a method that does not generate misting. Sprinkle area with sulfur or calcium polysulfide to suppress mercury. Do not flush to sewer. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker CINNASORB® and RESISORB® are recommended for spills of this product.

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7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Do not use or store on porous work surfaces (wood, unsealed concrete, etc.). Follow strict hygiene practices. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Acceptable Ceiling Concentration:
mercury and mercury compounds: 0.1 mg/m3 (TWA), skin
- ACGIH Threshold Limit Value (TLV):
inorganic and metallic mercury, as Hg: 0.025 mg/m3 (TWA) skin, A4 Not classifiable as a human carcinogen.
- ACGIH Biological Exposure Indices:
total inorganic mercury in urine (preshift): 35 ug/g creatinine;
total inorganic mercury in blood (end of shift): 15 ug/l.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half-face respirator with a mercury vapor or chlorine gas cartridge may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece respirator with a mercury vapor or chlorine gas cartridge may be worn up to 50 times the exposure limit, or the maximum use concentraiton specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
Silver-white, heavy, mobile, liquid metal.
Odor:
Odorless.
Solubility:
Insoluble in water.
Density:
13.55
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
356.7C (675F)
Melting Point:
-38.87C (-38F)
Vapor Density (Air=1):
7.0
Vapor Pressure (mm Hg):
0.0018 @ 25C (77F)
Evaporation Rate (BuAc=1):
4

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
At high temperatures, vaporizes to form extremely toxic fumes.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Acetylenes, ammonia, ethylene oxide, chlorine dioxide, azides, metal oxides, methyl silane, lithium, rubidium, oxygen, strong oxidants, metal carbonyls.
Conditions to Avoid:
Heat, flames, ignition sources, metal surfaces and incompatibles.

11. Toxicological Information

Toxicological Data:
Investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
All forms of mercury can cross the placenta to the fetus, but most of what is known has

been learned from experimental animals. See Chronic Health Hazards.
Carcinogenicity:
EPA / IRIS classification: Group D1 - Not classifiable as a human carcinogen.

--------\Cancer Lists\--------

	---NTP Carcinogen---		
Ingredient	Known	Anticipated	IARC Category
Mercury (7439-97-6)	No	No	3

12. Ecological Information

Environmental Fate:
This material has an experimentally-determined bioconcentration factor (BCF) of greater than 100. This material is expected to significantly bioaccumulate.
Environmental Toxicity:
This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are less than 1 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: RQ, MERCURY
Hazard Class: 8
UN/NA: UN2809
Packing Group: III
Information reported for product/size: 1LB

International (Water, I.M.O.)

Proper Shipping Name: MERCURY
Hazard Class: 8
UN/NA: UN2809
Packing Group: III
Information reported for product/size: 1LB

International (Air, I.C.A.O.)

Proper Shipping Name: MERCURY
Hazard Class: 8
UN/NA: UN2809
Packing Group: III
Information reported for product/size: 1LB

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Mercury (7439-97-6)	Yes	Yes	No	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Mercury (7439-97-6)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Mercury (7439-97-6)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------------

		-RCRA-	-TSCA-
Ingredient	CERCLA	261.33	8(d)
Mercury (7439-97-6)	1	U151	No

Chemical Weapons Convention: No   TSCA 12(b): No   CDTA: No
SARA 311/312: Acute: Yes   Chronic: Yes Fire: No Pressure: No
Reactivity: No   (Pure / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 2Z
Poison Schedule: S7
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**

Label Hazard Warning:

DANGER! CORROSIVE. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM. MAY CAUSE ALLERGIC SKIN REACTION.

Label Precautions:

Do not get in eyes, on skin, or on clothing.
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.

Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 3.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Material Safety Data Sheet

Phenanthrene, 90%

ACC# 59921

Section 1 - Chemical Product and Company Identification

MSDS Name: Phenanthrene, 90%
Catalog Numbers: AC130100000, AC130100010, AC130102500
Synonyms:
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
85-01-8	Phenanthrene	90.0	201-581-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: brown solid.
Caution! Powdered material may form explosive dust-air mixtures. May cause allergic skin reaction. May cause eye and skin irritation. May cause respiratory tract irritation. Cancer suspect agent.
Target Organs: None.

Potential Health Effects

Eye: May cause eye irritation.
Skin: May cause skin irritation. May cause photosensitive skin reactions in certain individuals.
Ingestion: May cause irritation of the digestive tract.
Inhalation: Inhalation of dust may cause respiratory tract irritation.
Chronic: No information found.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid imme diately.
Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
Extinguishing Media: Use water spray or dry chemical.
Flash Point: Not available.
Autoignition Temperature: Not available.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 1; Flammability: 1; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation. Do not let this chemical enter the environment.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.
Storage: Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use adequate ventilation to keep airborne concentrations low.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Phenanthrene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches).	0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches).

OSHA Vacated PELs: Phenanthrene: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance: brown
Odor: none reported
pH: Not available.
Vapor Pressure: 1 mm Hg @116c
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 340 deg C
Freezing/Melting Point:101 deg C
Decomposition Temperature: Not available.
Solubility: insoluble
Specific Gravity/Density:1.0630g/cm3
Molecular Formula:$C_{14}H_{10}$
Molecular Weight:178.23

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Incompatible materials, dust generation, strong oxidants.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 85-01-8: SF7175000
LD50/LC50:
CAS# 85-01-8:
    Oral, mouse: LD50 = 700 mg/kg;
    Oral, rat: LD50 = 1.8 gm/kg;
.

Carcinogenicity:
CAS# 85-01-8:

- **ACGIH:** A1 - Confirmed Human Carcinogen (as benzene soluble aerosol) (listed as 'Coal tar pitches').
- **California:** Not listed.
- **NTP:** Known carcinogen (listed as Coal tar pitches).
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No data available.
Teratogenicity: No data available.
Reproductive Effects: No data available.
Mutagenicity: No data available.
Neurotoxicity: No data available.
Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	**Canada TDG**
Shipping Name:	Not regulated as a hazardous material	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 85-01-8 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 85-01-8: 5000 lb final RQ; 2270 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 85-01-8: immediate.

Section 313

This material contains Phenanthrene (CAS# 85-01-8, 90.0%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 85-01-8 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 85-01-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, (listed as Coal tar pitches), Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T

Risk Phrases:

R 45 May cause cancer.

Safety Phrases:

S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)

CAS# 85-01-8: No information available.

Canada - DSL/NDSL

CAS# 85-01-8 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2B.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

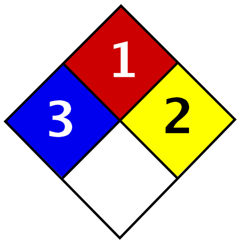
Canadian Ingredient Disclosure List

CAS# 85-01-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 7/14/1998
Revision #3 Date: 10/03/2005

ScienceLab.com
Chemicals & Laboratory Equipment



Health	3
Fire	1
Reactivity	2
Personal Protection	E

Material Safety Data Sheet
Arsenic MSDS

Section 1: Chemical Product and Company Identification

Product Name: Arsenic

Catalog Codes: SLA1006

CAS#: 7440-38-2

RTECS: CG0525000

TSCA: TSCA 8(b) inventory: Arsenic

CI#: Not applicable.

Synonym:

Chemical Name: Arsenic

Chemical Formula: As

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Arsenic	7440-38-2	100

Toxicological Data on Ingredients: Arsenic: ORAL (LD50): Acute: 763 mg/kg [Rat]. 145 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to kidneys, lungs, the nervous system, mucous membranes.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits highly toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not

present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.01 from ACGIH (TLV) [United States] [1995]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 74.92 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: Not available.

Melting Point: Sublimation temperature: 615°C (1139°F)

Critical Temperature: Not available.

Specific Gravity: 5.72 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 145 mg/kg [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH.
Causes damage to the following organs: kidneys, lungs, the nervous system, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion, of inhalation.
Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Arsenic UNNA: UN1558 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Arsenic
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Arsenic
Pennsylvania RTK: Arsenic
Massachusetts RTK: Arsenic
TSCA 8(b) inventory: Arsenic

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R22- Harmful if swallowed.
R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 2

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 2

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec.
-Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

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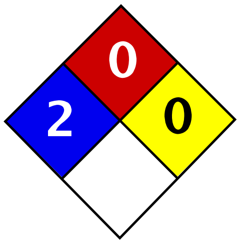

Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Nickel metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nickel metal

Catalog Codes: SLN2296, SLN1342, SLN1954

CAS#: 7440-02-0

RTECS: QR5950000

TSCA: TSCA 8(b) inventory: Nickel metal

CI#: Not applicable.

Synonym: Nickel Metal shot; Nickel metal foil.

Chemical Name: Nickel

Chemical Formula: Ni

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Nickel metal	7440-02-0	100

Toxicological Data on Ingredients: Nickel metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer).
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to skin.
The substance may be toxic to kidneys, lungs, liver, upper respiratory tract.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

Special Remarks on Explosion Hazards:
Material in powder form, capable of creating a dust explosion.
Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode.
Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion.
Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 (mg/m3) from ACGIH (TLV) [United States] Inhalation Respirable.
TWA: 0.5 (mg/m3) [United Kingdom (UK)]
TWA: 1 (mg/m3) from OSHA (PEL) [United States] InhalationConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid. Lustrous solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 58.71 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: 2730°C (4946°F)

Melting Point: 1455°C (2651°F)

Critical Temperature: Not available.

Specific Gravity: Density: 8.908 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Insoluble in cold water, hot water.
Insoluble in Ammonia.
Soluble in dilute Nitric Acid.
Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, combustible materials, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + indusorial earth.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
Causes damage to the following organs: skin.
May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:

Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose/Conc:
LDL [Rat] - Route: Oral; Dose: 5000 mg/kg
LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

Special Remarks on Chronic Effects on Humans: May cause cancer based on animal test data

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Nickel dust and fume can irritate skin.
Eyes: Nickel dust and fume can irritate eyes.
Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.
Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased cornary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).
Chronic Potential Health Effects:
Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.
Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).
Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy.
Chronic ingestion of NIckel may also affect respiration and cause pneumoconiosis or fibrosis.
Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Nickel metal
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Nickel metal
Connecticut hazardous material survey.: Nickel metal
Illinois toxic substances disclosure to employee act: Nickel metal
Illinois chemical safety act: Nickel metal
New York release reporting list: Nickel metal
Rhode Island RTK hazardous substances: Nickel metal
Pennsylvania RTK: Nickel metal
Michigan critical material: Nickel metal
Massachusetts RTK: Nickel metal
Massachusetts spill list: Nickel metal
New Jersey: Nickel metal
New Jersey spill list: Nickel metal
Louisiana spill reporting: Nickel metal
California Director's List of Hazardous Substances: Nickel metal
TSCA 8(b) inventory: Nickel metal

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects.
R43- May cause sensitization by skin contact.
S22- Do not breathe dust.
S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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U.S. Environmental Protection Agency

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Health & Safety
Specific Chemicals
Regulatory Actions

Assessing Health Risks from Pesticides

January 1999
735-F-99-002

The Federal Government, in cooperation with the States, carefully regulates pesticides to ensure that they do not pose unreasonable risks to human health or the environment. As part of that effort, the Environmental Protection Agency (EPA) requires extensive test data from pesticide producers that demonstrate pesticide products can be used without posing harm to human health and the environment. EPA scientists and analysts carefully review these data to determine whether to register (license) a pesticide product or a use and whether specific restrictions are necessary. This fact sheet is a brief overview of EPA's process for assessing potential risks to human health when evaluating pesticide products.

Background

There are more than 865 active ingredients registered as pesticides, which are formulated into thousands of pesticide products that are available in the marketplace. About 350 pesticides are used on the foods we eat, and to protect our homes and pets.

EPA plays a critical role in evaluating these chemicals prior to registration, and in reevaluating older pesticides already on the market, to ensure that they can be used with a reasonable certainty of no harm. The process EPA uses for evaluating the health impacts of a pesticide is called risk assessment.

EPA uses the National Research Council's four-step process for human health risk assessment:

Step One: Hazard Identification
Step Two: Dose-Response Assessment
Step Three: Exposure Assessment
Step Four: Risk Characterization

Step One: Hazard Identification (Toxicology)

The first step in the risk assessment process is to identify potential health effects that may occur from different types of pesticide exposure. EPA considers the full spectrum of a pesticide's potential health effects.

Generally, for human health risk assessments, many toxicity studies are conducted on animals by pesticide companies in independent laboratories and evaluated for acceptability by EPA scientists. EPA evaluates pesticides for a wide range of adverse effects, from eye and skin irritation to cancer and birth defects in laboratory animals. EPA may also consult the public literature or other sources of supporting information on any aspect of the chemical.

Step Two: Dose-Response Assessment

Paracelsus, the Swiss physician and alchemist, the "father" of modern toxicology (1493-1541) said,

> "The dose makes the poison."

In other words, **the amount of a substance a person is exposed to** is as important as **how toxic the chemical might be**. For example, small doses of aspirin can be beneficial to people, but at very high doses, this common medicine can be deadly. In some individuals, even at very low doses, aspirin may be deadly.

Dose-response assessment involves considering the dose levels at which adverse effects were observed in test animals, and using these dose levels to calculate an equal dose in humans.

Step Three: Exposure Assessment

People can be exposed to pesticides in three ways:

1. Inhaling pesticides (inhalation exposure),
2. Absorbing pesticides through the skin (dermal exposure), and
3. Getting pesticides in their mouth or digestive tract (oral exposure).

Depending on the situation, pesticides could enter the body by any one or all of these routes. Typical sources of pesticide exposure include:

- **Food**
  Most of the foods we eat have been grown with the use of pesticides. Therefore, pesticide residues may be present inside or on the surfaces of these foods.

- **Home and Personal Use Pesticides**
  You might use pesticides in and around your home to control insects, weeds, mold, mildew, bacteria, lawn and garden pests and to protect your pets from pests such as fleas. Pesticides may also be used as insect repellants which are directly applied to the skin or clothing.

- **Pesticides in Drinking Water**
  Some pesticides that are applied to farmland or other land structures can make their way in small amounts to the ground water or surface water systems that feed drinking water supplies.

- **Worker Exposure to Pesticides**
  Pesticide applicators, vegetable and fruit pickers and others who work around pesticides can be exposed due to the nature of their jobs. To address the unique risks workers face from occupational exposure, EPA evaluates occupational exposure through a separate program. All pesticides registered by EPA have been shown to be safe when used properly.

Step Four: Risk Characterization

Risk characterization is the final step in assessing human health risks from pesticides. It is the process of combining the hazard, dose-response and exposure assessments to describe the overall risk from a pesticide. It explains the assumptions used in assessing exposure as well as the uncertainties that are built into the dose-response assessment. The strength of the overall database is considered, and broad conclusions are made. EPA's role is to evaluate both toxicity and exposure and to determine the risk associated with use of the pesticide.

Simply put,

RISK = TOXICITY x EXPOSURE.

This means that the risk to human health from pesticide exposure depends on both the toxicity of the pesticide and the likelihood of people coming into contact with it. At least *some* exposure and *some* toxicity are required to result in a risk. For example, if the pesticide is very poisonous, but no people are exposed, there is no risk. Likewise, if there is ample exposure but the chemical is non-toxic, there is no risk. However, usually when pesticides are used, there is some toxicity and exposure, which results in a potential risk.

EPA recognizes that effects vary between animals of different species and from person to person. To account for this variability, *uncertainty factors* are built into the risk assessment. These uncertainty factors create an additional margin of safety for protecting people who may be exposed to the pesticides. FQPA requires EPA to use an extra 10-fold safety factor, if necessary, to protect infants and children from effects of the pesticide.

Types of Toxicity Tests EPA Requires for Human Health Risk Assessments

EPA evaluates studies conducted over different periods of time and that measure specific types of effects. These tests are evaluated to screen for potential health effects in infants, children and adults.

Acute Testing: Short-term exposure; a single exposure (dose).

- Oral, dermal (skin), and inhalation exposure
- Eye irritation
- Skin irritation
- Skin sensitization
- Neurotoxicity

Sub-chronic Testing: Intermediate exposure; repeated exposure over a longer period of time (i.e., 30-90 days).

- Oral, dermal (skin), and inhalation
- Neurotoxicity (nerve system damage)

Chronic Toxicity Testing: Long-term exposure; repeated exposure lasting for most of the test animal's life span. Intended to determine the effects of a pesticide after prolonged and repeated exposures.

- Chronic effects (non-cancer)
- Carcinogenicity (cancer)

Developmental and Reproductive Testing: Identify effects in the fetus of an exposed pregnant female (birth defects) and how pesticide exposure affects the ability of a test animal to successfully reproduce.

Mutagenicity Testing: Assess a pesticide's potential to affect the cell's genetic components.

Hormone Disruption: Measure effects for their potential to disrupt the endocrine system. The endocrine system consists of a set of glands and the hormones they produce that help guide the development, growth, reproduction, and behavior of animals including humans.

Risk Management

Once EPA completes the risk assessment process for a pesticide, we use this information to determine if (when used according to label directions), there is a reasonable certainty that the pesticide will not harm a person's health.

Using the conclusions of a risk assessment, EPA can then make a more informed decision regarding whether to approve a pesticide chemical or use, as proposed, or whether additional protective measures are necessary to limit occupational or non-occupational exposure to a pesticide. For example, EPA may prohibit a pesticide from being used on certain crops because consuming too much food treated with the pesticide may result in an unacceptable risk to consumers. Another example of protective measures is requiring workers to wear personal protective equipment (PPE) such as a respirator or chemical resistant gloves, or not allowing workers to enter treated crop fields until a specific period of time has passed.

If, after considering all appropriate risk reduction measures, the pesticide still does not meet EPA's safety standard, the Agency will not allow the proposed chemical or use. Regardless of the specific measures enforced, EPA's primary goal is to ensure that legal uses of the pesticide are protective of human health, especially the health of children, and the environment.

Human Health Risk Assessment and the Law

Federal law requires detailed evaluation of pesticides to protect human health and the environment. In 1996, Congress made significant changes to strengthen pesticide laws through the Food Quality Protection Act (FQPA). Many of these changes are key elements of the current risk assessment process. FQPA required that EPA consider:

- **A New Safety Standard**: FQPA strengthened the safety standard that pesticides must meet before being approved for use. EPA must ensure with a reasonable certainty that no harm will result from the legal uses of the pesticide.
- **Exposure from All Sources**: In evaluating a pesticide, EPA must estimate the combined risk from that pesticide from all non-occupational sources, such as:
  - Food Sources
  - Drinking Water Sources
  - Residential Sources
- **Cumulative Risk**: EPA is required to evaluate pesticides in light of similar toxic effects that different pesticides may share, or "a common mechanism of toxicity." At this time, EPA is developing a methodology for this type of assessment.
- **Special Sensitivity of Children to Pesticides**: EPA must ascertain whether there is an increased susceptibility from exposure to the pesticide to infants and children. EPA must build an additional 10-fold safety factor into risk assessments to ensure the protection of infants and children, unless it is determined that a lesser margin of safety will be safe for infants and children.

For More Information

If you would like more information about EPA's pesticide programs, contact the Communication Service Branch at (703) 305-5017 or visit the Pesticides Web site.

For more information on specific pesticides, or to inquire about the symptoms of pesticide poisoning, call the National Pesticide Information Center (NPIC), a toll-free hotline information at: 1-800-858-7378, or visit their Web site EXIT Disclaimer .

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Last updated on Tuesday, May 2nd, 2006
URL: http://www.epa.gov/pesticides/factsheets/riskassess.htm

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

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February 2001

ToxFAQs™
for
Polychlorinated Biphenyls (PCBs)

(Bifenilos Policlorados (BPCs))

This fact sheet answers the most frequently asked health questions about polychlorinated biphenyls (PCBs). For more information, you may call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls (PCBs)?

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors,

Contact Information

RELATED RESOURCES

ToxFAQ™ *35k*

ToxFAQ™ en Español *32k*

Public Health Statement *125k*

Public Health Statement en Español *321k*

Toxicological Profile *13.6MB*

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ToxFAQs™ en Español

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Division of Toxicology

and old microscope and hydraulic oils.

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What happens to polychlorinated biphenyls (PCBs) when they enter the environment?

- PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.
- PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.
- PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.
- PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

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How might I be exposed to polychlorinated biphenyls (PCBs)?

- Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.
- Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.
- Breathing air near hazardous waste sites and drinking contaminated well water.
- In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

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How can polychlorinated biphenyls (PCBs) affect my health?

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

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How likely are polychlorinated biphenyls (PCBs) to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The EPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

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How do polychlorinated biphenyls (PCBs) affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

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How can families reduce the risk of exposure to polychlorinated biphenyls (PCBs)?

- You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.
- Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.
- Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.
- If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

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Is there a medical test to show whether I've been exposed to polychlorinated biphenyls (PCBs)?

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

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Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

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References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for polychlorinated biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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Where can I get more information?

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

For more information, contact:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333
Phone: 1-888-42-ATSDR (1-888-422-8737)
FAX: (770)-488-4178
Email: ATSDRIC@cdc.gov

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ATSDR Department of Health and Human Services
Agency for Toxic Substances & Disease Registry

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2007 CERCLA Priority List of Hazardous Substances

2007 RANK	SUBSTANCE NAME	TOTAL POINTS	2005 RANK	CAS #
1	ARSENIC	1672.58	1	007440-38-2
2	LEAD	1534.07	2	007439-92-1
3	MERCURY	1504.69	3	007439-97-6
4	VINYL CHLORIDE	1387.75	4	000075-01-4
5	POLYCHLORINATED BIPHENYLS	1365.78	5	001336-36-3
6	BENZENE	1355.96	6	000071-43-2
7	CADMIUM	1324.22	8	007440-43-9
8	POLYCYCLIC AROMATIC HYDROCARBONS	1316.98	7	130498-29-2
9	BENZO(A)PYRENE	1312.45	9	000050-32-8
10	BENZO(B)FLUORANTHENE	1266.55	10	000205-99-2
11	CHLOROFORM	1223.03	11	000067-66-3
12	DDT, P,P'-	1193.36	12	000050-29-3
13	AROCLOR 1254	1182.63	13	011097-69-1
14	AROCLOR 1260	1177.77	14	011096-82-5
15	DIBENZO(A,H)ANTHRACENE	1165.88	15	000053-70-3
16	TRICHLOROETHYLENE	1154.73	16	000079-01-6
17	DIELDRIN	1150.91	17	000060-57-1
18	CHROMIUM, HEXAVALENT	1149.98	18	018540-29-9
19	PHOSPHORUS, WHITE	1144.77	19	007723-14-0
20	CHLORDANE	1133.21	21	000057-74-9
21	DDE, P,P'-	1132.49	20	000072-55-9
22	HEXACHLOROBUTADIENE	1129.63	22	000087-68-3
23	COAL TAR CREOSOTE	1124.32	23	008001-58-9
24	ALDRIN	1117.22	25	000309-00-2
25	DDD, P,P'-	1114.83	24	000072-54-8
26	BENZIDINE	1114.24	26	000092-87-5
27	AROCLOR 1248	1112.20	27	012672-29-6
28	CYANIDE	1099.48	28	000057-12-5
29	AROCLOR 1242	1093.14	29	053469-21-9
30	AROCLOR	1091.52	62	012767-79-2
31	TOXAPHENE	1086.65	30	008001-35-2
32	HEXACHLOROCYCLOHEXANE, GAMMA-	1081.63	32	000058-89-9
33	TETRACHLOROETHYLENE	1080.43	31	000127-18-4
34	HEPTACHLOR	1072.67	33	000076-44-8
35	1,2-DIBROMOETHANE	1064.06	34	000106-93-4
36	HEXACHLOROCYCLOHEXANE, BETA-	1060.22	37	000319-85-7
37	ACROLEIN	1059.07	36	000107-02-8
38	DISULFOTON	1058.85	35	000298-04-4
39	BENZO(A)ANTHRACENE	1057.96	38	000056-55-3
40	3,3'-DICHLOROBENZIDINE	1051.61	39	000091-94-1

41	ENDRIN	1048.57	41	000072-20-8
42	BERYLLIUM	1046.12	40	007440-41-7
43	HEXACHLOROCYCLOHEXANE, DELTA-	1038.27	42	000319-86-8
44	1,2-DIBROMO-3-CHLOROPROPANE	1035.55	43	000096-12-8
45	PENTACHLOROPHENOL	1028.01	45	000087-86-5
46	HEPTACHLOR EPOXIDE	1027.12	44	001024-57-3
47	CARBON TETRACHLORIDE	1023.32	46	000056-23-5
48	AROCLOR 1221	1018.41	47	011104-28-2
49	COBALT	1015.57	50	007440-48-4
50	DDT, O,P'-	1014.71	49	000789-02-6
51	AROCLOR 1016	1014.33	48	012674-11-2
52	DI-N-BUTYL PHTHALATE	1007.49	52	000084-74-2
53	NICKEL	1005.40	55	007440-02-0
54	ENDOSULFAN	1004.65	54	000115-29-7
55	ENDOSULFAN SULFATE	1003.56	53	001031-07-8
56	DIAZINON	1002.08	57	000333-41-5
57	ENDOSULFAN, ALPHA	1001.30	58	000959-98-8
58	XYLENES, TOTAL	996.07	59	001330-20-7
59	CIS-CHLORDANE	995.08	51	005103-71-9
60	DIBROMOCHLOROPROPANE	994.87	60	067708-83-2
61	METHOXYCHLOR	994.47	61	000072-43-5
62	BENZO(K)FLUORANTHENE	981.26	63	000207-08-9
63	ENDRIN KETONE	978.99	64	053494-70-5
64	TRANS-CHLORDANE	973.99	56	005103-74-2
65	CHROMIUM(VI) OXIDE	969.58	66	001333-82-0
66	METHANE	959.78	67	000074-82-8
67	ENDOSULFAN, BETA	959.19	65	033213-65-9
68	AROCLOR 1232	955.64	68	011141-16-5
69	ENDRIN ALDEHYDE	954.86	69	007421-93-4
70	BENZOFLUORANTHENE	951.48	70	056832-73-6
71	TOLUENE	947.50	71	000108-88-3
72	2-HEXANONE	942.02	72	000591-78-6
73	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	938.11	73	001746-01-6
74	ZINC	932.89	74	007440-66-6
75	DIMETHYLARSINIC ACID	922.06	75	000075-60-5
76	DI(2-ETHYLHEXYL)PHTHALATE	919.02	76	000117-81-7
77	CHROMIUM	908.52	77	007440-47-3
78	NAPHTHALENE	896.67	78	000091-20-3
79	1,1-DICHLOROETHENE	891.19	79	000075-35-4
80	METHYLENE CHLORIDE	888.96	81	000075-09-2
81	AROCLOR 1240	888.11	80	071328-89-7
82	2,4,6-TRINITROTOLUENE	883.59	82	000118-96-7
83	BROMODICHLOROETHANE	870.00	83	000683-53-4
84	HYDRAZINE	864.41	85	000302-01-2
85	1,2-DICHLOROETHANE	863.99	84	000107-06-2
86	2,4,6-TRICHLOROPHENOL	863.71	86	000088-06-2
87	2,4-DINITROPHENOL	860.45	87	000051-28-5
88	BIS(2-CHLOROETHYL) ETHER	859.88	88	000111-44-4
89	THIOCYANATE	849.21	89	000302-04-5
90	ASBESTOS	841.54	90	001332-21-4
91	CHLORINE	840.37	92	007782-50-5
92	CYCLOTRIMETHYLENETRINITRAMINE (RDX)	840.28	91	000121-82-4
93	HEXACHLOROBENZENE	838.34	93	000118-74-1

94	2,4-DINITROTOLUENE	837.88	96	000121-14-2
95	RADIUM-226	835.93	94	013982-63-3
96	ETHION	834.03	97	000563-12-2
97	1,1,1-TRICHLOROETHANE	833.81	95	000071-55-6
98	URANIUM	833.41	98	007440-61-1
99	ETHYLBENZENE	832.13	99	000100-41-4
100	RADIUM	828.07	100	007440-14-4
101	THORIUM	825.17	101	007440-29-1
102	4,6-DINITRO-O-CRESOL	822.78	102	000534-52-1
103	1,3,5-TRINITROBENZENE	820.17	103	000099-35-4
104	CHLOROBENZENE	819.69	105	000108-90-7
105	RADON	817.89	104	010043-92-2
106	RADIUM-228	816.76	106	015262-20-1
107	THORIUM-230	814.72	107	014269-63-7
107	URANIUM-235	814.72	107	015117-96-1
109	BARIUM	813.46	109	007440-39-3
110	FLUORANTHENE	812.40	113	000206-44-0
111	URANIUM-234	812.11	110	013966-29-5
112	N-NITROSODI-N-PROPYLAMINE	811.05	111	000621-64-7
113	THORIUM-228	810.36	112	014274-82-9
114	RADON-222	809.78	114	014859-67-7
115	HEXACHLOROCYCLOHEXANE, ALPHA-	809.56	116	000319-84-6
116	1,2,3-TRICHLOROBENZENE	808.41	143	000087-61-6
117	MANGANESE	807.90	115	007439-96-5
118	COAL TARS	807.07	117	008007-45-2
119	CHRYSOTILE ASBESTOS	806.68	119	012001-29-5
119	STRONTIUM-90	806.68	119	010098-97-2
121	PLUTONIUM-239	806.67	118	015117-48-3
122	POLONIUM-210	806.39	122	013981-52-7
123	METHYLMERCURY	806.39	121	022967-92-6
124	PLUTONIUM-238	806.01	123	013981-16-3
125	LEAD-210	805.90	124	014255-04-0
126	PLUTONIUM	805.23	125	007440-07-5
127	CHLORPYRIFOS	804.93	125	002921-88-2
128	COPPER	804.86	133	007440-50-8
129	AMERICIUM-241	804.55	128	086954-36-1
130	RADON-220	804.54	127	022481-48-7
131	AMOSITE ASBESTOS	804.07	129	012172-73-5
132	IODINE-131	803.48	130	010043-66-0
133	HYDROGEN CYANIDE	803.08	132	000074-90-8
134	TRIBUTYLTIN	802.61	131	000688-73-3
135	GUTHION	802.32	134	000086-50-0
136	NEPTUNIUM-237	802.13	135	013994-20-2
137	CHRYSENE	802.10	139	000218-01-9
138	CHLORDECONE	801.64	136	000143-50-0
138	IODINE-129	801.64	136	015046-84-1
138	PLUTONIUM-240	801.64	136	014119-33-6
141	S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	797.88	140	000078-48-8
142	BROMINE	789.15	142	007726-95-6
143	POLYBROMINATED BIPHENYLS	789.11	141	067774-32-7
144	DICOFOL	787.56	144	000115-32-2
145	PARATHION	784.14	145	000056-38-2
146	1,1,2,2-TETRACHLOROETHANE	782.15	146	000079-34-5

147	SELENIUM	778.98	147	007782-49-2	
	148	HEXACHLOROCYCLOHEXANE, TECHNICAL GRADE	774.91	148	000608-73-1
149	TRICHLOROFLUOROETHANE	770.74	149	027154-33-2	
150	TRIFLURALIN	770.12	150	001582-09-8	
151	DDD, O,P'-	768.73	151	000053-19-0	
152	4,4'-METHYLENEBIS(2-CHLOROANILINE)	766.66	152	000101-14-4	
153	HEXACHLORODIBENZO-P-DIOXIN	760.42	153	034465-46-8	
154	HEPTACHLORODIBENZO-P-DIOXIN	754.47	154	037871-00-4	
155	PENTACHLOROBENZENE	753.58	155	000608-93-5	
156	1,3-BUTADIENE	747.31	201	000106-99-0	
157	AMMONIA	745.55	156	007664-41-7	
158	2-METHYLNAPHTHALENE	743.24	157	000091-57-6	
159	1,4-DICHLOROBENZENE	737.32	159	000106-46-7	
160	1,1-DICHLOROETHANE	736.23	158	000075-34-3	
161	ACENAPHTHENE	731.25	160	000083-32-9	
162	1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN	726.14	161	039001-02-0	
163	1,1,2-TRICHLOROETHANE	724.96	162	000079-00-5	
164	TRICHLOROETHANE	723.32	163	025323-89-1	
165	HEXACHLOROCYCLOPENTADIENE	719.01	164	000077-47-4	
166	HEPTACHLORODIBENZOFURAN	718.58	165	038998-75-3	
167	1,2-DIPHENYLHYDRAZINE	713.90	166	000122-66-7	
168	2,3,4,7,8-PENTACHLORODIBENZOFURAN	710.71	167	057117-31-4	
169	TETRACHLOROBIPHENYL	709.21	168	026914-33-0	
170	CRESOL, PARA-	707.83	169	000106-44-5	
171	OXYCHLORDANE	706.32	170	027304-13-8	
172	1,2-DICHLOROBENZENE	704.91	171	000095-50-1	
173	1,2-DICHLOROETHENE, TRANS-	704.04	178	000156-60-5	
174	INDENO(1,2,3-CD)PYRENE	703.30	180	000193-39-5	
175	GAMMA-CHLORDENE	702.59	172	056641-38-4	
176	CARBON DISULFIDE	702.55	174	000075-15-0	
177	TETRACHLOROPHENOL	702.54	173	025167-83-3	
178	AMERICIUM	701.62	175	007440-35-9	
178	URANIUM-233	701.62	175	013968-55-3	
180	PALLADIUM	700.66	177	007440-05-3	
181	HEXACHLORODIBENZOFURAN	700.56	179	055684-94-1	
182	PHENOL	696.96	183	000108-95-2	
183	CHLOROETHANE	693.90	182	000075-00-3	
184	ACETONE	693.31	181	000067-64-1	
185	P-XYLENE	690.20	185	000106-42-3	
186	DIBENZOFURAN	689.19	187	000132-64-9	
187	ALUMINUM	688.13	186	007429-90-5	
188	2,4-DIMETHYLPHENOL	685.76	189	000105-67-9	
189	CARBON MONOXIDE	684.49	188	000630-08-0	
190	TETRACHLOROETHANE	677.97	190	025322-20-7	
191	HYDROGEN SULFIDE	676.51	193	007783-06-4	
192	PENTACHLORODIBENZOFURAN	673.21	192	030402-15-4	
193	CHLOROMETHANE	670.19	191	000074-87-3	
194	BIS(2-METHOXYETHYL) PHTHALATE	666.08	194	034006-76-3	
195	BUTYL BENZYL PHTHALATE	659.38	195	000085-68-7	
196	CRESOL, ORTHO-	658.66	196	000095-48-7	
197	HEXACHLOROETHANE	653.10	199	000067-72-1	
198	VANADIUM	651.70	198	007440-62-2	

199	N-NITROSODIMETHYLAMINE	650.71	200	000062-75-9
200	1,2,4-TRICHLOROBENZENE	647.30	203	000120-82-1
201	BROMOFORM	643.53	202	000075-25-2
202	TETRACHLORODIBENZO-P-DIOXIN	635.74	204	041903-57-5
203	1,3-DICHLOROBENZENE	631.41	205	000541-73-1
204	PENTACHLORODIBENZO-P-DIOXIN	625.12	207	036088-22-9
205	N-NITROSODIPHENYLAMINE	624.79	208	000086-30-6
206	1,2-DICHLOROETHYLENE	622.49	206	000540-59-0
207	2,3,7,8-TETRACHLORODIBENZOFURAN	622.15	210	051207-31-9
208	2-BUTANONE	620.01	209	000078-93-3
209	2,4-DICHLOROPHENOL	616.45	212	000120-83-2
210	1,4-DIOXANE	616.29	215	000123-91-1
211	FLUORINE	613.28	214	007782-41-4
212	NITRITE	612.64	216	014797-65-0
213	CESIUM-137	612.50	217	010045-97-3
214	SILVER	612.19	213	007440-22-4
215	CHROMIUM TRIOXIDE	610.85	218	007738-94-5
216	NITRATE	610.66	219	014797-55-8
217	POTASSIUM-40	608.91	220	013966-00-2
218	DINITROTOLUENE	607.65	221	025321-14-6
219	ANTIMONY	605.37	222	007440-36-0
220	COAL TAR PITCH	605.33	224	065996-93-2
221	THORIUM-227	605.32	223	015623-47-9
222	2,4,5-TRICHLOROPHENOL	604.83	225	000095-95-4
223	ARSENIC ACID	604.45	226	007778-39-4
224	ARSENIC TRIOXIDE	604.36	227	001327-53-3
225	PHORATE	603.10	228	000298-02-2
226	BENZOPYRENE	603.00	230	073467-76-2
227	CRESOLS	602.74	229	001319-77-3
228	CHLORDANE, TECHNICAL	602.62	231	012789-03-6
229	DIMETHOATE	602.61	232	000060-51-5
230	ACTINIUM-227	602.57	233	014952-40-0
230	STROBANE	602.57	233	008001-50-1
232	4-AMINOBIPHENYL	602.51	235	000092-67-1
232	PYRETHRUM	602.51	235	008003-34-7
234	ARSINE	602.42	237	007784-42-1
235	NALED	602.32	238	000300-76-5
236	DIBENZOFURANS, CHLORINATED	602.13	239	042934-53-2
236	ETHOPROP	602.13	239	013194-48-4
238	ALPHA-CHLORDENE	601.94	241	056534-02-2
238	CARBOPHENOTHION	601.94	241	000786-19-6
240	DICHLORVOS	601.64	243	000062-73-7
241	CALCIUM ARSENATE	601.45	244	007778-44-1
241	MERCURIC CHLORIDE	601.45	244	007487-94-7
241	SODIUM ARSENITE	601.45	244	007784-46-5
244	FORMALDEHYDE	599.64	247	000050-00-0
245	2-CHLOROPHENOL	599.62	248	000095-57-8
246	PHENANTHRENE	597.68	249	000085-01-8
247	HYDROGEN FLUORIDE	588.03	250	007664-39-3
248	2,4-D ACID	584.47	251	000094-75-7
249	DIBROMOCHLOROMETHANE	580.59	252	000124-48-1
250	DIURON	579.16	253	000330-54-1
251	BUTYLATE	578.43	254	002008-41-5

252	DIMETHYL FORMAMIDE	578.23	255	000068-12-2
253	PYRENE	577.95	256	000129-00-0
254	DICHLOROBENZENE	577.70	211	025321-22-6
255	ETHYL ETHER	572.47	257	000060-29-7
256	DICHLOROETHANE	570.46	258	001300-21-6
257	4-NITROPHENOL	567.79	259	000100-02-7
258	1,3-DICHLOROPROPENE, CIS-	561.82	184	010061-01-5
259	PHOSPHINE	559.74	260	007803-51-2
260	TRICHLOROBENZENE	557.96	261	012002-48-1
261	2,6-DINITROTOLUENE	555.20	262	000606-20-2
262	FLUORIDE ION	549.64	263	016984-48-8
263	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	547.90	264	035822-46-9
264	METHYL PARATHION	545.83	265	000298-00-0
265	PENTAERYTHRITOL TETRANITRATE	545.59	266	000078-11-5
266	1,3-DICHLOROPROPENE, TRANS-	543.37	267	010061-02-6
267	BIS(2-ETHYLHEXYL)ADIPATE	540.20	268	000103-23-1
268	CARBAZOLE	534.52	269	000086-74-8
269	METHYL ISOBUTYL KETONE	533.24	271	000108-10-1
270	1,2-DICHLOROETHENE, CIS-	533.15	270	000156-59-2
271	STYRENE	532.70	272	000100-42-5
272	CARBARYL	530.98	273	000063-25-2
273	1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	529.45	274	067562-39-4
274	ACRYLONITRILE	528.28	275	000107-13-1
275	1-METHYLNAPHTHALENE	526.51	NEW	

Substances were assigned the same rank when two (or more) substances received equivalent total point scores.

CAS #= Chemical Abstracts Service Registry Number

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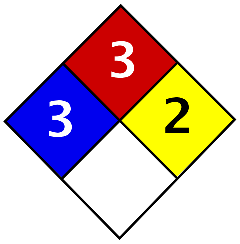

Health	3
Fire	3
Reactivity	2
Personal Protection	J

Material Safety Data Sheet

Calcium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Calcium

Catalog Codes: SLC2782

CAS#: 7440-70-2

RTECS: EV8040000

TSCA: TSCA 8(b) inventory: Calcium

CI#: Not available.

Synonym:

Chemical Formula: Ca

Contact Information:

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International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Calcium	7440-70-2	100

Toxicological Data on Ingredients: Calcium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Corrosive to eyes and skin. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to lungs, mucous membranes.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands : Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Corrosive solid. Flammable solid that, in contact with water, emits flammable gases.
Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage

Precautions:
Keep under inert atmosphere. Keep container dry. Do not breathe dust. Never add water to this product Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes Keep away from incompatibles such as acids, moisture.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 40.08 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 1484°C (2703.2°F)

Melting Point: 839°C (1542.2°F)

Critical Temperature: Not available.

Specific Gravity: 1.54 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Not available.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances:
Highly reactive with acids.
Reactive with moisture.
The product reacts violently with water to emit flammable but non toxic gases.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans: The substance is toxic to lungs, mucous membranes.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 4.3: Material that emits flammable gases on contact with water.

Identification: : Calcium : UN1401 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Calcium
Massachusetts RTK: Calcium
TSCA 8(b) inventory: Calcium

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-6: Reactive and very flammable material.
CLASS E: Corrosive solid.

DSCL (EEC): R36/38- Irritating to eyes and skin.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 3

Reactivity: 2

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 3

Reactivity: 2

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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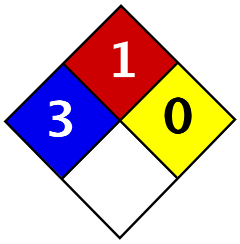

Health	3
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Cadmium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Cadmium

Catalog Codes: SLC3484, SLC5272, SLC2482

CAS#: 7440-43-9

RTECS: EU9800000

TSCA: TSCA 8(b) inventory: Cadmium

CI#: Not applicable.

Synonym:

Chemical Name: Cadmium

Chemical Formula: Cd

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

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1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Cadmium	7440-43-9	100

Toxicological Data on Ingredients: Cadmium: ORAL (LD50): Acute: 2330 mg/kg [Rat.]. 890 mg/kg [Mouse]. DUST (LC50): Acute: 50 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant). Severe over-exposure can result in death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to kidneys, lungs, liver.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact: No known effect on eye contact, rinse with water for a few minutes.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 570°C (1058°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:
Non-flammable in presence of open flames and sparks, of heat, of oxidizing materials, of reducing materials, of combustible materials, of moisture.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.01 (ppm)
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 112.4 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: 765°C (1409°F)

Melting Point: 320.9°C (609.6°F)

Critical Temperature: Not available.

Specific Gravity: 8.64 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity: Reacts violently with potassium.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 890 mg/kg [Mouse].
Acute toxicity of the dust (LC50): 229.9 mg/m3 4 hour(s) [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP.
The substance is toxic to kidneys, lungs, liver.

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation.
Slightly hazardous in case of skin contact (irritant, sensitizer).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: An allergen. 0047 Animal: embryotoxic, passes through the placental barrier.

Special Remarks on other Toxic Effects on Humans: May cause allergic reactions, exzema and/or dehydration of the skin.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:

Identification:

Special Provisions for Transport:

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Cadmium
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Cadmium
Pennsylvania RTK: Cadmium
Massachusetts RTK: Cadmium
TSCA 8(b) inventory: Cadmium
SARA 313 toxic chemical notification and release reporting: Cadmium
CERCLA: Hazardous substances.: Cadmium

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R26- Very toxic by inhalation.
R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec.
-Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

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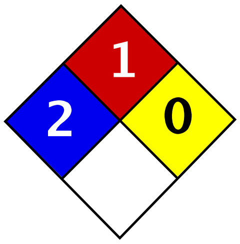

Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Copper MSDS

Section 1: Chemical Product and Company Identification

Product Name: Copper

Catalog Codes: SLC4939, SLC2152, SLC3943, SLC1150, SLC2941, SLC4729, SLC1936, SLC3727, SLC5515

CAS#: 7440-50-8

RTECS: GL5325000

TSCA: TSCA 8(b) inventory: Copper

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: Cu

Contact Information:

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14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Copper	7440-50-8	100

Toxicological Data on Ingredients: Copper LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of ingestion. Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to lungs, mucous membranes.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust. Avoid contact with eyes Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If you feel unwell, seek medical attention and show the label when possible.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 (mg/m3) from ACGIH [1990]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 63.54 g/mole

Color: Not available.

pH (1% soln/water): Not applicable.

Boiling Point: 2595°C (4703°F)

Melting Point: 1083°C (1981.4°F)

Critical Temperature: Not available.

Specific Gravity: 8.94 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans: The substance is toxic to lungs, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion.
Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Human: passes through the placenta, excreted in maternal milk.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Copper
Massachusetts RTK: Copper
TSCA 8(b) inventory: Copper
CERCLA: Hazardous substances.: Copper

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC): R36- Irritating to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an
approved/certified respirator or
equivalent. Wear appropriate respirator

when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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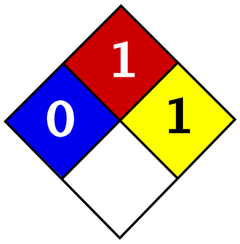

Health	1
Fire	3
Reactivity	2
Personal Protection	E

Material Safety Data Sheet

Magnesium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Magnesium

Catalog Codes: SLM4408, SLM2263, SLM3637

CAS#: 7439-95-4

RTECS: OM2100000

TSCA: TSCA 8(b) inventory: Magnesium

CI#: Not applicable.

Synonym: Magnesium ribbons, turnings or sticks

Chemical Name: Magnesium

Chemical Formula: Mg

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Magnesium	7439-95-4	100

Toxicological Data on Ingredients: Magnesium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at

least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat.
Flammable in presence of acids, of moisture.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Explosive in presence of acids, of moisture.

Fire Fighting Media and Instructions:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Magnesium turnings, chips or granules, ribbons, are flammable. They can be easily ignited. They may reignite after fire is extinguished. Produces flammable gases on contact with water and acid. May ignite on contact with water or moist air.
Magnesium fires do not flare up violently unless moisture is present.

Special Remarks on Explosion Hazards: Reacts with acids and water to form hydrogen gas with is highly flammable and eplosive

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Flammable solid.
Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage:
Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Moisture sensitive. Dangerous when wet.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 24.31 g/mole

Color: Silver-white

pH (1% soln/water): Not applicable.

Boiling Point: 1100°C (2012°F)

Melting Point: 651°C (1203.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.74 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Very slightly soluble in hot water.
Insoluble in cold water.
Insoluble in chromium trioxides, and mineral acids, alkalies.
Slightly soluble with decomposition in hot water.
Soluble in concentrated hydrogen fluoride, and ammonium salts.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, incompatible materials, water or moisture, moist air.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Violent chemical reaction with oxidizing agents.
Reacts with water to create hydrogen gas and heat. Must be kept dry.
Reacts with acids to form hydrogen gas which is highly flammable and explosive.
Magnesium forms hazardous or explosive mixtures with aluminum and potassium perchlorate; ammonium nitrate; barium nitrate, barium dioxide and zinc; beryllium oxide; boron phosphodiiodide; bromobenzyl trifluoride; cadmium cyanide; cadmium oxide; calcium carbide; carbonates; carbon tetrachloride; chlorine; chlorine trifluoride; chloroform; cobalt cyanide; copper cyanide; copper sulfate(anhydrous), ammonium nitrate, potassium chlorate and water; cupric oxide; cupric sulfate; fluorine; gold cyanide; hydrogen and calcium carbonate; hydrogen iodide; hydrogen peroxide; iodine; lead cyanide; mercuric oxide; mercury cyanide; methyl chloride; molybdenum trioxide; nickel cyanide; nitric acid; nitrogen dioxide; oxygen (liquid); performic acid; phosphates; potassium chlorate; potassium perchlorate; silver nitrate; silver oxide; sodium perchlorate; sodium peroxide; sodium peroxide and carbon dioxide; stannic oxide; sulfates; trichloroethylene; zinc cyanide; zinc oxide.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: May cause skin irritation by mechanical action. May get mechanical injury or embedding of chips/particles in skin. The particles that are embedded in the wounds may retard healing.
Eyes: May cause eye irritation by mechanical action. Mechanical injury may occur. Particles or chips may embed in eye and retard healing.
Inhalation: Low hazard for ususal industrial handling. It may cause respiratory tract irritation. However, it is unlikely due to physical form. When Magnesium metal is heated during welding or smelting process, Metal Fume Fever may result from inhalation of magnesium fumes. Metal Fume Fever is a flu-like condition consisting of fever, chills, sweating, aches, pains, cough, weakness, headache, nausea, vomiting, and breathing difficulty. Other symptoms may include metallic taste, increased white blood cell count. There is no permanent ill-effect.
Ingestion: Low hazard for usual industrial handling. There are no known reports of serious industrial poisonings with Magnesium. Ingeston of large amounts of chips, turnings or ribbons may cause gastrointestinal tract irritation with nausea, vomiting, and diarrhea. Acute ingestion may also result in Hypermagnesia.
Hypermagnesia may cause hypotension, bradycardia, CNS depression, respiratory depression, and impairment of neuromuscular transmission (hyporeflexia, paralysis).

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Magnesium UNNA: 1869 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Magnesium
Rhode Island RTK hazardous substances: Magnesium
Pennsylvania RTK: Magnesium

Massachusetts RTK: Magnesium
Massachusetts spill list: Magnesium
New Jersey: Magnesium
TSCA 8(b) inventory: Magnesium

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-4: Flammable solid.
CLASS B-6: Reactive and very flammable material.

DSCL (EEC):
R11- Highly flammable.
R15- Contact with water liberates extremely flammable gases.
S7/8- Keep container tightly closed and dry.
S43- In case of fire, use dry chemical. Never use water.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 3

Reactivity: 2

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 1

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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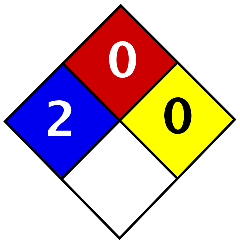

Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Nickel metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nickel metal

Catalog Codes: SLN2296, SLN1342, SLN1954

CAS#: 7440-02-0

RTECS: QR5950000

TSCA: TSCA 8(b) inventory: Nickel metal

CI#: Not applicable.

Synonym: Nickel Metal shot; Nickel metal foil.

Chemical Name: Nickel

Chemical Formula: Ni

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Nickel metal	7440-02-0	100

Toxicological Data on Ingredients: Nickel metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer).
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to skin.
The substance may be toxic to kidneys, lungs, liver, upper respiratory tract.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

Special Remarks on Explosion Hazards:
Material in powder form, capable of creating a dust explosion.
Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode.
Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion.
Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 (mg/m3) from ACGIH (TLV) [United States] Inhalation Respirable.
TWA: 0.5 (mg/m3) [United Kingdom (UK)]
TWA: 1 (mg/m3) from OSHA (PEL) [United States] InhalationConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid. Lustrous solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 58.71 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: 2730°C (4946°F)

Melting Point: 1455°C (2651°F)

Critical Temperature: Not available.

Specific Gravity: Density: 8.908 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Insoluble in cold water, hot water.
Insoluble in Ammonia.
Soluble in dilute Nitric Acid.
Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, combustible materials, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + indusorial earth.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
Causes damage to the following organs: skin.
May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:

Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose/Conc:
LDL [Rat] - Route: Oral; Dose: 5000 mg/kg
LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

Special Remarks on Chronic Effects on Humans: May cause cancer based on animal test data

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Nickel dust and fume can irritate skin.
Eyes: Nickel dust and fume can irritate eyes.
Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.
Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased cornary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).
Chronic Potential Health Effects:
Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.
Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).
Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy. Chronic ingestion of NIckel may also affect respiration and cause pneumoconiosis or fibrosis.
Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Nickel metal
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Nickel metal
Connecticut hazardous material survey.: Nickel metal
Illinois toxic substances disclosure to employee act: Nickel metal
Illinois chemical safety act: Nickel metal
New York release reporting list: Nickel metal
Rhode Island RTK hazardous substances: Nickel metal
Pennsylvania RTK: Nickel metal
Michigan critical material: Nickel metal
Massachusetts RTK: Nickel metal
Massachusetts spill list: Nickel metal
New Jersey: Nickel metal
New Jersey spill list: Nickel metal
Louisiana spill reporting: Nickel metal
California Director's List of Hazardous Substances: Nickel metal
TSCA 8(b) inventory: Nickel metal

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects.
R43- May cause sensitization by skin contact.
S22- Do not breathe dust.
S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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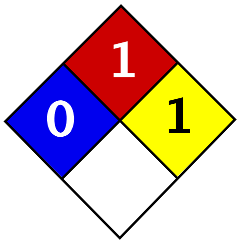

Health	**1**
Fire	**1**
Reactivity	**1**
Personal Protection	**E**

Material Safety Data Sheet
Zinc Metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Zinc Metal

Catalog Codes: SLZ1054, SLZ1159, SLZ1267, SLZ1099, SLZ1204

CAS#: 7440-66-6

RTECS: ZG8600000

TSCA: TSCA 8(b) inventory: Zinc Metal

CI#: Not applicable.

Synonym: Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips

Chemical Name: Zinc Metal

Chemical Formula: Zn

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Zinc Metal	7440-66-6	100

Toxicological Data on Ingredients: Zinc Metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances:
Slightly flammable to flammable in presence of open flames and sparks, of heat, of oxidizing materials, of acids, of alkalis, of moisture.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Zinc + NaOH causes ignition.
Oxidation of zinc by potassium proceeds with incandescence.
Residues from zinc dust /acetic acid reduction operations may ignite after long delay if discarded into waste bins with paper.
Incandescent reaction when Zinc and Arsenic or Tellurium, or Selenium are combined.
When hydrazine mononitrate is heated in contact with zinc, a flamming decomposition occurs at temperatures a little above its melting point.
Contact with acids and alkali hydroxides (sodium hydroxide, postasium hydroxide, calcium hydroxide, etc.) results in evolution of hydrogen with sufficient heat of reaction to ignite the hydrogen gas.
Zinc foil ignites if traces of moisture are present.
It is water reactive and produces flammable gases on contact with water. It may ignite on contact with water or

moist air.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Flammable solid that, in contact with water, emits flammable gases.
Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.

Storage:
Keep container tightly closed. Keep container in a cool, well-ventilated area. Keep from any possible contact with water. Do not allow water to get into container because of violent reaction.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid. Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 65.39 g/mole

Color: Bluish-grey

pH (1% soln/water): Not applicable.

Boiling Point: 907°C (1664.6°F)

Melting Point: 419°C (786.2°F)

Critical Temperature: Not available.

Specific Gravity: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials, moisture

Incompatibility with various substances:
Reactive with oxidizing agents, acids, alkalis.
Slightly reactive to reactive with moisture.
The product may react violently with water to emit flammable but non toxic gases.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with acids, halogenated hydrocarbons, NH4NO3, barium oxide, Ba(NO3)2, Cadmium, CS2, chlorates, Cl2, CrO3, F2, Hydroxylamine, Pb(N3)2, MnCl2, HNO3, performic acid, KClO3, KNO3, N2O2, Selenium, NaClO3, Na2O2, Sulfur, Te, water, (NH4)2S, As2O3, CS2, CaCl2, chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide, HCl, H2SO4, (Mg +Ba(NO3)2 +BaO2), (ethyl acetoacetate +tribromoneopentyl alcohol.
Contact with Alkali Hydroxides(Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide, etc) results in evolution of hydrogen.
Ammonium nitrate + zinc + water causes a violent reaction with evolution of steam and zinc oxide.
May react with water.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.
LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: May cause skin irritation. Dermal exposure to zinc may produce leg pains, fatigue, anorexia and weight loss.
Eyes: May cause eye irritation.
Ingestion: May be harmul if swallowed. May cause digestive tract irritation with tightness in throat, nausea, vomiting, diarrhea, loss of appetite, malaise, abdominal pain. fever, and chills. May affect behavior/central nervous system and autonomic nervous system with ataxia, lethargy, staggering gait, mild derrangement in cerebellar function, lightheadness, dizzness, irritability, muscular stiffness, and pain. May also affect blood.
Inhalation: Inhalation of zinc dust or fumes may cause respiratory tract and mucous membrane irritation with cough and chest pain. It can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headached fever, maliase, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis.
The toxicological properties of this substance have not been fully investisgated.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: Not available.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

New York release reporting list: Zinc Metal
Rhode Island RTK hazardous substances: Zinc Metal
Pennsylvania RTK: Zinc Metal
Florida: Zinc Metal
Michigan critical material: Zinc Metal
Massachusetts RTK: Zinc Metal
New Jersey: Zinc Metal
California Director's List of Hazardous Substances: Zinc Metal
TSCA 8(b) inventory: Zinc Metal
TSCA 12(b) one time export: Zinc Metal
SARA 313 toxic chemical notification and release reporting: Zinc Metal
CERCLA: Hazardous substances.: Zinc Metal: 1000 lbs. (453.6 kg)

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not Available

DSCL (EEC):
R15- Contact with water liberates
extremely flammable gases.
R17- Spontaneously flammable in air.
S7/8- Keep container tightly closed and dry.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 1

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 1

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an
approved/certified respirator or
equivalent.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Department of Health and Human Services
Agency for Toxic Substances & Disease Registry

Home > CABS > Lead

ToxFAQs™: Chemical Agent Briefing Sheets (CABS)

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Lead

January 2006

PDF Version

What is lead?

Lead is a heavy, bluish-gray metal that has a low melting point. It occurs naturally in the Earth' s crust, but it is not a particularly abundant element. It is rarely found naturally as a metal, but rather in its divalent (2+) oxidative state in ore deposits widely distributed throughout the world. The most important lead containing ores are galena (PbS), anglesite ($PbSO_4$), and cerussite ($PbCO_3$). Natural lead is a mixture of four stable isotopes: ^{208}Pb (51%–53%), ^{206}Pb (23.5%–27%), ^{207}Pb (20.5%–23%), and ^{204}Pb (1.35%–1.5%).

What are the forms of lead?

- Metallic lead
- Inorganic lead and lead compounds (or lead salts)
- Organic lead (containing carbon)

What are the common uses of lead?

The largest use for lead is in storage batteries in cars and other vehicles. Lead may be used as a pure metal, alloyed with other metals, or as chemical compounds.

Lead used by industry comes from mined ores ("primary") or from recycled scrap metal or batteries ("secondary"). However, most lead today is obtained from recovery of recycled scrap, mostly lead-acid batteries.

Human activities, such as lead mining and smelting operations and manufacturing and use of lead products (*e.g.*, leaded gasoline, lead-based paint), have resulted in the contamination of many industrial and residential areas with lead.

Form	Uses
Metallic lead	Certain uses of lead, such as leaded gasoline, lead-based paints for domestic use, lead-based solder in food cans and water pipes, lead sinkers, and ammunition, have been reduced or banned to minimize lead's harmful effects on people and animals.
Lead and lead compounds (or lead salts), such as • **lead acetate** • **lead chloride** • **lead nitrate** • **lead oxide** • **lead phosphate** • **lead acetate**	• **Cosmetics and hair dye** - Some hair dyes and some non-Western cosmetics, such as kohl and surma, contain lead. • **Fishing equipment** - Most fishing weights and sinkers are made from lead. • **Folk remedies** - Many non-Western folk remedies used to treat diarrhea or other ailments may contain substantial amounts of lead. Examples of these include alarcon, ghasard, alkohl, greta, azarcon,

• **lead sulfate** • **lead sulfide**	liga, bali goli, pay-loo-ah, coral, and rueda. • **Glazing** - Applied to some ceramicware can contain lead. • **Lead based paint** - Although the sale of residential lead-based paint was banned in the United States in 1978, it remains a major source of lead exposure for young children residing in older houses. • **Lead batteries** - Production of lead-acid batteries is the major use of lead. • **Lead-based solder** - Has been banned for use in water distribution systems, but many buildings and homes contain lead pipes or lead-based solder. Lead-based solder also is used for electrical circuitry applications. • **Lead-shot** and **ammunition** - It is the second highest production use of lead. • Other uses of lead include the production of lead alloys, soldering materials, shielding for x-ray machines, and manufacturing of corrosion- and acid-resistant materials used in the building industry.
Organic • **tetraethyl lead** • **tetramethyl lead**	The use of lead in gasoline was phased out in the 1980s, and has been banned since January 1, 1996. The use of lead in gasoline has contributed to its dispersion throughout the environment. During the combustion of gasoline containing these alkyllead compounds, significant amounts of inorganic lead can be released to the surrounding areas. **Current Uses** • Gasoline for off-road vehicles, farm equipment, and airplanes **Past Uses** • Gasoline additives (to increase octane rating)

What are the routes of exposure for lead?

People are most likely to be exposed to lead by consuming contaminated food and drinking water. Exposure can also occur by inadvertently ingesting contaminated soil, dust, or lead-based paint.

Form	Routes of Exposure
Metallic lead **Lead and lead compounds (or lead salts), such as** • **lead acetate** • **lead chloride** • **lead nitrate** • **lead oxide** • **lead phosphate** • **lead subacetate** • **lead sulfate** • **lead sulfide**	• Ingestion is the primary source of exposure to the general population. • Lead paint is a major source of environmental exposure for children who ingest flaking paint, paint chips, and weathered powdered paint (mostly from deteriorated housing units in urban areas). Lead paint can also contribute to soil/dust lead which can be inadvertently ingested via hand-to-mouth activity of young children. • Lead can leach into drinking water from lead-based solder used in water pipes. • Lead can leach into foods or liquids stored in ceramic containers made with lead glazing. • Engaging in hobbies such as casting ammunition, making fishing weights, and stained glass can result in exposure to lead. • Exposure by inhalation can result during activities such as soldering with lead solder or sanding or sandblasting lead-based paint.
Organic • **tetraethyl lead** • **tetramethyl lead**	• Inhalation • Dermal studies in animals have shown that organic lead is well absorbed through the skin

Who are the populations most at risk and how are they usually exposed?

People living near hazardous waste sites, lead smelters or refineries, battery recycling or crushing centers, or other industrial lead sources may be exposed to lead and chemicals that contain lead. Workers in occupations that have sources of lead exposure (*e.g.*, plumbers, miners, mechanics, and lead smelter or refinery workers).

Certain hobbies, folk remedies, home activities, and car repairs (*e.g.*, radiator repair) can contribute to lead exposure. Smoking cigarettes or breathing second-hand smoke increases exposure because tobacco smoke contains small amounts of lead.

Pregnant women, the developing fetuses, and young children are particularly vulnerable to the effects of lead. Young children are more likely to play in dirt and to place their hands and other objects in their mouths, thereby increasing the opportunity for exposure via ingestion of lead-contaminated soil and dust.

What are the possible toxic effects of lead?

The most sensitive targets for lead toxicity are the developing nervous system, the hematological and cardiovascular systems, and the kidney. However, because of lead's many modes of action in biological systems, lead could potentially affect any system or organs in the body. The effects are the same whether it is breathed or swallowed.

Blood Lead Concentrations Corresponding to Adverse Health Effects

Life Stage	Effect	Blood lead (µg/dL)
Children	Depressed ALAD* activity	<5
	Neurodevelopmental effects	<10
	Sexual maturation	<10
	Depressed vitamin D	>15
	Elevated EP**	>15
	Depressed NCV***	>30
	Depressed hemoglobin	>40
	Colic	>60
Adults	Depressed GFR****	<10
	Elevated blood pressure	<10
	Elevated EP (females)	>20
	Enzymuria/proteinuria	>30
	Peripheral neuropathy	>40
	Neurobehavioral effects	>40
	Altered thyroid hormone	>40
	Reduced fertility	>40
	Depressed hemoglobin	>50
Elderly adults	Depressed ALAD*	<5
	Neurobehavioral effects	>4

*aminolevulinic acid dehydratase (ALAD)

**erythrocyte porphyrin (EP)

***nerve conduction velocity (NCV)

****glomerular filtration rate (GFR)

Source: ATSDR Toxicological Profile for Lead (Draft for Public Comment), 2005.

How can I reduce the risk of exposure to lead?

- Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint (homes built before 1978).
- If you have a water lead problem, the U.S. Environmental Protection Agency (EPA) recommends that you flush your cold water pipes if they have not been used in over 6 hours by running water until it is cold (5 seconds to 2 minutes) before drinking or cooking with it.
- Avoid some types of paints and pigments that contain lead and are used as make-up or hair coloring; keep these kinds of products away from children.
- Hire a professional contractor, who is required to follow certain health safety requirements for remediation or renovation involving lead-based paint, (www.epa.gov/lead/pubs/leadinfo.htm#remodeling).
- Wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

What are the safety guidelines for lead exposure?

Air

- National Institute for Occupational Safety and Health (NIOSH)

  Recommended exposure limit (REL) time-weighted average (TWA) - 0.05 mg/m^3
  Immediately dangerous to life or health (IDLH) - 100 mg/m^3

- Occupational Safety and Health Administration (OSHA)

  Air - workplace 50 µg/m^3
  Action level - 40 µg/100 g of whole blood

- The American Conference of Governmental Industrial Hygienists (ACGIH)

Threshold limit values (TLV)/(TWA) - 0.05 mg/m^3
TLV/TWA guideline for lead arsenate - 150 µg/m^3
TLV/TWA guideline for other forms of lead - 50 µg lead/m^3

- U.S. Environmental Protection Agency (EPA)

  National Primary and Secondary Ambient Air Quality Standards - 1.5 µg/m^3

- World Health Organization (WHO)

  Air quality guidelines -- 0.5 µg/m^3

Water

- EPA

  Maximum contaminant level (MCL) - action level 0.015 mg/L
  Action level for public supplies - 15 µg/L

- WHO

  Drinking Water Quality Guidelines - 0.01 mg/L

Blood

- Centers for Disease Control and Prevention (CDC)

  Level of concern for children - 10 µg/dL

- OSHA

  Cause for written notification and medical exam - 40 µg/dL
  Cause for medical removal from exposure - 50 µg/dL

- ACGIH

  Advisory; biological exposure index - 30 µg/dL

Food

- Food and Drug Administration (FDA)

  Bottled drinking water - 0.005 mg/L

Other

- ACGIH

  Biological exposure indices (lead in blood) - 30 µg/100 mL

- Consumer Product Safety Commission

  Paint - 600 ppm

- FDA

  Ceramicware (µg/mL leaching solution) - 0.5-3.0 µg/mL

µg/m^3: micrograms per cubic meter
µg/dL: micrograms per deciliter
µg/L: micrograms per liter
g: gram
mg/L: milligrams per liter
mL: milliliter
ppm: parts per million

What are the most important or common mediating factors?

Factors that determine the severity of the health effects from lead exposure include

- Dose
- Age of the person exposed
  - the developing nervous system is the most sensitive system to the effects of lead
  - the efficiency of lead absorption from the gastrointestinal tract is greater in children than in adults
- Life stages of women (childbirth, lactating, menopause)
- Occupational exposures
- Duration of exposure
- Health and lifestyle of the person exposed
- Nutritional status of the person exposed
  - a diet adequate in calcium and iron may decrease lead absorption

The toxic effects of lead exposure may be worse in individuals with inherited genetic diseases or gene polymorphisms such as thalassemia, individuals with glucose-6-phosphate dehydrogenase (G6PD) deficiency, and carriers of certain gene polymorphic forms (*e.g.*, ALAD and vitamin D receptor). Research continues about this topic.

Is there a test to see if my child or I have been exposed to lead?

Blood	• The screening test of choice is blood lead levels. • Blood tests are commonly used to screen children for lead poisoning. • Analysis of lead in whole blood is the most common and accurate method of assessing lead exposure. • Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (µg/dL).
Bone and Teeth	• X-ray fluorescence techniques have been used to determine lead concentration in bones and teeth. It is not widely available and is used mostly in research. • Lead partitions to bone over a lifetime of exposure; therefore, bone lead measurements may be a better indicator of cumulative exposure than blood lead.
Urine	• Measurements of urinary lead levels have been used to assess lead exposure. • The measurement of lead excreted in urine following chelation with calcium disodium EDTA (EDTA provocation) has been used to detect elevated body burden of lead in adults and children.
Hair and Nails	• These are not reliable for testing due to errors external contamination. They are relatively poor predictors of blood lead, particularly at low concentrations.

Future Research Needs

To close current gaps in the scientific database on the health effects of lead, a long–term resear ch program is needed that might include the following:

- Further short-term studies or studies in vitro designed to clarify mechanisms of action for the various toxicities might be useful.
- Studies identifying exposures during different developmental periods can help identify critical periods of vulnerability for immunocompetence, development of sex organs, or neurobehavioral parameters.
- Chronic-duration exposure studies in animals would expand information on the toxicity of lead. Special studies that examine biochemical and morphological effects of lead may provide new information on mechanisms of action of lead, particularly for the effects of greatest concern such as neurobehavioral changes in children.
- Development of new and more sensitive tests of specific neuropsychological functions.
- Further investigation of links between lead and amyotrophic lateral sclerosis, essential tremor, schizophrenia, and Parkinson's disease.
- Epidemiological studies designed in a manner that permits more rigorous assessments of effect modification.
- Studies about the long-term consequences of lead-related neurobehavioral deficits detected in infants and children and the manifestation of chronic neurobehavioral problems in adolescence and adulthood.
- Further characterization of bone lead concentration as a biomarker of exposure for various effect end points (*e.g.*, blood pressure and renal effects).
- Studies of the potential prevalence of elevated bone lead stores in women of reproductive age and the associated risk that this poses to fetal development by mobilization of maternal bone stores during pregnancy.
- Further clarification of the role of some genetic polymorphisms.
- Evaluation of cohorts from prospective studies into adulthood for potential late-appearing effects including cancer.

For more information

- Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Lead

  http://www.atsdr.cdc.gov/toxprofiles/tp13.html

- ATSDR ToxFAQs™ for Lead

  http://www.atsdr.cdc.gov/tfacts13.html

- ATSDR Case Studies in Environmental Medicine Lead Toxicity

  http://www.atsdr.cdc.gov/csem/lead/

- ATSDR Interaction Profile for Chemical Mixtures for Arsenic, Cadmium, Chromium, and Lead

  http://www.atsdr.cdc.gov/interactionprofiles/ip04.html

- ATSDR Interaction Profile for Chemical Mixtures for Lead, Manganese, Zinc, and Copper

  http://www.atsdr.cdc.gov/interactionprofiles/ip06.html

- ATSDR Interaction Profile for Chemical Mixtures for Chlorpyrifos, Lead, Mercury, and Methylmercury

  http://www.atsdr.cdc.gov/interactionprofiles/ip11.html

- Centers for Disease Control and Prevention Lead Web Page

  http://www.cdc.gov/lead/

- U.S. Environmental Protection Agency Lead Web Page

  http://www.epa.gov/lead/

- U.S. Department of Labor, Occupational Safety & Health Administration

  http://www.osha.gov/SLTC/lead/

For more information, contact:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333
Phone: 1-800-CDC-INFO (800-232-4636)
TTY 888-232-6348

FAX: (770)-488-4178
Email: CDCINFO@cdc.gov

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Mercury

Mercury is a naturally occurring metal found in air, water, and soil. It exists in several forms, including elemental (or metallic) mercury, inorganic mercury compounds, and organic mercury compounds:

- **Elemental mercury** is liquid at room temperature and is used in thermometers, fluorescent light bulbs, some electrical switches, and some industrial processes.
- **Inorganic mercury** compounds are formed when mercury combines with other elements to form salts, which are usually powders or crystals. Inorganic mercury compounds are found naturally in the environment. Some forms of inorganic mercury have been used in antiseptic creams, ointments, and preservatives.
- **Organic mercury** compounds are formed when mercury combines with carbon. Microscopic organisms can produce organic mercury compounds (methylmercury) in contaminated water and soil, which can accumulate in the food chain. Other special types of organomercurials have been used as medical preservatives and medicines.

How People Are Exposed to Mercury

- Eating fish or shellfish that is contaminated with methylmercury, which is the main source of general human exposures to mercury;
- Breathing air contaminated with elemental mercury vapors (e.g., in workplaces such as dental offices and industries that use mercury or in locations where a mercury spill or release has occurred);
- Having dental fillings that contain mercury; and
- Practicing cultural or religious rituals that use mercury.

How Mercury Affects People’s Health

- Short-term exposure to extremely high levels of elemental mercury vapors can result in lung damage, nausea, diarrhea, increases in blood pressure or heart rate, skin rashes, eye irritation, and injury to the nervous system.
- Prolonged exposure to lower levels of elemental mercury can permanently damage the brain and kidneys.
- The developing brain of a fetus can be injured if the mother is exposed to methylmercury.

Levels of Mercury in U.S. Population

Scientists tested levels of mercury in the blood of 16,780 participants who took part in CDC's national study known as the National Health and Nutrition Examination Survey (NHANES). These findings are based on total blood mercury levels in the U.S. general population for persons aged 1 year and older who participated in NHANES during 2003-2006, as well as trends in the total mercury of children aged 1–5 and females aged 16–49 during 1999–2006.

- In the total population during 2003–2006, the total blood mercury levels for non–Hispanic blacks and non–Hispanic whites were higher than those for Mexican Americans.
- Across the age groups in the total population during 2003-2006, total blood mercury levels increased with age, peaked at the fifth or sixth decade, depending on race/ethnicity, and then declined.
- In the most recent survey period of 2005–2006, the 95th percentile levels for total blood mercury in children aged 1-5 years and females aged 16-49 years were 1.43 µg/L and 4.48 µg/L, respectively. The 95th percentile means that 95 percent of the U.S. population's exposure is below this estimated level. Conversely, only 5 percent of the population will have values at this level or higher.
- Over the four survey periods from 1999-2006, blood mercury levels increased slightly for non–Hispanic white children and decreased slightly for non–Hispanic black and Mexican American children. Female children had slightly higher blood mercury levels than male children.

For More Information

- Agency for Toxic Substances and Disease Registry
  Detailed information about mercury and public health is available at
  http://www.atsdr.cdc.gov/alerts/970626.html and
  http://www.atsdr.cdc.gov/cabs/mercury/index.html
- CDC Emergency Preparedness and Response
  Case definitions of mercury, toxicology FAQs, and toxicological profile at
  http://emergency.cdc.gov/agent/mercury/

May 2009

The Centers for Disease Control and Prevention (CDC) protects people's health and safety by preventing and controlling diseases and injuries; enhances health decisions by providing credible information on critical health issues; and promotes healthy living through strong partnerships with local, national, and international organizations.

Department of Health and Human Services
ATSDR Agency for Toxic Substances & Disease Registry

ATSDR Home › ToxFAQs™ Arsenic

ToxFAQs™

ToxFAQs™
for
Arsenic
(*Arsénico*)
August 2007

PDF Version, 92 KB

CAS#: 7440-38-2

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

Highlights

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

What is arsenic?

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

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

What happens to arsenic when it enters the environment?

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

How might I be exposed to arsenic?

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

How can arsenic affect my health?

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

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

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

Skin contact with inorganic arsenic may cause redness and swelling.

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

How likely is arsenic to cause cancer?

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

How does arsenic affect children?

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

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

How can families reduce their risk for exposure to arsenic?

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

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

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

Has the federal government made recommendations to protect human health?

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

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

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic *(Update)*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE, Mailstop F-62
Atlanta, GA 30333
Phone: 1-800-CDC-INFO • 888-232-6348 (TTY)
FAX: 770-488-4178
Email: cdcinfo@cdc.gov

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

This page was updated on 10/05/2007

SAFETY DATA SHEET

Creation Date 06-Feb-2012 **Revision Date** 29-Mar-2024 **Revision Number** 5

1. Identification

Product Name	**Perfluorooctanoic acid**
Cat No. :	**L08862**
CAS No	335-67-1
Synonyms	No information available
Recommended Use	Laboratory chemicals.
Uses advised against	Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Thermo Fisher Scientific Chemicals, Inc.
30 Bond Street
Ward Hill, MA 01835-8099
Tel: 800-343-0660
Fax: 800-322-4757

Emergency Telephone Number
For information **US** call: 001-800-227-6701 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No. **US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Dusts and Mists	Category 4
Serious Eye Damage/Eye Irritation	Category 1
Carcinogenicity	Category 2
Reproductive Toxicity	Category 1B
Effects on or via lactation	
Specific target organ toxicity - (repeated exposure)	Category 1
Target Organs - Liver.	

Label Elements

Signal Word
Danger

Hazard Statements
Causes serious eye damage
Suspected of causing cancer
May damage the unborn child
May cause harm to breast-fed children
Causes damage to organs through prolonged or repeated exposure
Harmful if swallowed or if inhaled

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Do not breathe dust/fume/gas/mist/vapors/spray
Avoid contact during pregnancy/while nursing
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Immediately call a POISON CENTER or doctor/physician
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Storage
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

WARNING. Cancer and Reproductive Harm - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS No	Weight %
Octanoic acid, pentadecafluoro-	335-67-1	>95

4. First-aid measures

General Advice	If symptoms persist, call a physician.
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists,

	call a physician.
Inhalation	Remove to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur.
Ingestion	Clean mouth with water and drink afterwards plenty of water. Get medical attention if symptoms occur.
Most important symptoms and effects	None reasonably foreseeable. Causes severe eye damage. Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Water spray. Carbon dioxide (CO_2). Dry chemical. Chemical foam.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. In the event of fire and/or explosion do not breathe fumes.

Hazardous Combustion Products
Carbon monoxide (CO). Carbon dioxide (CO_2). Gaseous hydrogen fluoride (HF). Thermal decomposition can lead to release of irritating gases and vapors.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
3	1	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment as required. Ensure adequate ventilation. Avoid dust formation.
Environmental Precautions	Should not be released into the environment.
Methods for Containment and Clean Up	Sweep up and shovel into suitable containers for disposal. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Do not get in eyes, on skin, or on clothing. Wear personal protective equipment/face protection. Ensure adequate ventilation. Avoid ingestion and inhalation. Avoid dust formation.

Storage.	Corrosives area. Keep containers tightly closed in a dry, cool and well-ventilated place. Keep in properly labeled containers. Incompatible Materials. Bases. Strong acids. Reducing Agent.

8. Exposure controls / personal protection

Exposure Guidelines	This product does not contain any hazardous materials with occupational exposure limitsestablished by the region specific regulatory bodies.
Engineering Measures	Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.
Personal Protective Equipment	
Eye/face Protection	Tight sealing safety goggles. Face protection shield.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Recommended Filter type:	Particulates filter conforming to EN 143.
Hygiene Measures	Keep away from food, drink and animal feeding stuffs. When using do not eat, drink or smoke. Contaminated work clothing should not be allowed out of the workplace. Provide regular cleaning of equipment, work area and clothing. Avoid contact with skin, eyes or clothing. Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wear suitable gloves and eye/face protection.

9. Physical and chemical properties

Physical State	Solid
Appearance	Off-white
Odor	pungent
Odor Threshold	No information available
pH	2.6 1g/l aq.sol., 20°C
Melting Point/Range	53 - 60 °C / 127.4 - 140 °F
Boiling Point/Range	189 - 192 °C / 372.2 - 377.6 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	Not applicable
Specific Gravity	No information available
Solubility	Soluble
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	> 300°C
Viscosity	Not applicable
Molecular Formula	C8 H F15 O2
Molecular Weight	414.07

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products. Exposure to air or moisture over prolonged periods.
Incompatible Materials	Bases, Strong acids, Reducing Agent
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO_2), Gaseous hydrogen fluoride (HF), Thermal decomposition can lead to release of irritating gases and vapors
Hazardous Polymerization	No information available.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Octanoic acid, pentadecafluoro-	LD50 200 - 2000 mg/kg (Rat)	Not listed	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation No information available

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
Octanoic acid, pentadecafluoro-	335-67-1	Group 2B	Not listed	Not listed	X	Not listed

IARC (International Agency for Research on Cancer)

IARC (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

Mutagenic Effects	No information available
Reproductive Effects	Experiments have shown reproductive toxicity effects on laboratory animals.
Developmental Effects	No information available.
Teratogenicity	No information available.
STOT - single exposure	None known
STOT - repeated exposure	Liver
Aspiration hazard	No information available
Symptoms / effects,both acute and delayed	Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation
Endocrine Disruptor Information	No information available
Other Adverse Effects	The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system.

Persistence and Degradability	Soluble in water Persistence is unlikely based on information available.
Bioaccumulation/ Accumulation	No information available.
Mobility	Will likely be mobile in the environment due to its water solubility.

13. Disposal considerations

Waste Disposal Methods	Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT	
UN-No	UN3261
Proper Shipping Name	Corrosive solid, acidic, organic, n.o.s.
Technical Name	Octanoic acid, pentadecafluoro-
Hazard Class	8
Packing Group	III
TDG	
UN-No	UN3261
Proper Shipping Name	Corrosive solid, acidic, organic, n.o.s.
Hazard Class	8
Packing Group	III
IATA	
UN-No	UN3261
Proper Shipping Name	Corrosive solid, acidic, organic, n.o.s.
Hazard Class	8
Packing Group	III
IMDG/IMO	
UN-No	UN3261
Proper Shipping Name	Corrosive solid, acidic, organic, n.o.s.
Hazard Class	8
Packing Group	III

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
Octanoic acid, pentadecafluoro-	335-67-1	X	ACTIVE	S;SP

Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed
SP - Indicates a substance that is identified in a proposed SNUR

TSCA - Per 40 CFR 751, Regulation of Certain Chemical Substances & Mixtures, Under TSCA Section 6(h) (PBT)	Not applicable

TSCA 12(b) - Notices of Export

Component	CAS No	**TSCA 12(b)** - Notices of Export
Octanoic acid, pentadecafluoro-	335-67-1	Section 5

International Inventories

Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
Octanoic acid, pentadecafluoro-	335-67-1	-	-	206-397-9	X	X	X	X	X	KE-27883

KECL - NIER number or KE number (http://ncis.nier.go.kr/en/main.do)

U.S. Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

Component	CAS No	Weight %	SARA 313 - Threshold Values %	SARA 313 - Reporting threasholds
Octanoic acid, pentadecafluoro-	335-67-1	>95	0.1 %	-

SARA 311/312 Hazard Categories

Should this product meet EPCRA 311/312 Tier reporting criteria at 40 CFR 370, refer to Section 2 of this SDS for appropriate classifications.

CWA (Clean Water Act)	Not applicable
Clean Air Act	Not applicable
OSHA - Occupational Safety and Health Administration	Not applicable

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

California Proposition 65 This product contains the following Proposition 65 chemicals.

Component	CAS No	California Prop. 65	Prop 65 NSRL	Category
Octanoic acid, pentadecafluoro-	335-67-1	Carcinogen Developmental	-	Carcinogen Developmental

U.S. State Right-to-Know Regulations Not applicable

U.S. Department of Transportation

Reportable Quantity (RQ):	N
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Authorisation/Restrictions according to EU REACH

Component	CAS No	REACH (1907/2006) - Annex XIV - Substances Subject to Authorization	REACH (1907/2006) - Annex XVII - Restrictions on Certain Dangerous Substances	REACH Regulation (EC 1907/2006) article 59 - Candidate List of Substances of Very High Concern (SVHC)
Octanoic acid, pentadecafluoro-	335-67-1	-	Use restricted. See item 75. (see link for restriction details) Use restricted. See item 30. (see link for restriction details)	SVHC Candidate list - Toxic for reproduction (Article 57 c) SVHC Candidate list - PBT (Article 57 d)

After the sunset date the use of this substance requires either an authorization or can only be used for exempted uses, e.g. use in scientific research and development which includes routine analytics or use as intermediate.

REACH links
https://echa.europa.eu/authorisation-list
https://echa.europa.eu/candidate-list-table

Safety, health and environmental regulations/legislation specific for the substance or mixture

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
Octanoic acid, pentadecafluoro-	335-67-1	Not applicable	Annex I - Substance subject to prohibitions Annex IV : 1 mg/kg (Waste Management - Conc. Limit) Stockholm Convention - Persistent Organic Pollutant	Not applicable	Not applicable

Contains component(s) that meet a 'definition' of per & poly fluoroalkyl substance (PFAS)?

See table for values

Component	OECD PFAS	US (EPA) PFAS	EU (ECHA) PFAS	UK (HSE) PFAS	Chemsec PFAS (Sin List)
Octanoic acid, pentadecafluoro- (CAS #: 335-67-1)	Listed	Listed	Listed	Listed	Listed

PFAS Legend
Listed = Meets the PFAS definition of the named authority

Other International Regulations

Component	CAS No	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Major Accident Notification	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Rotterdam Convention (PIC)	Basel Convention (Hazardous Waste)
Octanoic acid, pentadecafluoro-	335-67-1	Not applicable	Not applicable	X	Not applicable

16. Other information

Prepared By	Health, Safety and Environmental Department Email: chem.techinfo@thermofisher.com

www.thermofisher.com

Creation Date	06-Feb-2012
Revision Date	29-Mar-2024
Print Date	29-Mar-2024
Revision Summary	New emergency telephone response service provider.

Disclaimer

End of SDS

APPENDIX B

CAMP

COMMUNITY AIR MONITORING PLAN (CAMP)

3083 Webster Ave BCP Site
3083 Webster Avenue
Block 3331; Lot 57
Bronx, NY 10467

1. Introduction

The Community Air Monitoring Plan (CAMP) has been prepared to monitor the air quality during the intrusive activities proposed as a part of the Remedial Investigation (RI) activities at the 3083 Webster Ave BCP Site located at 3083 Webster in Bronx, New York. Levels of VOCs and dust in the air will be monitored continuously and periodically utilizing a Photo Ionization Detector (PID) and Real-Time Particulate Dust Tracker, respectively. For this investigation, the PID will be calibrated at the beginning of each day to the compound isobutylene, which is published by the manufacturer. The PID has a minimum detection limit of 0.1 parts per million (ppm). The Dust Tracker provides real-time measurement based on 90° light scattering. The Dust Tracker has a minimum detection limit of 0.001 mg/m^3.

Continuous real-time air monitoring for VOCs and particulate levels at the perimeter of the exclusion zone or work area will be performed for all ground intrusive activities. Ground intrusive activities include, but are not limited to the installation of soil borings and monitoring wells.

Periodic monitoring for VOCs will be performed during non-intrusive activities such as the collection of soil samples, the collection of groundwater samples from monitoring wells. For instance, periodic monitoring during sample collection will 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. Depending upon the proximity of potentially exposed individuals, continuous monitoring may be performed 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. Exceedances of action levels observed during performance of the Community Air Monitoring Plan (CAMP) will be reported to the NYSDEC and recorded in a field daily log. A summary of daily logs/reports will be provided in the RI.

2. VOCs Monitoring, Response Levels And Actions

VOCs will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis during invasive work. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using a PID, which will be calibrated at least daily for to the compound isobutylene. The PID will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.

If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 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.

Activities will be shut down if the organic vapor level at the perimeter of the work area is above 25 ppm.

All 15-minute readings must be recorded in a daily field log. Instantaneous readings, if any, used for decision purposes will also be recorded.

3. PM Monitoring, Response Levels And Actions

Particulate concentrations will be monitored continuously at the downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring will be performed using a Dust Tracker 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 will 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.

If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels are not 150 mcg/m^3 or greater above the upwind level and provided that no visible dust is migrating from the work area.

If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are 150 mcg/m^3 or greater above the upwind level, work will be stopped and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration. All readings will be recorded in a daily field log.

APPENDIX C

SAMPLE BORING LOG

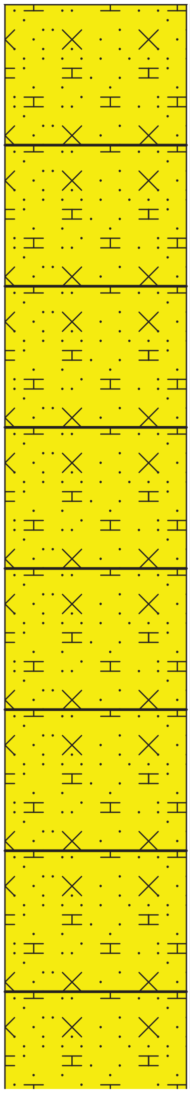
HydroTech Environmental
ENGINEERING AND GEOLOGY, DPC

Soil Probe Log

Job No: 180120
Date: October 2, 2018
Page: 1 of 1
Location: 77-57 Vleigh Place
Queens, NY
Sampling Interval: 2 Feet
Sampling Method: Discrete
Boring No.: WC-C P3
Driller: M. Pineda
Drilling Method: Direct Push
Depth to Water: N/A
Total Depth: 27 Feet

USCS SYMBOLS

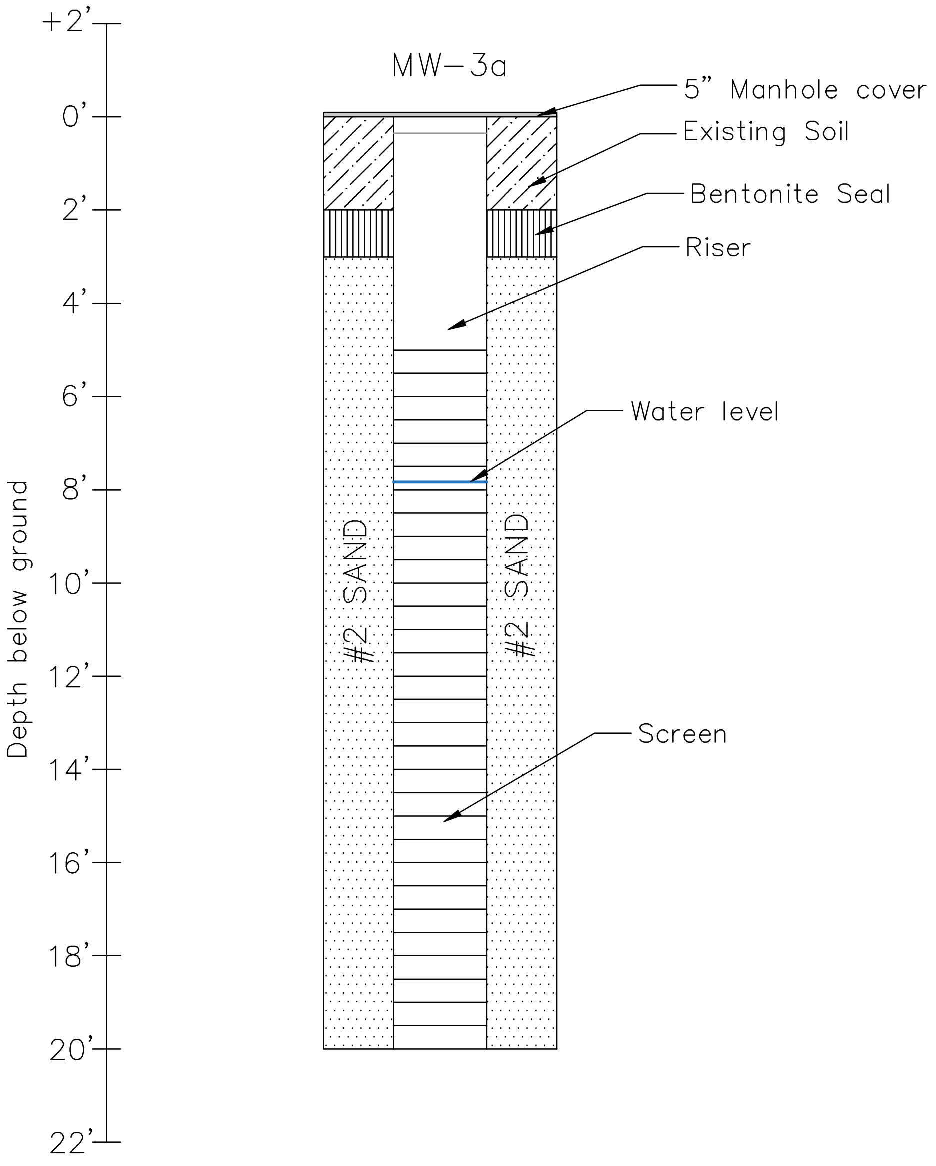
GW - Well Graded Gravel
GP - Poorly Graded Gravel
GM - Silty Gravel
GC - Clayey Gravel
SW - Well Graded Sand
SP - Poorly Graded Sand
SM - Silty Sand
SC - Clayey Sand
ML - Inorganic Silt / Sandy Silt
CL - Inorganic Clays/Sandy Clay
OL - Inorganic Silts/Organic Silty Clay
MH- Elastic Silts
CH - Inorganic Clay, High Plastic
OH - Organic Silt / Clay
PT - Peat/High Organics



Depth and Lithology	PID Reading (ppm)	USCS	Soil Description
0	0.0	SP	Brown medium grained sand with charcoal and pebbles. No odor
-2	0.0	SP	SAB
-4	0.0	SP	SAB
-6	0.0	SP	SAB
-8	0.0	SP	Brown coarse grained sand with pebbles
-10	0.0	SP	SAB
-12	0.0	SP	SAB
-14	0.0	SP	SAB

APPENDIX D

SAMPLE MONITORING WELL CONSTRUCTION LOG



Date 9/2/2021

0.00' – 2.00' – Existing Soil

2.00' – 3.00' – Bentonite Seal

3.00' – 20.00' – #2 Sand

0.00' – 5.00' – Riser

5.00' – 20.00' – Screen

7.8'– Water level

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

HYDROTECH ENVIRONMENTAL
ENGINEERING AND GEOLOGY,
DPC

BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

PROJECT FIGURE

MW-3a CONSTRUCTION LOG

APPENDIX E

QAPP

QUALITY ASSURANCE PROJECT PLAN

3083 Webster Ave BCP Site
3083 Webster Avenue
Block 3331; Lot 57
Bronx, NY 10467

NYSDEC Site Number: **TBD**

Table of Contents

1.0 Introduction

This Quality Assurance Project Plan (QAPP) has been prepared for the samples to be collected in accordance with the Remedial Investigation Work Plan (RIWP) developed for 3083 Webster Ave BCP Site located at 1032 and 3083 Webster Avenue in Bronx, New York. The intent of the QAPP is to ensure that (1) proper equipment handling and maintenance is followed, (2) cross-contamination between sampling locations does not occur, (3) standard number of quality control replicate environmental samples are obtained, (4) proper procedures for samples custody are performed and (5) data review, validation and verification requirements are complete.

All related portions of the fieldwork will be performed, at a minimum, in accordance with acceptable industry standards. These acceptable industry standards include, but are not limited to, the ASTM Standard Guide for Phase II Environmental Site Assessments (E 1903-97), the New York State Department of Environmental Conservation (NYSDEC) Bureau of Spill Prevention & Response Sampling Guidelines and Protocols, March 1991, NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation, May 2010, NYCRR Part 360, and NYSDEC Guidelines for Sampling, Analysis, And Assessment Of Per- And Polyfluoroalkyl -Substances (PFAS) Under NYSDEC’s Part 375 Remedial Programs, April 2023.

2.0 Project Objective and Scope of Work

The objective of the investigation as set forth in the RIWP is to address the data gaps for the characterization of environmental quality of on-site soil and groundwater at this Site. This investigation will be performed in accordance to the New York State Department of Environmental Conservation (NYSDEC) requirements under the NYS Brownfield Cleanup Program (BCP) and in compliance with the NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (May 2010), the NYSDEC Guidelines for Sampling, Analysis, And Assessment Of Per- And Polyfluoroalkyl -Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs (April 2023) and other acceptable industry standards.

To meet the above objectives a total of six (6) on-site soil probes and six (6) on-site monitoring wells will be installed and sampled during this investigation. Soil boring and monitoring well installation, construction, and development shall conform to NYCRR Part 360.

3.0 Sampling Procedures, Decontamination Methods and Data Quality Usability Objectives

3.1 Soil Sampling

Soil samples will be collected from six (6) soil borings designated as SP-9 through SP-14. All soil samples will be obtained at 2-foot intervals utilizing a 4-foot or 5-foot long Macro Core sampler fitted with dedicated acetate liners. The location of the soil probes is provided in **Figure 1-** Proposed Sampling Plan.

At minimum three (3) soil samples will be collected from each of the soil probes for lab analysis and will consist of the 2-foot interval that contains staining, odor and/or highest PID reading above the groundwater interface and the 2-foot interval that contains staining, odor and/or highest PID reading below the groundwater interface. The third sample will be collected at the soil and groundwater interface.

Each soil sample will be placed directly into pre-cleaned containers provided by the laboratory samples from select soil probes. Sample containers will be labeled and placed in a cooler filled with ice and maintained at 4 degrees Celsius. Each sample will be transmitted under proper chain of custody procedures to a NYSDOH ELAP-certified laboratory for analysis. **Table 1** provides the sample containers, volumes, test methods, preservation techniques, reporting limits and holding times for soil samples.

3.2 Groundwater Sampling

Groundwater samples will be obtained from the six (6) monitoring wells designated as MW-1a to MW-5a and Mw-6 that will be installed during the investigation. Groundwater samples will be collected utilizing a low flow pump fitted with dedicated polyethylene tubing. Initially, each monitoring well will be purged prior to sampling. Purging and sampling of the monitoring wells will be conducted according USEPA's Region 1 Low-Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells (EQASOP #GW4, Rev. September 19, 2017) utilizing a portable water quality meter Horiba U-52 Multiparameter Meter flow-through cell, which utilizes an in-line flow cell for water quality indicator measurements (the USEPA's Region 1 Low-Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells guidance is provided in **Attachment A**). Groundwater will be purged at a low flow rate of less than 200 milliliter per minute (mL/min) until water quality indicator parameters including pH, temperature, specific conductivity, oxidation reduction potential, dissolved oxygen and turbidity are stabilized within the specified confidence limits for three consecutive readings:

- Turbidity (10% for values greater than 5 NTUs; if three Turbidity values are less
- than 5 NTUs, consider the values as stabilized),
- Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three Dissolved
- Oxygen values are less than 0.5 mg/L, consider the values as
- stabilized),
- Specific Conductance (3%),
- Temperature (3%),
- pH (± 0.1 unit),

- Oxidation/Reduction Potential (±10 millivolts),
- Depth to Water.

During this low flow sampling from each monitoring well, the use of any equipment, materials or sampling jars that are known to contain Perfluorinated Compounds (PFCs) or polytetrafluoroethylene (PTFE) such as teflon tubing, low density polyethylene (LDPE) tubing or sample bottle cap liners should be prevented. Besides any contact with PFC waterproofed cloths or PFC containing materials such as aluminum foils and many food and drink packaging materials and should be avoided (**Attachment B** provides sampling guidelines and protocols for FPAS).

The sampling of each well will be performed once groundwater purging is completed. **Attachment C** provides a sample Groundwater Sampling/Purge Log. The location of the monitoring wells is provided in **Figure 1-** Proposed Sampling Plan.

Each groundwater sample will be placed directly into pre-cleaned containers provided by the laboratory. Sample containers will be labeled and placed in a cooler filled with ice and maintained at 4 degrees Celsius. Sample containers will be labeled and placed in a cooler filled with ice and maintained at 4 degrees Celsius. Each sample will be transmitted under proper chain of custody procedures to a NYSDOH ELAP-certified laboratory for analysis. **Table 2** provides the sample containers, volumes, test methods, preservation techniques, reporting limits and holding times for the groundwater samples.

3.3 Decontamination Procedures

During the field sampling, Ruijie Xu, who is a Project Quality Assurance Officer (QAO) at HydroTech Environmental Engineering and Geology, DPC will be responsible for monitoring the decontamination procedure of every piece of sampling equipment prior to each use by field personnel.

The following procedure will be implemented during the decontamination process for non-FPAS sampling of soil and groundwater:

- Wipe clean and wash with Alconox®
- Potable water rinse
- Methanol rinse
- Deionized water rinse
- Air dry

The following procedure will be implemented during the decontamination process for FPAS sampling of soil and groundwater:

- Wipe clean and wash with Alconox®
- PFAS-free water rinse.

All decontamination procedures will be performed in an area segregated from any sampling areas. Any rinsate from the decontamination area will be contained and placed in 55-gallons drums and properly disposed of.

3.4 Quality Assurance and Quality Control (QA/QC)

The following Quality Assurance (QA) and Quality Control (QC) samples will also be collected and analyzed.

- One trip blank per trip will be analyzed via EPA Method 8260
- One equipment blank (rinsate blank) for soil per day of sampling will be analyzed via EPA Method 8260, EPA Method 8270, EPA Method 8081, EPA Method 8151, EPA Method 8082, EPA Method 6010, EPA Method 7471 and also for EPA Method 8270D SIM and EPA Method 1633.
- One field blank for soil per day of sampling will be analyzed for EPA Method 1633.
- One equipment blank (rinsate blank) for groundwater per day of sampling will be analyzed via EPA Method 8260, EPA Method 8270, EPA Method 8081, EPA Method 8151, EPA Method 8082, EPA Method 6010, EPA Method 7471 and also EPA Method 8270D SIM and EPA Method 1633.
- One field blank for groundwater per day of sampling will be analyzed for EPA Method 1633.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) samples will also be collected and analyzed.

- One MS soil sample and One MSD soil sample will be analyzed via EPA Method 8260, EPA Method 8270, EPA Method 8081, EPA Method 8151, EPA Method 8082, EPA Method 6010 and EPA Method 7471, and also for EPA Method 8270 SIM and EPA Method 1633.
- One MS groundwater sample and one MSD groundwater sample will be analyzed via EPA Method 8260, EPA Method 8270, EPA Method 8081, EPA Method 8151, EPA Method 8082, EPA Method 6010, EPA Method 7471 and also EPA Method 8270D SIM and EPA Method 1633. **Tables 1** and **Table 2 p**rovide the sampling and analytical Method Requirements along with a summary of anticipated QA/QC for soil and groundwater.

3.5 General QA/QC Considerations

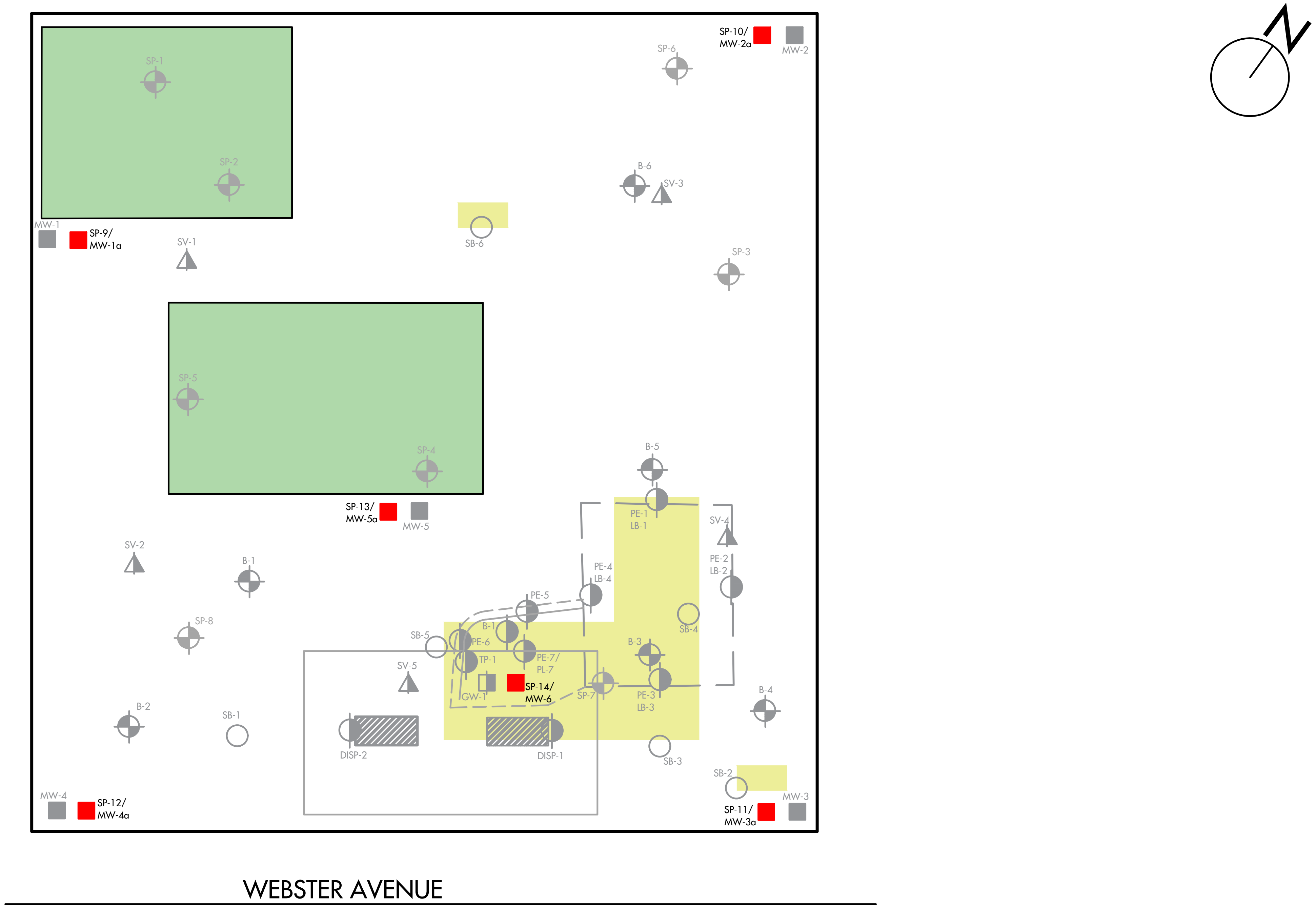
The soil and groundwater samples will be managed as per the following protocols:

- HydroTech PM (Paul I. Matli) and HydroTech QAO (Ruijie Xu) shall perform field audits to verify compliance with the RIWP and identify corrective measures where problems are identified. A resume for Paul I. Matli and Ruijie Xu are included in **Attachment D.**
- Samples will be labeled and logged in a monitor notebook and Chain of Custody upon collection including sampler name, sampling identification, date and time of sample collection and sampling depth, sampling methods and devices.

- In the field, samples will be the responsibility of, and will stay with, the HydroTech PM (Paul I. Matli) and/or QAO (Ruijie Xu).
- HydroTech staff will be then responsible for transporting samples to State-certified (ELAP) laboratory for analysis under a proper Chain of Custody. **Attachment E** provides a sample chain of custody form.
- Once samples have been collected, they will be picked-up by the laboratory from the field or returned to HydroTech office and logged in for temporary storage under a proper Chain of Custody.
- The Sample Chain of Custody form will be used to record all transport and storage information.
- All samples will be refrigerated to maintain a temperature at a maximum 4 degrees Celsius.
- Laboratory personnel will record the date and time of samples arrival at the lab and ensure that all holding times for each matrix and analysis will be met.
- After samples are analyzed, laboratory information is added to the label.
- Samples analytical data report will undergo QA/QC performed by a laboratory QA officer who checks each data sheet for precision, missing or illegible information, errors in calculation and values outside of the expected range. A minimum of five percent of the total of a given type of sample shall be devoted to internal QC checks. These checks are designed to ensure accuracy in the sampling procedure and the analytical methods and include blanks, duplicates, matrix spikes reference standards and performance evaluation samples. **Attachment F** provides a conventional lab QA/QC procedures associated with soil samples and analysis.
- The Laboratory data packages will conform to the Analytical Services Protocols (ASP) Category B Deliverables in accordance to NYSDEC DER-10 Appendix 2B.
- To ensure that data quality objectives are met, HydroTech QAO will assess data precision, accuracy, degree of representation, comparability and completeness of samples and data. This is primarily accomplished in the evaluation of data together with field notes and sampling logs. In order to ensure that cross-contamination between sampling locations did not occur, each piece of detection and reporting limits shall allow for comparison with soil quality standards.
- All deficiencies identified by HydroTech PM during the performance of field audits or evaluation of the data will be immediately reported to the field Geologist, and the NYSDEC. In addition to identifying deficiencies, the HydroTech PM is responsible for recommending corrective actions.
- The analytical data generated from this project will be provided in an electronic format in accordance with NYSDECs DER-10 Section 1.15. Specifically, the final reports shall be in an electronic format that complies with the NYSDEC's Electronic Document Standards (EDS).

- A Category B deliverable is required and a Data Usability Summary Report (DUSR) will be prepared. The DUSR will include all data and answer the following questions:
  1. Is the data package complete as defined under the requirements for the most current DEC ASP Category B or USEPA CLP data deliverables?
  2. Have all holding times been met?
  3. Do all the QC data; blanks, instrument tunings, calibration standards, calibration verifications, surrogate recoveries, spike recoveries, replicate analyses, laboratory controls and sample data fall within the protocol required limits and specifications?
  4. Have all of the data been generated using established and agreed upon analytical protocols?
  5. Does an evaluation of the raw data confirm the results provided in the data summary sheets and quality control verification forms?
  6. Have the correct data qualifiers been used and are they consistent with the most current DEC ASP?
  7. Have any quality control (QC) exceedances been specifically noted in the DUSR and have the corresponding QC summary sheets from the data package been attached to the DUSR?
- All validated data will be reviewed by Dr. Hanibal Tayeh, an independent QAO, who is responsible of generating a data usability analysis. This analysis shall consist of (1) an assessment to determine if the data quality objectives were met; (2) evaluation of field duplicate results to indicate the samples are representative; (3) comparison of the results of trip blanks and methods blanks with full data sets to provide information concerning contaminants that may have been introduced during sampling, shipping or analyzing; (4) evaluation of matrix effects to assess the performance of the analytical method with respect to sample matrix, and determine whether the data have been biased high or low due to matrix effects. A Data Usability Summary Report (DUSR) will be prepared and provided in an electronic format in accordance to NYSDEC DER-10 Appendix 2B and in compliance with the NYSDEC's Electronic Document Standards (EDS). A resume for Dr. Hanibal Tayeh is included in **Attachment D.**
- Field investigation will be performed under the full oversight of Tarek Z. Khouri, a NYS registered professional engineer. A resume for Tarek Z. Khouri is included in **Attachment D**.
- Points to remember during sampling of PFAS:
  1. Field sampling for PFAS shall follow appropriate procedures for soils and monitoring wells as outlined in Appendix B and in Appendix C of the NYSDEC Guidance For Sampling Analysis And Assessment of PFAS – April 2023.
  2. PFAS compounds will be analyzed at the laboratory by LC-MS/MS for PFAS using methodologies based on EPA Method 1633.
  3. PFAS analysis should include all the compounds listed in Appendix G of the NYSDEC Guidance For Sampling Analysis And Assessment of PFAS – April 2023
  4. Reporting limits for PFAS in aqueous samples should not exceed 2 ng/L and in soil samples should not exceed 0.5 µg/kg.
  5. All sources of water used for equipment decontamination will be verified in advance to be PFAS-free through laboratory analysis or certification.

6. During sampling, avoid contact with aluminum foils, waterproof field books or clothing, food packaging, tools with coatings or paint, soda cans, low density polyethylene (LDPE) tubing, Teflon-based materials including sample bottle cap, liners. Cloth worn by field personnel should be washed and clean.
7. Materials that can be used during sampling include High density polyethylene (HDPE) tubing, PVC, silicone, nitrile gloves, acetate liners and propylene.
8. Avoid use of sunscreen or any spray-on perfume or insect repellant that contain PFAS, unless site warrants use of shipment protective measures that contain PFAS, and such use should be documented in field notes.
9. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided.
10. The sampler should wear nitrile gloves while conducting fieldwork and handling sample containers.
11. Regular ice only will be used for samples shipment



LEGEND:

- ⊕ SOIL PROBE (SP-) INSTALLED BY HYDROTECH IN JULY 2024
- ⊕ SOIL PROBES (B-) INSTALLED BY ADVANTAGE ENVIRONMENTAL CONSULTANTS, LLC IN DECEMBER 2021
- ◑ POST-USTs, DISPENSERS, TEST PIT AND PRODUCT LINE EXCAVATION ENDPOINT SAMPLES (PE-, LB-, PL-, TP-, DISP-) COLLECTED BY LABELLA ASSOCIATES, D.P.C. (LABELLA) IN AUGUST & SEPTEMBER 2021
- ○ SOIL PROBE INSTALLED BY TYREE BROTHER'S ENVIRONMENTAL SERVICES, INC (TYREE) IN OCTOBER 2009 (WITH SB-2 AND SB-3 CONVERTED INTO GROUNDWATER PROBES)
- △ SOIL VAPOR PROBE (SV-)
- ■ MONITORING WELLS INSTALLED BY TYREE BROTHER'S ENVIRONMENTAL SERVICES, INC (TYREE) IN 1998
- ◨ GROUNDWATER GRAB SAMPLE(GW-) FROM TEST PIT COLLECTED IN SEPTEMBER 2021
- ━ SITE BOUNDARY
- 🟨 FORMER LOCATIONS OF REMOVED USTs BY TYREE IN JANUARY 1998
- – – FORMER LOCATIONS OF REMOVED UNDERGROUND STORAGE TANKS (USTs) BY LABELLA IN AUGUST 2021
- ▨ FORMER LOCATIONS OF REMOVED DISPENSERS
- — FORMER LOCATION OF REMOVED PRODUCT LINE
- ☐ CANOPY OF FORMER DISPENSERS
- 🟩 1-STORY FORMER AUTO REPAIR BUILDINGS
- 🟥 PROPOSED LOCATION OF MONITORING WELL (MW-) AND SOIL PROBE (SP-)

0' 40'

APPROXIMATE SCALE IN FEET

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

HydroTech

HYDROTECH ENVIRONMENTAL
ENGINEERING AND GEOLOGY,
DPC

231 WEST 29TH STREET, SUITE
1104, NEW YORK,
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BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

3038 WEBSTER AVENUE, BRONX, NY.

PROJECT FIGURE

FIGURE 1: PROPOSED SAMPLING PLAN

PROJECT NO. 240040	DATE 11/25/24
DRAWN BY A.S.	REVIEWED BY P.M.
SCALE (11X17) AS SHOWN	APPROVED BY P.M.

Table 1: Sampling & Analytical Method Requirements – Soil Samples

Soil Matrix (1)	Parameters	Minimum Sample Volume	Sample Container	Sample Preserva tion	Analytical Method	Lab Reporting Limit	Technical Holding Time
Sample ID							
Twenty two (22) Soil Samples (3 Samples per Each Soil Probe SP-9 to SP-14 + Duplicate Sample) & Matrix Spike /Matrix Spike Duplicates & Equipment Blank & Field Blank (3)	TCL VOCs	120 ml + 2 OZ	2 oz. clear wide-mouth glass with Teflon lined septum + 40 ml methanol vial with Teflon lined cap + 40 ml DI water vial with Teflon lined cap + 40 ml unpreserved vial with Teflon lined cap	Cool to 4 °C(2)	EPA Method 8260	Compound Specific (0.001-0.05 mg/Kg)	14 days
	TCL SVOCs	8 OZ	8 oz. clear wide-mouth glass with Teflon lined septum	Cool to 4 °C	EPA Method 8270	Compound Specific (0.065-0.250	14 days
	TAL Metals	8 OZ	8 oz. clear wide-mouth glass with Teflon lined septum	Cool to 4 °C	EPA Method 6010/EPA 7470 for Mercury	Compound Specific (0.05-10	6 months/ Chromium Hexavalent 24
	Herbicides/ Pesticides	8 OZ	8 oz. clear wide-mouth glass with Teflon lined septum	Cool to 4 °C	EPA Methods 8082/8151	Compound Specific	14 days
	PCBs	8 OZ	8 oz. clear wide-mouth glass with Teflon lined septum	Cool to 4 °C	EPA Method 8081	Compound Specific (0.025 mg/Kg)	14 days
	1,4 Dioxine	500 mL	4 oz. clear glass	Cool 4°C	EPA Method 8270	0.1 mg/Kg	14 days
	21 Target PFAS	500	500 ml ml HDPE or polypropylene	Cool to 4 °C	Modified EPA Method 537m	Compound Specific (≤0.5 µg/kg)	14 days
1 Trip Blank/ Per Shipment to Laboratory	TCL VOCs	80 ml	40 ml VOC vial with Teflon lined cap	1:1 HCL to pH<2 Cool to 4 °C	EPA Method 8260	Compound Specific (0.2-10 µg/L)	14 days

((1)….Analytical Services Protocols (ASP) Deliverables Package Category B.

(2)…If samples are not delivered to the lab with 48 hours after collection, the 40 ml DI Water vials should be preserved in a frozen condition following sampling

(3)….Applies to PFAS Analysis, only.

Table 2: Sampling & Analytical Method Requirements – Groundwater Samples

Groundwater Matrix (1)	**Parameters**	**Minimum Sample Volume**	**Sample Container**	**Sample Preservation**	**Analytical Method**	**Lab Reporting Limit**	**Technical Holding Time**
Sample ID							
Seven Groundwater Samples (MW-1a to MW-5, MW-6 + Duplicate Sample) & Matrix Spike /Matrix Spike Duplicates & Equipment Blank & Field Blank (2)	TCL VOCs	120 ml	40 ml VOC vial with Teflon lined	1:1 HCL to pH<2 Cool to 4 °C	EPA Method 8260	Compound Specific (0.2-10 µg/L)	14 days
	TCL SVOCs	1 liter	Amber glass with Teflon lined cap	Cool to 4 °C	EPA Method 8270	Compound Specific (2-20 µg/L)	7 days
	TAL Metals	500 ml	500 ml Poly cup with Teflon lined cap	HNO3 to pH<2 Cool to 4 °C	EPA Method 6010/EPA 7470 for Mercury	Compound Specific (2-20 µg/L)	6 months/ Chromium Hexavalent 24
	Herbicides/ Pesticides	1 liter	Amber glass with Teflon lined cap	Cool to 4 °C	EPA Methods 8082/8151	Compound Specific (0.01-0.1 µg/L)	7 days
	PCBs	1 liter	Amber glass with Teflon lined cap	Cool to 4 °C	EPA Method 8081	Compound Specific (0.05 µg/L)	7 days
	1,4 Dioxine	1 liter	Amber glass with Teflon lined cap	Cool to 4 °C	EPA Method 8270D SIM	Compound Specific (≤0.28 µg/L)	7 days
	21 Target PFAS	500	500 ml ml HDPE or polypropylene	Cool to 4 °C	EPA Method 1633	Compound Specific (≤2 ng/L)	14 days
Trip Blank/ Per Shipment to Laboratory	TCL VOCs	80 ml	40 ml VOC vial with Teflon	1:1 HCL to pH<2 Cool to 4 °C	EPA Method 8260	Compound Specific (0.5-20 µg/L)	14 days

((1)….Analytical Services Protocols (ASP) Deliverables Package Category B.

(2)…. Applies to PFAS Analysis, only.

ATTACHMENT A

USEPA LOW FLOW SAMPLING PROTOCOL

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS

Quality Assurance Unit
U.S. Environmental Protection Agency – Region 1
11 Technology Drive
North Chelmsford, MA 01863

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Prepared by:__________________________________ ____________
(Robert Reinhart, Quality Assurance Unit) Date

Approved by:__________________________________ ____________
(John Smaldone, Quality Assurance Unit) Date

Revision Page

Date	**Rev #**	**Summary of changes**	**Sections**
7/30/96	1	Finalized	
01/19/10	2	Updated	All sections
3/23/17	3	Updated	All sections
9/20/17	4	Updated	Section 7.0

Table of Contents

1.0 USE OF TERMS

Equipment blank: The equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank needs only to include the pump in subsequent sampling rounds. If the pump and tubing are dedicated to the well, the equipment blank is collected prior to its placement in the well. If the pump and tubing will be used to sample multiple wells, the equipment blank is normally collected after sampling from contaminated wells and not after background wells.

Field duplicates: Field duplicates are collected to determine precision of the sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

Indicator field parameters: This SOP uses field measurements of turbidity, dissolved oxygen, specific conductance, temperature, pH, and oxidation/reduction potential (ORP) as indicators of when purging operations are sufficient and sample collection may begin.

Matrix Spike/Matrix Spike Duplicates: Used by the laboratory in its quality assurance program. Consult the laboratory for the sample volume to be collected.

Potentiometric Surface: The level to which water rises in a tightly cased well constructed in a confined aquifer. In an unconfined aquifer, the potentiometric surface is the water table.

QAPP: Quality Assurance Project Plan

SAP: Sampling and Analysis Plan

SOP: Standard operating procedure

Stabilization: A condition that is achieved when all indicator field parameter measurements are sufficiently stable (as described in the "Monitoring Indicator Field Parameters" section) to allow sample collection to begin.

Temperature blank: A temperature blank is added to each sample cooler. The blank is measured upon receipt at the laboratory to assess whether the samples were properly cooled during transit.

Trip blank (VOCs): Trip blank is a sample of analyte-free water taken to the sampling site and returned to the laboratory. The trip blanks (one pair) are added to each sample cooler that contains VOC samples.

2.0 SCOPE & APPLICATION

The goal of this groundwater sampling procedure is to collect water samples that reflect the total mobile organic and inorganic loads (dissolved and colloidal sized fractions) transported through the subsurface under ambient flow conditions, with minimal physical and chemical alterations from sampling operations. This standard operating procedure (SOP) for collecting groundwater samples will help ensure that the project's data quality objectives (DQOs) are met under certain low-flow conditions.

The SOP emphasizes the need to minimize hydraulic stress at the well-aquifer interface by maintaining low water-level drawdowns, and by using low pumping rates during purging and sampling operations. Indicator field parameters (e.g., dissolved oxygen, pH, etc.) are monitored during purging in order to determine when sample collection may begin. Samples properly collected using this SOP are suitable for analysis of groundwater contaminants (volatile and semi-volatile organic analytes, dissolved gases, pesticides, PCBs, metals and other inorganics), or naturally occurring analytes. This SOP is based on Puls, and Barcelona (1996).

This procedure is designed for monitoring wells with an inside diameter (1.5-inches or greater) that can accommodate a positive lift pump with a screen length or open interval ten feet or less and with a water level above the top of the screen or open interval (Hereafter, the "screen or open interval" will be referred to only as "screen interval"). This SOP is not applicable to other well-sampling conditions.

While the use of dedicated sampling equipment is not mandatory, dedicated pumps and tubing can reduce sampling costs significantly by streamlining sampling activities and thereby reducing the overall field costs.

The goal of this procedure is to emphasize the need for consistency in deploying and operating equipment while purging and sampling monitoring wells during each sampling event. This will help to minimize sampling variability.

This procedure describes a general framework for groundwater sampling. Other site specific information (hydrogeological context, conceptual site model (CSM), DQOs, etc.) coupled with systematic planning must be added to the procedure in order to develop an appropriate site specific SAP/QAPP. In addition, the site specific SAP/QAPP must identify the specific equipment that will be used to collect the groundwater samples.

This procedure does not address the collection of water or free product samples from wells containing free phase LNAPLs and/or DNAPLs (light or dense non-aqueous phase liquids). For this type of situation, the reader may wish to check: Cohen, and Mercer (1993) or other pertinent documents.

This SOP is to be used when collecting groundwater samples from monitoring wells at all Superfund, Federal Facility and RCRA sites in Region 1 under the conditions described herein. Request for modification of this SOP, in order to better address specific situations at individual wells, must include adequate technical justification for proposed changes. <u>All changes and modifications must be approved and included in a revised SAP/QAPP before implementation in field.</u>

3.0 BACKGROUND FOR IMPLEMENTATION

It is expected that the monitoring well screen has been properly located (both laterally and vertically) to intercept existing contaminant plume(s) or along flow paths of potential contaminant migration. Problems with inappropriate monitoring well placement or faulty/improper well installation cannot be overcome by even the best water sampling procedures. This SOP presumes that the analytes of interest are moving (or will potentially move) primarily through the more permeable zones intercepted by the screen interval.

Proper well construction, development, and operation and maintenance cannot be overemphasized. The use of installation techniques that are appropriate to the hydrogeologic setting of the site often prevent "problem well" situations from occurring. During well development, or redevelopment, tests should be conducted to determine the hydraulic characteristics of the monitoring well. The data can then be used to set the purging/sampling rate, and provide a baseline for evaluating changes in well performance and the potential need for well rehabilitation. Note: if this installation data or well history (construction and sampling) is not available or discoverable, for all wells to be sampled, efforts to build a sampling history should commence with the next sampling event.

The pump intake should be located within the screen interval and at a depth that will remain under water at all times. It is recommended that the intake depth and pumping rate remain the same for all sampling events. The mid-point or the lowest historical midpoint of the saturated screen length is often used as the location of the pump intake. For new wells, or for wells without pump intake depth information, the site’s SAP/QAPP must provide clear reasons and instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected. If the depths to top and bottom of the well screen are not known, the SAP/QAPP will need to describe how the sampling depth will be determined and how the data can be used.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU, and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection may still take place provided the indicator field parameter criteria in this procedure are met. If after 2 hours of purging indicator field parameters have not stabilized, one of three optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization), c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may reflect a sampling bias and therefore, the data may not meet the data quality objectives of the sampling event).

It is recommended that low-flow sampling be conducted when the air temperature is above 32°F (0°C). If the procedure is used below 32°F, special precautions will need to be taken to prevent the groundwater from freezing in the equipment. Because sampling during freezing temperatures may adversely impact the data quality objectives, the need for water sample collection during months when these conditions are likely to occur should be evaluated during site planning and special sampling measures may need to be developed. Ice formation in the flow-through-cell will cause the monitoring probes to act erratically. A transparent flow-through-cell needs to be used to observe if ice is forming in the cell. If ice starts to form on the other pieces of the sampling equipment, additional problems may occur.

4.0 HEALTH & SAFETY

When working on-site, comply with all applicable OSHA requirements and the site's health/safety procedures. All proper personal protection clothing and equipment are to be worn. Some samples may contain biological and chemical hazards. These samples should be handled with suitable protection to skin, eyes, etc.

5.0 CAUTIONS

The following cautions need to be considered when planning to collect groundwater samples when the below conditions occur.

If the groundwater degasses during purging of the monitoring well, dissolved gases and VOCs will be lost. When this happens, the groundwater data for dissolved gases (e.g., methane, ethene, ethane, dissolved oxygen, etc.) and VOCs will need to be qualified. Some conditions that can promote degassing are the use of a vacuum pump (e.g., peristaltic pumps), changes in aperture along the sampling tubing, and squeezing/pinching the pump's tubing which results in a pressure change.

When collecting the samples for dissolved gases and VOCs analyses, avoid aerating the groundwater in the pump's tubing. This can cause loss of the dissolved gases and VOCs in the groundwater. Having the pump's tubing completely filled prior to sampling will avoid this problem when using a centrifugal pump or peristaltic pump.

Direct sun light and hot ambient air temperatures may cause the groundwater in the tubing and flow-through-cell to heat up. This may cause the groundwater to degas which will result in loss of VOCs and dissolved gases. When sampling under these conditions, the sampler will need to shade the equipment from the sunlight (e.g., umbrella, tent, etc.). If possible, sampling on hot days, or during the hottest time of the day, should be avoided. The tubing exiting the monitoring well should be kept as short as possible to avoid the sun light or ambient air from heating up the groundwater.

Thermal currents in the monitoring well may cause vertical mixing of water in the well bore. When the air temperature is colder than the groundwater temperature, it can cool the top of the water column. Colder water which is denser than warm water sinks to the bottom of the well and the warmer water at the bottom of the well rises, setting up a convection cell. "During low-flow sampling, the pumped water may be a mixture of convecting water from within the well casing and aquifer water moving inward through the screen. This mixing of water during low-flow sampling can substantially increase equilibration times, can cause false stabilization of indicator parameters, can give false indication of redox state, and can provide biological data that are not representative of the aquifer conditions" (Vroblesky 2007).

Failure to calibrate or perform proper maintenance on the sampling equipment and measurement instruments (e.g., dissolved oxygen meter, etc.) can result in faulty data being collected.

Interferences may result from using contaminated equipment, cleaning materials, sample containers, or uncontrolled ambient/surrounding air conditions (e.g., truck/vehicle exhaust nearby).

Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment and/or proper planning to avoid ambient air interferences. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

Clean and decontaminate all sampling equipment prior to use. All sampling equipment needs to be routinely checked to be free from contaminants and equipment blanks collected to ensure that the equipment is free of contaminants. Check the previous equipment blank data for the site (if they exist) to determine if the previous cleaning procedure removed the contaminants. If contaminants were detected and they are a concern, then a more vigorous cleaning procedure will be needed.

6.0 PERSONNEL QUALIFICATIONS

All field samplers working at sites containing hazardous waste must meet the requirements of the OSHA regulations. OSHA regulations may require the sampler to take the 40 hour OSHA health and safety training course and a refresher course prior to engaging in any field activities, depending upon the site and field conditions.

The field samplers must be trained prior to the use of the sampling equipment, field instruments, and procedures. Training is to be conducted by an experienced sampler before initiating any sampling procedure.

The entire sampling team needs to read, and be familiar with, the site Health and Safety Plan, all relevant SOPs, and SAP/QAPP (and the most recent amendments) before going onsite for the sampling event. It is recommended that the field sampling leader attest to the understanding of these site documents and that it is recorded.

7.0 EQUIPMENT AND SUPPLIES

A. Informational materials for sampling event

A copy of the current Health and Safety Plan, SAP/QAPP, monitoring well construction data, location map(s), field data from last sampling event, manuals for sampling, and the monitoring instruments' operation, maintenance, and calibration manuals should be brought to the site.

B. Well keys.

C. Extraction device

Adjustable rate, submersible pumps (e.g., centrifugal, bladder, etc.) which are constructed of stainless steel or polytetrafluoroethylene (PTFE, i.e. Teflon®) are preferred. PTFE, however, should not be used when sampling for per- and polyfluoroalkyl substances (PFAS) as it is likely to contain these substances.

Note: If extraction devices constructed of other materials are to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

If bladder pumps are selected for the collection of VOCs and dissolved gases, the pump setting should be set so that one pulse will deliver a water volume that is sufficient to fill a 40 mL VOC vial. This is not mandatory, but is considered a “best practice”. For the proper operation, the bladder pump will need a minimum amount of water above the pump; consult the manufacturer for the recommended submergence. The pump’s recommended submergence value should be determined during the planning stage, since it may influence well construction and placement of dedicated pumps where water-level fluctuations are significant.

Adjustable rate, peristaltic pumps (suction) are to be used with caution when collecting samples for VOCs and dissolved gases (e.g., methane, carbon dioxide, etc.) analyses. Additional information on the use of peristaltic pumps can be found in Appendix A.
If peristaltic pumps are used, the inside diameter of the rotor head tubing needs to match the inside diameter of the tubing installed in the monitoring well.

Inertial pumping devices (motor driven or manual) are not recommended. These devices frequently cause greater disturbance during purging and sampling, and are less easily controlled than submersible pumps (potentially increasing turbidity and sampling variability, etc.). This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

D. Tubing

PTFE (Teflon®) or PTFE-lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics. As discussed in the previous section, PTFE tubing should not be used when sampling for PFAS. In this case, a suitable alternative such as high-density polyethylene tubing should be used.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for metal and other inorganics analyses.

Note: If tubing constructed of other materials is to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

The use of 1/4 inch or 3/8 inch (inside diameter) tubing is recommended. This will help ensure that the tubing remains liquid filled when operating at very low pumping rates when using centrifugal and peristaltic pumps.

Silastic tubing should be used for the section around the rotor head of a peristaltic pump. It should be less than a foot in length. The inside diameter of the tubing used at the pump rotor head must be the same as the inside diameter of tubing placed in the well. A tubing connector is used to connect the pump rotor head tubing to the well tubing. Alternatively, the two pieces of tubing can be connected to each other by placing the one end of the tubing inside the end of the other tubing. The tubing must not be reused.

E. The water level measuring device

Electronic ”tape”, pressure transducer, water level sounder/level indicator, etc. should be capable of measuring to 0.01 foot accuracy. Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level “tape” at the start and end of each sampling event.

F. Flow measurement supplies

Graduated cylinder (size according to flow rate) and stopwatch usually will suffice.

Large graduated bucket used to record total water purged from the well.

G. Interface probe

To be used to check on the presence of free phase liquids (LNAPL, or DNAPL) before purging begins (as needed).

H. Power source (generator, nitrogen tank, battery, etc.)

When a gasoline generator is used, locate it downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate samples.

I. Indicator field parameter monitoring instruments

Use of a multi-parameter instrument capable of measuring pH, oxidation/reduction potential (ORP), dissolved oxygen (DO), specific conductance, temperature, and coupled with a flow-through-cell is required when measuring all indicator field parameters, except turbidity. Turbidity is collected using a separate instrument. Record equipment/instrument identification (manufacturer, and model number).

Transparent, small volume flow-through-cells (e.g., 250 mLs or less) are preferred. This allows observation of air bubbles and sediment buildup in the cell, which can interfere with the operation of the monitoring instrument probes, to be easily detected. A small volume cell facilitates rapid turnover of water in the cell between measurements of the indicator field parameters.

It is recommended to use a flow-through-cell and monitoring probes from the same manufacturer and model to avoid incompatibility between the probes and flow-through-cell.

Turbidity samples are collected before the flow-through-cell. A “T” connector coupled with a valve is connected between the pump’s tubing and flow-through-cell. When a turbidity measurement is required, the valve is opened to allow the groundwater to flow into a container. The valve is closed and the container sample is then placed in the turbidimeter.

Standards are necessary to perform field calibration of instruments. A minimum of two standards are needed to bracket the instrument measurement range for all parameters except ORP which use a Zobell solution as a standard. For dissolved oxygen, a wet sponge used for the 100% saturation and a zero dissolved oxygen solution are used for the calibration.

Barometer (used in the calibration of the Dissolved Oxygen probe) and the conversion formula to convert the barometric pressure into the units of measure used by the Dissolved Oxygen meter are needed.

J. Decontamination supplies

Includes (for example) non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.

K. Record keeping supplies

Logbook(s), well purging forms, chain-of-custody forms, field instrument calibration forms, etc.

L. Sample bottles

M. Sample preservation supplies (as required by the analytical methods)

N. Sample tags or labels

O. PID or FID instrument

If appropriate, to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

P. Miscellaneous Equipment

Equipment to keep the sampling apparatus shaded in the summer (e.g., umbrella) and from freezing in the winter. If the pump's tubing is allowed to heat up in the warm weather, the cold groundwater may degas as it is warmed in the tubing.

8.0 EQUIPMENT/INSTRUMENT CALIBRATION

Prior to the sampling event, perform maintenance checks on the equipment and instruments according to the manufacturer's manual and/or applicable SOP. This will ensure that the equipment/instruments are working properly before they are used in the field.

Prior to sampling, the monitoring instruments must be calibrated and the calibration documented. The instruments are calibrated using U.S Environmental Protection Agency Region 1 *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity),* March 23, 2017, or latest version or from one of the methods listed in 40CFR136, 40CFR141 and SW-846.

The instruments shall be calibrated at the beginning of each day. If the field measurement falls outside the calibration range, the instrument must be re-calibrated so that all measurements fall within the calibration range. At the end of each day, a calibration check is performed to verify that instruments remained in calibration throughout the day. This check is performed while the instrument is in measurement mode, not calibration mode. If the field instruments are being used to monitor the natural attenuation parameters, then a calibration check at mid-day is highly recommended to ensure that the instruments did not drift out of calibration. Note: during the day if the instrument reads zero or a negative number for dissolved oxygen, pH, specific conductance, or turbidity (negative value only), this indicates that the instrument drifted out of calibration or the instrument is malfunctioning. If this situation occurs the data from this instrument will need to be qualified or rejected.

9.0 PRELIMINARY SITE ACTIVITIES (as applicable)

Check the well for security (damage, evidence of tampering, missing lock, etc.) and record pertinent observations (include photograph as warranted).

If needed, lay out a sheet of clean polyethylene for monitoring and sampling equipment, unless equipment is elevated above the ground (e.g., on a table, etc.).

Remove well cap and if appropriate measure VOCs at the rim of the well with a PID or FID instrument and record reading in field logbook or on the well purge form.

If the well casing does not have an established reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook (consider a photographic record as well). All water level measurements must be recorded relative to this reference point (and the altitude of this point should be determined using techniques that are appropriate to site's DQOs.

If water-table or potentiometric surface map(s) are to be constructed for the sampling event, perform synoptic water level measurement round (in the shortest possible time) before any purging and sampling activities begin. If possible, measure water level depth (to 0.01 ft.) and total well depth (to 0.1 ft.) the day before sampling begins, in order to allow for re-settlement of any particulates in the water column. This is especially important for those wells that have not been recently sampled because sediment buildup in the well may require the well to be redeveloped. If measurement of total well depth is not made the day before, it should be measured after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe may not be necessary unless analytical data or field analysis signal a worsening situation. This SOP cannot be used in the presence of LNAPLs or DNAPLs. If NAPLs are present, the project team must decide upon an alternate sampling method. All project modifications must be approved and documented prior to implementation.

If available check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). If changes are made in the intake depth or extraction rate(s) used during previous sampling event(s), for either portable or dedicated extraction devices, record new values, and explain reasons for the changes in the field logbook.

10.0 PURGING AND SAMPLING PROCEDURE

Purging and sampling wells in order of increasing chemical concentrations (known or anticipated) are preferred.

The use of dedicated pumps is recommended to minimize artificial mobilization and entrainment of particulates each time the well is sampled. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

A. Initial Water Level

Measure the water level in the well before installing the pump if a non-dedicated pump is being used. The initial water level is recorded on the purge form or in the field logbook.

B. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the appropriate depth (may not be the mid-point of the screen/open interval). The Sampling and Analysis Plan/Quality Assurance Project Plan should specify the sampling depth (used previously), or provide criteria for selection of intake depth for each new well. If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well.

Pump tubing lengths, above the top of well casing should be kept as short as possible to minimize heating the groundwater in the tubing by exposure to sun light and ambient air temperatures. Heating may cause the groundwater to degas, which is unacceptable for the collection of samples for VOC and dissolved gases analyses.

C. Measure Water Level

Before starting pump, measure water level. Install recording pressure transducer, if used to track drawdowns, to initialize starting condition.

D. Purge Well

From the time the pump starts purging and until the time the samples are collected, the purged water is discharged into a graduated bucket to determine the total volume of groundwater purged. This information is recorded on the purge form or in the field logbook.

Start the pump at low speed and slowly increase the speed until discharge occurs. Check water level. Check equipment for water leaks and if present fix or replace the affected equipment. Try to match pumping rate used during previous sampling event(s). Otherwise, adjust pump speed until there is little or no water level drawdown. If the minimal drawdown that can be achieved exceeds 0.3 feet, but remains stable, continue purging.

Monitor and record the water level and pumping rate every five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" somewhat as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. If the initial water level is above the top of the screen do not allow the water level to fall into the well screen. The final purge volume must be greater than the stabilized drawdown volume plus the pump’s tubing volume. If the drawdown has exceeded 0.3 feet and stabilizes, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump’s tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are collected.

Avoid the use of constriction devices on the tubing to decrease the flow rate because the constrictor will cause a pressure difference in the water column. This will cause the groundwater to degas and result in a loss of VOCs and dissolved gasses in the groundwater samples.

Note: the flow rate used to achieve a stable pumping level should remain constant while monitoring the indicator parameters for stabilization and while collecting the samples.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (e.g., bladder, peristaltic), and/or the use of dedicated equipment. For new monitoring wells, or wells where the following situation has not occurred before, if the recovery rate to the well is less than 50 mL/min., or the well is being essentially dewatered during purging, the well should be sampled as soon as the water level has recovered sufficiently to collect the volume needed for all anticipated samples. The project manager or field team leader will need to make the decision when samples should be collected, how the sample is to be collected, and the reasons recorded on the purge form or in the field logbook. A water level measurement needs to be performed and recorded before samples are collected. If the project manager decides to collect the samples using the pump, it is best during this recovery period that the pump intake tubing not be removed, since this will aggravate any turbidity problems. Samples in this specific situation may be collected without stabilization of indicator field parameters. Note that field conditions and efforts to overcome problematic situations must be recorded in order to support field decisions to deviate from normal procedures described in this SOP. If this type of problematic situation persists in a well, then water sample collection should be changed to a passive or no-purge method, if consistent with the site's DQOs, or have a new well installed.

E. Monitor Indicator Field Parameters

After the water level has stabilized, connect the "T" connector with a valve and the flow-through-cell to monitor the indicator field parameters. If excessive turbidity is anticipated or encountered with the pump startup, the well may be purged for a while without connecting up the flow-through-cell, in order to minimize particulate buildup in the cell (This is a judgment call made by the sampler). Water level drawdown measurements should be made as usual. If possible, the pump may be installed the day before purging to allow particulates that were disturbed during pump insertion to settle.

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, ORP, DO) at a frequency of five minute intervals or greater. The pump's flow rate must be able to "turn over" at least one flow-through-cell volume between measurements (for a 250 mL flow-through-cell with a flow rate of 50 mLs/min., the monitoring frequency would be every five minutes; for a 500 mL flow-through-cell it would be every ten minutes). If the cell volume cannot be replaced in the five minute interval, then the time between measurements must be increased accordingly. Note: during the early phase of purging, emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments followed by stabilization of indicator parameters. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings are within the following limits:

Turbidity (10% for values greater than 5 NTU; if three Turbidity values are less than 5 NTU, consider the values as stabilized),
Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
Specific Conductance (3%),
Temperature (3%),
pH (± 0.1 unit),
Oxidation/Reduction Potential (±10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Samples for turbidity measurements are obtained before water enters the flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities. Record start and stop times and give a brief description of cleaning activities.

The flow-through-cell must be designed in a way that prevents gas bubble entrapment in the cell. Placing the flow-through-cell at a 45 degree angle with the port facing upward can help remove bubbles from the flow-through-cell (see Appendix B Low-Flow Setup Diagram). Throughout the measurement process, the flow-through-cell must remain free of any gas bubbles. Otherwise, the monitoring probes may act erratically. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must remain submerged in water at all times.

F. Collect Water Samples

When samples are collected for laboratory analyses, the pump's tubing is disconnected from the "T" connector with a valve and the flow-through-cell. The samples are collected directly from the pump's tubing. Samples must not be collected from the flow-through-cell or from the "T" connector with a valve.

VOC samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

If the pump's flow rate is too high to collect the VOC/dissolved gases samples, collect the other samples first. Lower the pump's flow rate to a reasonable rate and collect the VOC/dissolved gases samples and record the new flow rate.

During purging and sampling, the centrifugal/peristaltic pump tubing must remain filled with water to avoid aeration of the groundwater. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help ensure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use the following procedure to collect samples: collect non-VOC/dissolved gases samples first, then increase flow rate slightly until the water completely fills the tubing, collect the VOC/dissolved gases samples, and record new drawdown depth and flow rate.

For bladder pumps that will be used to collect VOC or dissolved gas samples, it is recommended that the pump be set to deliver long pulses of water so that one pulse will fill a 40 mL VOC vial.

Use pre-preserved sample containers or add preservative, as required by analytical methods, to the samples immediately after they are collected. Check the analytical methods (e.g. EPA SW-846, 40 CFR 136, water supply, etc.) for additional information on preservation.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter (transparent housing preferred) is required, and the filter size (0.45 µm is commonly used) should be based on the sampling objective. Pre-rinse the filter with groundwater prior to sample collection. Make sure the filter is free of air bubbles before samples are collected. Preserve the filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in groundwater for human health or ecological risk calculations.

Label each sample as collected. Samples requiring cooling will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

G. Post Sampling Activities

If a recording pressure transducer is used to track drawdown, re-measure water level with tape.

After collection of samples, the pump tubing may be dedicated to the well for re-sampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth annually is usually sufficient after the initial low stress sampling event. However, a greater frequency may be needed if the well has a “silting” problem or if confirmation of well identity is needed.

Secure the well.

11.0 DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well, and then following sampling of each subsequent well. Pumps should not be removed between purging and sampling operations. The pump, tubing, support cable and electrical wires which were in contact with the well should be decontaminated by one of the procedures listed below.

The use of dedicated pumps and tubing will reduce the amount of time spent on decontamination of the equipment. If dedicated pumps and tubing are used, only the initial sampling event will require decontamination of the pump and tubing.

Note if the previous equipment blank data showed that contaminant(s) were present after using the below procedure or the one described in the SAP/QAPP, a more vigorous procedure may be needed.

Procedure 1

Decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump and tubing. The pump may be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Optional - flush with isopropyl alcohol (pesticide grade; must be free of ketones {e.g., acetone}) or with methanol. This step may be required if the well is highly contaminated or if the equipment blank data from the previous sampling event show that the level of contaminants is significant.

Flush with distilled/deionized water. This step must remove all traces of alcohol (if used) from the equipment. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

12.0 FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the groundwater samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. Quality control samples include field duplicates, equipment blanks, matrix spike/matrix spike duplicates, trip blanks (VOCs), and temperature blanks.

13.0 FIELD LOGBOOK

A field log shall be kept to document all groundwater field monitoring activities (see Appendix C, example table), and record the following for each well:

Site name, municipality, state.

Well identifier, latitude-longitude or state grid coordinates.

Measuring point description (e.g., north side of PVC pipe).

Well depth, and measurement technique.

Well screen length.

Pump depth.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and detection method.

Pumping rate, drawdown, indicator parameters values, calculated or measured total volume pumped, and clock time of each set of measurements.

Type of tubing used and its length.

Type of pump used.

Clock time of start and end of purging and sampling activity.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analyses.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions, including approximate ambient air temperature.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling/monitoring equipment used, including trade names, model number, instrument identification number, diameters, material composition, etc.

14.0 DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, field indicator parameters measured during purging, field instrument calibration information, and whatever other field logbook information is needed to allow for a full evaluation of data usability.

Note: the use of trade, product, or firm names in this sampling procedure is for descriptive purposes only and does not constitute endorsement by the U.S. EPA.

15.0 REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, *DNAPL Site Evaluation*; C.K. Smoley (CRC Press), Boca Raton, Florida.

Robert W. Puls and Michael J. Barcelona, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, April 1996 (EPA/540/S-95/504).

U.S. Environmental Protection Agency, 1992, *RCRA Ground-Water Monitoring: Draft Technical Guidance*; Washington, DC (EPA/530-R-93-001).

U.S. Environmental Protection Agency, 1987, *A Compendium of Superfund Field Operations Methods*; Washington, DC (EPA/540/P-87/001).

U.S Environmental Protection Agency, Region 1, *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity)*, March 23, 2017 or latest version.

U.S Environmental Protection Agency, EPA SW-846.

U.S Environmental Protection Agency, 40 CFR 136.

U.S Environmental Protection Agency, 40 CFR 141.

Vroblesky, Don A., Clifton C. Casey, and Mark A. Lowery, Summer 2007, Influence of Dissolved Oxygen Convection on Well Sampling, *Ground Water Monitoring & Remediation* 27, no. 3: 49-58.

APPENDIX A

PERISTALTIC PUMPS

Before selecting a peristaltic pump to collect groundwater samples for VOCs and/or dissolved gases, (e.g., methane, carbon dioxide, etc.) consideration should be given to the following:

- The decision of whether or not to use a peristaltic pump is dependent on the intended use of the data.
- If the additional sampling error that may be introduced by this device is NOT of concern for the VOC/dissolved gases data's intended use, then this device may be acceptable.
- If minor differences in the groundwater concentrations could affect the decision, such as to continue or terminate groundwater cleanup or whether the cleanup goals have been reached, then this device should NOT be used for VOC/dissolved gases sampling. In these cases, centrifugal or bladder pumps are a better choice for more accurate results.

EPA and USGS have documented their concerns with the use of the peristaltic pumps to collect water sample in the below documents.

- "Suction Pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, December 1987.
- "The agency does not recommend the use of peristaltic pumps to sample ground water particularly for volatile organic analytes" *RCRA Ground-Water Monitoring Draft Technical Guidance*, EPA Office of Solid Waste, November 1992.
- "The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and volatiles loss", *Low-flow (Minimal drawdown) Ground-Water Sampling Procedures*, by Robert Puls & Michael Barcelona, April 1996, EPA/540/S-95/504.
- "Suction-lift pumps, such as peristaltic pumps, can operate at a very low pumping rate; however, using negative pressure to lift the sample can result in the loss of volatile analytes", USGS Book 9 Techniques of Water-Resources Investigation, Chapter A4. (Version 2.0, 9/2006).

APPENDIX B

SUMMARY OF SAMPLING INSTRUCTIONS

These instructions are for using an adjustable rate, submersible pump or a peristaltic pump with the pump's intake placed at the midpoint of a 10 foot or less well screen or an open interval. The water level in the monitoring well is above the top of the well screen or open interval, the ambient temperature is above 32°F, and the equipment is not dedicated. Field instruments are already calibrated. The equipment is setup according to the diagram at the end of these instructions.

1. Review well installation information. Record well depth, length of screen or open interval, and depth to top of the well screen. Determine the pump's intake depth (e.g., mid-point of screen/open interval).

2. On the day of sampling, check security of the well casing, perform any safety checks needed for the site, lay out a sheet of polyethylene around the well (if necessary), and setup the equipment. If necessary a canopy or an equivalent item can be setup to shade the pump's tubing and flow-through-cell from the sun light to prevent the sun light from heating the groundwater.

3. Check well casing for a reference mark. If missing, make a reference mark. Measure the water level (initial) to 0.01 ft. and record this information.

4. Install the pump's intake to the appropriate depth (e.g., midpoint) of the well screen or open interval. Do not turn-on the pump at this time.

5. Measure water level and record this information.

6. Turn-on the pump and discharge the groundwater into a graduated waste bucket. Slowly increase the flow rate until the water level starts to drop. Reduce the flow rate slightly so the water level stabilizes. Record the pump's settings. Calculate the flow rate using a graduated container and a stop watch. Record the flow rate. Do not let the water level drop below the top of the well screen.

If the groundwater is highly turbid or discolored, continue to discharge the water into the bucket until the water clears (visual observation); this usually takes a few minutes. The turbid or discolored water is usually from the well-being disturbed during the pump installation. If the water does not clear, then you need to make a choice whether to continue purging the well (hoping that it will clear after a reasonable time) or continue to the next step. Note, it is sometimes helpful to install the pump the day before the sampling event so that the disturbed materials in the well can settle out.

If the water level drops to the top of the well screen during the purging of the well, stop purging the well, and do the following:

> Wait for the well to recharge to a sufficient volume so samples can be collected. This may take a while (pump may be removed from well, if turbidity is not a problem). The project manager will need to make the decision when samples should be collected and the reasons recorded in the site's log book. A water level measurement needs to be performed and recorded before samples are collected. When samples are being collected, the water level must not drop below the top of the screen or open interval. Collect the samples from the pump's tubing. Always collect the VOCs and dissolved gases samples first. Normally, the samples requiring a small volume are collected before the large volume samples are collected just in case there is not sufficient water in the well to fill all the sample containers. All samples must be collected, preserved, and stored according to the analytical method. Remove the pump from the well and decontaminate the sampling equipment.

If the water level has dropped 0.3 feet or less from the initial water level (water level measure before the pump was installed); proceed to Step 7. If the water level has dropped more than 0.3 feet, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are be collected.

7. Attach the pump's tubing to the "T" connector with a valve (or a three-way stop cock). The pump's tubing from the well casing to the "T" connector must be as short as possible to prevent the groundwater in the tubing from heating up from the sun light or from the ambient air. Attach a short piece of tubing to the other end of the end of the "T" connector to serve as a sampling port for the turbidity samples. Attach the remaining end of the "T" connector to a short piece of tubing and connect the tubing to the flow-through-cell bottom port. To the top port, attach a small piece of tubing to direct the water into a calibrated waste bucket. Fill the cell with the groundwater and remove all gas bubbles from the cell. Position the flow-through-cell in such a way that if gas bubbles enter the cell they can easily exit the cell. If the ports are on the same side of the cell and the cell is cylindrical shape, the cell can be placed at a 45-degree angle with the ports facing upwards; this position should keep any gas bubbles entering the cell away from the monitoring probes and allow the gas bubbles to exit the cell easily (see Low-Flow Setup Diagram). Note:

make sure there are no gas bubbles caught in the probes' protective guard; you may need to shake the cell to remove these bubbles.

8. Turn-on the monitoring probes and turbidity meter.

9. Record the temperature, pH, dissolved oxygen, specific conductance, and oxidation/reduction potential measurements. Open the valve on the "T" connector to collect a sample for the turbidity measurement, close the valve, do the measurement, and record this measurement. Calculate the pump's flow rate from the water exiting the flow-through-cell using a graduated container and a stop watch, and record the measurement. Measure and record the water level. Check flow-through-cell for gas bubbles and sediment; if present, remove them.

10. Repeat Step 9 every 5 minutes or as appropriate until monitoring parameters stabilized. Note: at least one flow-through-cell volume must be exchanged between readings. If not, the time interval between readings will need to be increased. Stabilization is achieved when three consecutive measurements are within the following limits:

> **Turbidity** (10% for values greater than 5 NTUs; if three Turbidity values are less than 5 NTUs, consider the values as stabilized),
> **Dissolved Oxygen** (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
> **Specific Conductance** (3%),
> **Temperature** (3%),
> **pH** (± 0.1 unit),
> **Oxidation/Reduction Potential** (±10 millivolts).

If these stabilization requirements do not stabilize in a reasonable time, the probes may have been coated from the materials in the groundwater, from a buildup of sediment in the flow-through-cell, or a gas bubble is lodged in the probe. The cell and the probes will need to be cleaned. Turn-off the probes (not the pump), disconnect the cell from the "T" connector and continue to purge the well. Disassemble the cell, remove the sediment, and clean the probes according to the manufacturer's instructions. Reassemble the cell and connect the cell to the "T" connector. Remove all gas bubbles from the cell, turn-on the probes, and continue the measurements. Record the time the cell was cleaned.

11. When it is time to collect the groundwater samples, turn-off the monitoring probes, and disconnect the pump's tubing from the "T" connector. If you are using a centrifugal or peristaltic pump check the pump's tubing to determine if the tubing is completely filled with water (no air space).

All samples must be collected and preserved according to the analytical method. VOCs and dissolved gases samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

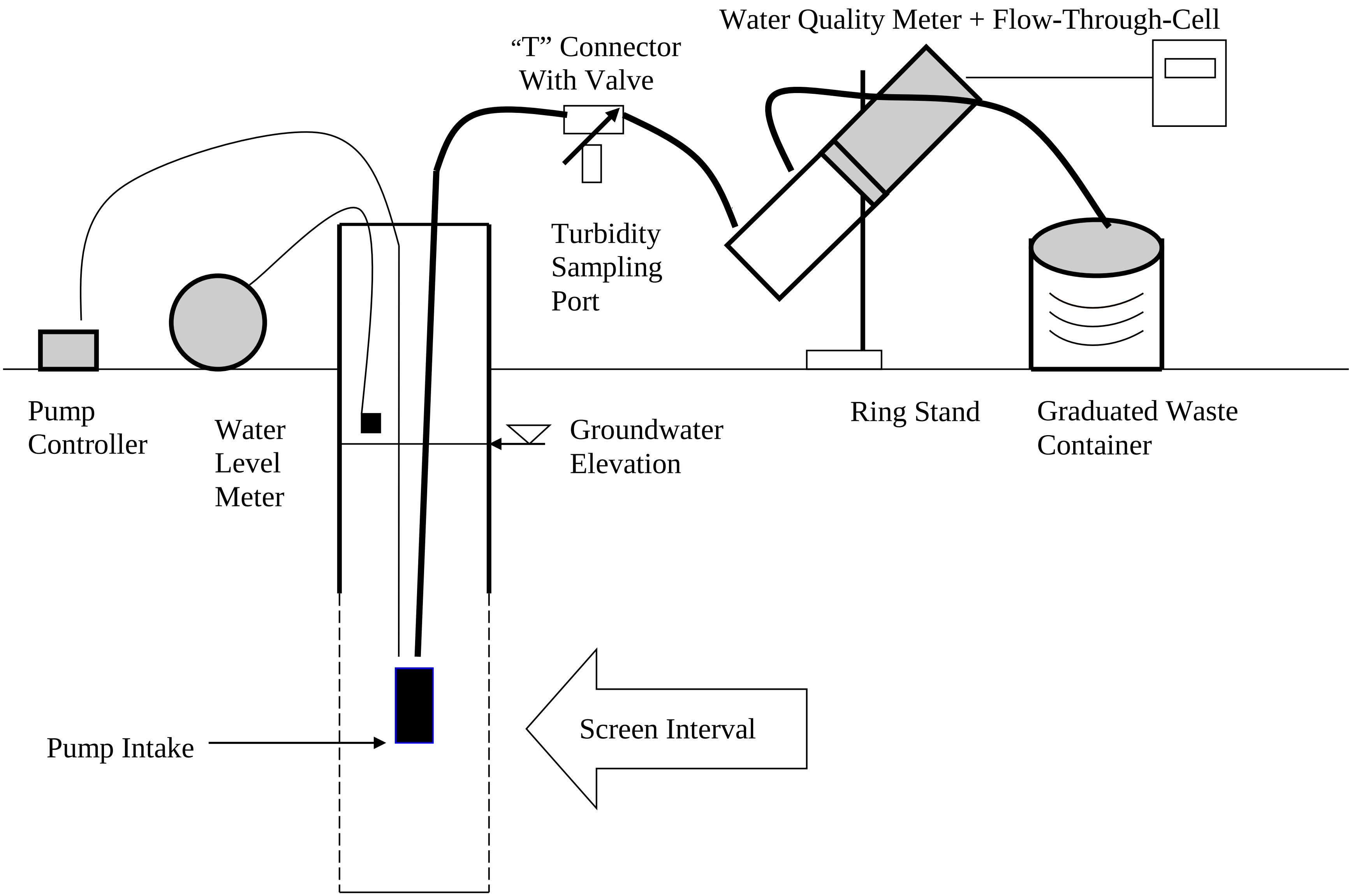
If the pump's tubing is not completely filled with water and the samples are being collected for VOCs and/or dissolved gases analyses using a centrifugal or peristaltic pump, do the following:

> All samples must be collected and preserved according to the analytical method. The VOCs and the dissolved gases (e.g., methane, ethane, ethene, and carbon dioxide) samples are collected last. When it becomes time to collect these samples increase the pump's flow rate until the tubing is completely filled. Collect the samples and record the new flow rate.

12. Store the samples according to the analytical method.

13. Record the total purged volume (graduated waste bucket). Remove the pump from the well and decontaminate the sampling equipment.

Low-Flow Setup Diagram



APPENDIX C

EXAMPLE (Minimum Requirements)

WELL PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name)______________________________
Well Number________________ Date_______________________
Field Personnel____
Sampling Organization_____________________________________
Identify MP____

Depth to _______/________ of screen
(below MP) top bottom
Pump Intake at (ft. below MP)_________
Purging Device; (pump type)__________
Total Volume Purged _______________

Clock Time 24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. "C	Spec. Cond.[2] µS/cm	pH	ORP[3] mv	DO mg/L	Tur-bidity NTU	Comments

Stabilization Criteria 3% 3% ±0.1 ±10 mv 10% 10%

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm(same as µmhos/cm)at 25°C.
3. Oxidation reduction potential (ORP)

ATTACHMENT B

GUIDELINES AND PROTOCOLS FOR FPAS SAMPLING

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Under NYSDEC's Part 375 Remedial Programs

April 2023

www.dec.ny.gov

Table of Contents

April 2023

New York State of Opportunity | Department of Environmental Conservation

ERRATA SHEET for

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) Under NYSDEC's Part 375 Remedial Programs Issued January 17, 2020

Citation and Page Number	Current Text	Corrected Text	Date
Title of Appendix I, page 32	Appendix H	Appendix I	2/25/2020
Document Cover, page 1	Guidelines for Sampling and Analysis of PFAS	Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs	9/15/2020
Data Assessment and Application to Site Cleanup Page 3	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published	Until such time as Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published	3/28/2023
Water Sample Results Page 3	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt) and is determined to be attributable to the site, either by a comparison of upgradient and downgradient levels, or the presence of soil source areas, as defined below.	NYSDEC has adopted ambient water quality guidance values for PFOA and PFOS. Groundwater samples should be compared to the human health criteria of 6.7 ng/l (ppt) for PFOA and 2.7 ng/l (ppt) for PFOS. These guidance values also include criteria for surface water for PFOS applicable for aquatic life, which may be applicable at some sites. Drinking water sample results should be compared to the NYS maximum contaminant level (MCL) of 10 ng/l (ppt).Analysis to determine if PFOA and PFOS concentrations are attributable to the site should include a comparison between upgradient and downgradient levels, and the presence of soil source areas, as defined below.	3/28/2023
Soil Sample Results Page 3	Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values:	NYSDEC will delay adding soil cleanup objectives for PFOA and PFOS to 6 NYCRR Part 375-6 until the PFAS rural soil background study has been completed. Until SCOs are in effect, the following are to be used as guidance values:	3/28/2023
Protection of Groundwater Page 3	PFOA (ppb) 1.1 PFOS (ppb) 3.7	PFOA (ppb) 0.8 PFOS (ppb) 1.0	3/28/2023

Citation and Page Number	Current Text	Corrected Text	Date
Footnote 2 Page 3	The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	The Protection of Groundwater values are based on the above referenced ambient groundwater guidance values. Details on that calculation are available in the following document, prepared for the February 2022 proposed changes to Part 375 (https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf). The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	3/28/2023
Testing for Imported Soil Page 4	If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.	If the concentrations of PFOA and PFOS in leachate are at or above the ambient water quality guidance values for groundwater, then the soil is not acceptable.	3/28/2023
Routine Analysis, page 9	“However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1 or ISO 25101.”	“However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533.”	9/15/2020
Additional Analysis, page 9, new paragraph regarding soil parameters	None	“In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.”	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Data Assessment and Application to Site Cleanup Page 10	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Target levels for cleanup of PFAS in other media, including biota and sediment, have not yet been established by the DEC.	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.	9/15/2020
Water Sample Results Page 10	PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water (…) If PFAS are identified as a contaminant of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water (…) If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Soil Sample Results, page 10	"The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase."	"Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values. " [Interim SCO Table] "PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP. As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf. "	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Testing for Imported Soil Page 11	Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the PFAS Analyte List (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs. If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable. PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Footnotes	None	[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. [2] The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the soil cleanup objective for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	9/15/2020
Additional Analysis, page 9	In cases… soil parameters, such as Total Organic Carbon (EPA Method 9060), soil…	In cases… soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil…	1/8/2021
Appendix A, General Guidelines, fourth bullet	List the ELAP-approved lab(s) to be used for analysis of samples	List the ELAP- certified lab(s) to be used for analysis of samples	1/8/2021
Appendix E, Laboratory Analysis and Containers	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101.	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101	1/8/2021
Water Sample Results Page 9	"In addition, further assessment of water may be warranted if either of the following screening levels are met: a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L"	Deleted	6/15/2021

Citation and Page Number	Current Text	Corrected Text	Date
Routine Analysis, Page XX	Currently, New York State Department of Health's Environmental Laboratory Approval Program (ELAP)… criteria set forth in the DER's laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids).	Deleted	5/31/2022
Analysis and Reporting, Page XX	As of October 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.	Deleted	5/31/2022
Routine Analysis, Page XX	LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media.	EPA Method 1633 is the procedure to use for environmental samples.	
Soil Sample Results, Page XX	Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6	Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6	
Appendix A	"Include in the text… LC-MS/MS for PFAS using methodologies based on EPA Method 537.1"	"Include in the text ….EPA Method 1633"	
Appendix A	"Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, EPA Method 533, or ISO 25101"	Deleted	
Appendix B	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	

Citation and Page Number	Current Text	Corrected Text	Date
Appendix C	“Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1”	“Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633”	
Appendix D	“Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1”	“Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633”	
Appendix G		Updated to include all forty PFAS analytes in EPA Method 533	
Appendix H		Deleted	
Appendix I	Appendix I	Appendix H	
Appendix H	“These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report.”	“These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER).”	
Appendix H	“The holding time is 14 days…”	“The holding time is 28 days…”	
Appendix H, Initial Calibration	“The initial calibration should contain a minimum of five standards for linear fit…”	“The initial calibration should contain a minimum of six standards for linear fit…”	
Appendix H, Initial Calibration	Linear fit calibration curves should have an R^2 value greater than 0.990.	Deleted	
Appendix H, Initial Calibration Verification	Initial Calibration Verification Section	Deleted	
Appendix H	secondary Ion Monitoring Section	Deleted	
Appendix H	Branched and Linear Isomers Section	Deleted	

April 2023

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

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Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis, reporting, and assessment of PFAS, DER has developed this document which summarizes currently accepted procedures and updates previous DER technical guidance pertaining to PFAS.

Applicability

All work plans submitted to DEC pursuant to one of the remedial programs under Part 375 shall include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments, or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected. Equipment blanks should be collected at a minimum frequency of one per day per site or one per twenty samples, whichever is more frequent.

Analysis and Reporting

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third-party data validator. Electronic data submissions should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

DER has developed a *PFAS Analyte List* (Appendix G) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

EPA Method 1633 is the procedure to use for environmental samples. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist. Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay).

In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.[1]

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[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Data Assessment and Application to Site Cleanup

Until such time as Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.

Water Sample Results

NYSDEC has adopted ambient water quality guidance values for PFOA and PFOS. Groundwater samples should be compared to the human health criteria of 6.7 ng/l (ppt) for PFOA and 2.7 ng/l (ppt) for PFOS. These human health criteria should also be applied to surface water that is used as a water supply. This guidance also includes criteria for surface water for PFOS applicable for aquatic life, which may be applicable at some sites. Drinking water sample results should be compared to the NYS maximum contaminant level (MCL) of 10 ng/l (ppt). Analysis to determine if PFOA and PFOS concentrations are attributable to the site should include a comparison between upgradient and downgradient levels, and the presence of soil source areas, as defined below.

If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

NYSDEC will delay adding soil cleanup objectives for PFOA and PFOS to 6 NYCRR Part 375-6 until the PFAS rural soil background study has been completed. Until SCOs are in effect, the following are to be used as guidance values:

Guidance Values for Anticipated Site Use	PFOA (ppb)	PFOS (ppb)
Unrestricted	0.66	0.88
Residential	6.6	8.8
Restricted Residential	33	44
Commercial	500	440
Industrial	600	440
Protection of Groundwater[2]	0.8	1.0

PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These

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[2] The Protection of Groundwater values are based on the above referenced ambient groundwater guidance values. Details on that calculation are available in the following document, prepared for the February 2022 proposed changes to Part 375 (https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf). The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).

additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP.

As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf.

Testing for Imported Soil

Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above the ambient water quality guidance values for groundwater, then the soil is not acceptable.

PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
    - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP certified lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an “Analytical Methods/Quality Assurance Summary Table” specifying:
    - Matrix type
    - Number or frequency of samples to be collected per matrix
    - Number of field and trip blanks per matrix
    - Analytical parameters to be measured per matrix
    - Analytical methods to be used per matrix with minimum reporting limits
    - Number and type of matrix spike and matrix spike duplicate samples to be collected
    - Number and type of duplicate samples to be collected
    - Sample preservation to be used per analytical method and sample matrix
    - Sample container volume and type to be used per analytical method and sample matrix
    - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by EPA Method 1633
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
    - Reporting Limits should be less than or equal to:
        - Aqueous – 2 ng/L (ppt)
        - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
-
- Include detailed sampling procedures
    - Precautions to be taken
    - Pump and equipment types
    - Decontamination procedures
    - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment
- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per site for each matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., washroom sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank per day per site and a minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers.
- A field reagent blank (FRB) should be collected at a rate of one per 20 samples. The lab will provide a FRB bottle containing PFAS free water and one empty FRB bottle. In the field, pour the water from the one bottle into the empty FRB bottle and label appropriately.
- Request appropriate data deliverable (Category B) and an electronic data deliverable
- For sampling events where multiple private wells (homes or sites) are to be sampled per day, it is acceptable to collect QC samples at a rate of one per 20 across multiple sites or days.

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the current SOP developed by the Division of Fish and Wildlife (DFW) entitled "General Fish Handling Procedures for Contaminant Analysis" (Ver. 8). This SOP should be followed when collecting fish for contaminant analysis. Note, however, that the Bureau of Ecosystem Health will not be supplying bags or tags. All supplies are the responsibility of the collector

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:

1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).

2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.

3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.

B. The following data are required on each **Fish Collection Record** form:

1. Project and Site Name.

2. DEC Region.

3. All personnel (and affiliation) involved in the collection.

4. Method of collection (gill net, hook and line, etc.)

5. Preservation Method.

C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:

1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.

2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.

3. Date collected.

4. Sample location (waterway and nearest prominent identifiable landmark).

5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.

2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.

3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.

4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate “Age” column.

5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.

6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.

7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.

E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish’s tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **<u>The Bureau of Ecosystem Health will supply the bags.</u>** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with the same information.

F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **<u>The Bureau of Ecosystem Health will supply the larger bags</u>.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.

G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.

H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:

    No materials containing Teflon.
    No Post-it notes.
    No ice packs; only water ice or dry ice.
    Any gloves worn must be powder free nitrile.
    No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
    No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
    Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
    Wash hands after handling any food containers or packages as these may contain PFCs. Keep pre-wrapped food containers and wrappers isolated from fish handling.
    Wear clothing washed at least six times since purchase.
    Wear clothing washed without fabric softener.
    Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with “fluor” in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.

I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.

J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.

K. A recommended equipment list is at the end of this document.

page ______ of ______

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

Project and Site Name ____ DEC Region ____________

Collections made by (include all crew) ____

Sampling Method: ☐Electrofishing ☐Gill netting ☐Trap netting ☐Trawling ☐Seining ☐Angling ☐Other ____________________

Preservation Method: ☐Freezing ☐Other ____________________ Notes (SWFDB survey number): ____________________

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ( )	WEIGHT ( )	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CHAIN OF CUSTODY

I, ______________________________, of ____ collected the
(Print Name) (Print Business Address)

following on ____________________, 20____ from ____
(Date) (Water Body)

in the vicinity of ____
(Landmark, Village, Road, etc.)

Town of ____, in __________________________________ County.

Item(s) ____

____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on ____________________________________, 20______.

____ ___________________________
Signature Date

I, __________________________________, received the above mentioned sample(s) on the date specified and assigned identification number(s) ____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

_______________________________________ ___________________
Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

richter: revised 21 April 2014; becker: 23 March 2017, 26 April, 2019

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelops, approximately 2” x 3.5”, if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonic acids	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluoropentanesulfonic acid	PFPeS	2706-91-4
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorononanesulfonic acid	PFNS	68259-12-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
	Perfluorododecanesulfonic acid	PFDoS	79780-39-5
Perfluoroalkyl carboxylic acids	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUnA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTeDA	376-06-7
Per- and Polyfluoroether carboxylic acids	Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
	4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
	Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
	Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
	Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Fluorotelomer sulfonic acids	4:2 Fluorotelomer sulfonic acid	4:2-FTS	757124-72-4
	6:2 Fluorotelomer sulfonic acid	6:2-FTS	27619-97-2
	8:2 Fluorotelomer sulfonic acid	8:2-FTS	39108-34-4
Fluorotelomer carboxylic acids	3:3 Fluorotelomer carboxylic acid	3:3 FTCA	356-02-5
	5:3 Fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3
	7:3 Fluorotelomer carboxylic acid	7:3 FTCA	812-70-4
Perfluorooctane sulfonamides	Perfluorooctane sulfonamide	PFOSA	754-91-6
	N-methylperfluorooctane sulfonamide	NMeFOSA	31506-32-8
	N-ethylperfluorooctane sulfonamide	NEtFOSA	4151-50-2
Perfluorooctane sulfonamidoacetic acids	N-methylperfluorooctane sulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethylperfluorooctane sulfonamidoacetic acid	N-EtFOSAA	2991-50-6
Perfluorooctane sulfonamide ethanols	N-methylperfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7
	N-ethylperfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2

Group	Chemical Name	Abbreviation	CAS Number
Ether sulfonic acids	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (F-53B Major)	9Cl-PF3ONS	756426-58-1
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor)	11Cl-PF3OUdS	763051-92-9
	Perfluoro(2-ethoxyethane) sulfonic acid	PFEESA	113507-82-7

Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER). Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 28 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6ºC upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of six standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects

Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results

Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.

ATTACHMENT C

GROUNDWATER SAMPLING/PURGE LOG

Monitoring Well Sampling Log Sheet

Job No.: ______________ **Well No.:** ______________ **Date:** __/__/__

Well Depth: ____________ **Screen Length:** _______________ **Well Diameter:** ____________ **Casing Type:** ___________

Sampling Device: ________________ **Tubing Type:** _______ **Initial DTP:** ________________ **Initial DTW:** ____________

Well Volume: ____________________ **Total Volume Purged:** _____________

Sampling Personnel:____

Low Flow Sampling required ? Yes : ____________ No: ____________ pumping rate less than 0.2 L /minute

Deviation			±0.1	± 3%	± 3%	10%*	± 10%**	± 10 mv	Stabilization over 3 consecutive readings
Time	**DTP (ft)**	**DTW (ft)**	**pH**	**Temp (ºF)**	**Cond. (mS/Cm)**	**Dis.O2 (mg/L)**	**Turb.(NTU)**	**ORP (mV)**	**Purged water volume**

Notes

* Dissolved Oxygen (10% for values exceeding 5 mg/L or considered stabilized if less than 5 mg/L),

** Turbidity (10% for values exceeding 5 NTU or considered stabilized if less than 5 NTU).

ATTACHMENT D
RESUME OF KEY PERSONNEL

TAREK Z. KHOURI, P.E. *Principal Environmental Engineer*

Education

M.S. Environmental Engineering, University of Central Florida

B.S. Chemistry, University of Central Florida

Professional Registration

Professional Engineer (P.E.)
Connecticut # 0031583
D.C. # 908711
Maryland # 49155
Massachusetts # 52601
New Jersey # 24GE04697200
New York # 086611
Pennsylvania # PE084919
Rhode Island # 12059
Texas # 125442
Virginia # 0402056415

Certifications

OSHA: 40 Hour HAZWOPER; 8 Hour Supervisor Management; 10 Hour Construction Safety

USACE Construction Quality Management

Affiliations

Transportation & Infrastructure Committee, NY Building Congress (NYBC), NY, USA

Environmental and Energy Committee, American Society of Engineering Companies (ACEC) NY, USA

Chairman (2013), Solid Waste Committee, Qatar Green Building Council (QGBC) Qatar

Legislative Committee (2008-2010), National Brownfield Association (NBA), NY, USA

Environmental Council (2008-2010), The Business Council of NY State (BCNY), NY, USA

Summary of Experience

Mr. Khouri has more than 20 years of experience in the real estate development, construction and engineering industries.

He has been a trusted partner, providing environmental consulting services to public and private sector clients including developers, real estate owners, investors, facility managers and city, state and federal agencies and municipalities.

Mr. Khouri has participated and managed the remediation and reuse of contaminated properties for over 20 years. He has performed, directed, and overseen environmental investigations and remedial actions at petroleum and chlorinated solvent spill sites, fuel farms, refineries, former manufactured gas, landfills, and a variety of residential, commercial and industrial settings.

Mr. Khouri integrates environmental risk management with land use planning and sustainable development to meet the needs and objectives of diverse clients and stakeholders for residential, commercial, and industrial real estate, in urban and rural environment. Mr. Khouri utilizes his technical expertise as well as his leadership and management skills to direct and oversee teams of professionals for the successful completion of these complex projects.

Relevant Experience

- **Principal Environmental Engineer** – Hydro Tech Environmental Engineering and Geology, DPC (2017-Present)
- **Senior Vice President** – HAKS (2015-2017)
- **Vice President** – Langan Engineering and Environmental Services, USA. (2013-2015)
- **Managing Director** – Averda Environmental Services, Qatar. (2011-2013)
- **Managing Director** – Clean Planet International, USA, Africa and Middle East. (2010-2011)
- **Associate** – Langan Engineering and Environmental Services, USA and Middle East. (2004-2010)
- **Senior Project Manager** – URS Corporation, USA and Middle East. (1998-2004)
- **Senior Scientist** – Solidere, Lebanon. (1996-1998)
- **Environmental Engineer** – University of Central Florida, USA. (1994-1996)

- **Environmental Impact Assessments, Phase I ESAs, and Phase II ESIs - Clients: Developers, Property Managers, Environmental Attorneys, Architects, Banks, and Insurance Firms -** Conducted 100s of environmental assessments for various entities specializing in urban renewal: Mixed use, residential, commercial, retail, warehouses, manufacturing facilities, gas stations and vacant lands. I also designed and executed subsurface investigations for soil, groundwater, and soil gas.

- **Remedial Investigation, Remedial Design and Associated Remediation Projects - Clients: Developers, Property Managers, Environmental Attorneys, Architects, Banks, Insurance Firms -** Managed myriads of environmental investigations and remedial actions at petroleum and chlorinated solvent spill sites, former manufactured gas and a variety of other commercial and industrial settings. Constituents of concern have included LNAPLs and DNAPLs, petroleum hydrocarbons, chlorinated solvents, soil vapor, coal tar, creosote, PCBs, and metals. Managed and participated in historical research, sample collection and data evaluation, synthesis of information to determine site-specific cleanup levels, remedial technology evaluation, design of treatment systems, site cleanup, installation and operation of treatment systems, optimizing systems, and performance monitoring.

- **LIRR/MTA East Side Access Project, New York, NY - Client: MTA -** The project involves the construction of new metro tunnels system in densely developed areas of midtown Manhattan, new tunnels system construction beneath active Amtrak, Metro North and NYCTA facilities, construction of new terminals, ventilation facilities, off street entrances, and yards development. In addition to establishing the guidelines of the project specific environmental management system, I provided direct and extensive public and community relations outreach, educational and awareness programs, as well technical support for the design engineering and construction teams, inspectors, and environmental sub consultants, so that construction of the project proceeds in compliance with environmental commitments, be conducted under budget and on time, while maintaining the utmost quality. Another key component of the project success was the direct and constant coordination between the environmental department and the multiple agencies and operators/owners of the project, such as USEPA, NYSDEC, NYSDOH, NYCDOT, NYCDEP, NYCDOB, MTA, LIRR, NYCTA, Amtrak, and Metro North. Construction Cost: $8.4 Billion

- **Hudson Yards, Proposed New York Jets Stadium, New York, NY – Client: NY Jets -** Served as the environmental project manager for the due diligence, investigation, and preliminary design phases of the proposed Jets Stadium. The work included subsurface investigation for soil, groundwater, and soil gas, and required close interaction with multiple entities including the MTA, LIRR, NYCTA, NYCDOS, NYSDEC, and Amtrak. Construction Cost: $1.4 Billion

- **Columbia University Manhattanville Expansion Project, New York, NY – Client: Columbia University -** Columbia University new campus will be built within a 17-acre area and will be comprised of academic and research facilities, housing, as well as commercial retail stores and open space areas. As the senior environmental project manager, I oversaw all environmental engineering related activities, including site assessment prior to the development, pre-construction support for demolition, recycling, soil and groundwater management, air quality controls, and LEED certification support. Construction Cost: $2+ Billion

- **Potable Water System Testing for Lead, New York, NY – Client: NYCSCA -** Directly managed the emergency work for the sampling, testing, evaluation and reporting of lead in the potable water of approximately 300 public schools in New York City. HAKS was one of the main consultants working for NYCSCA to implement a potable water system testing protocol which included coordination with school facilities, field work encompassing flushing and sampling, laboratory testing, analyzing, and reporting sample results. The project was conducted on a tight 24/7 timetable. The project was completed successfully under the direct supervision and daily coordination with the NYCSCA, with limited to no disturbance to schools' schedule and extracurricular activities, on time and on budget.

- **City University of New York, Tank Rehabilitation, Remediation and Closure Program, New York, NY – Client: DASNY -** Served as the project manager for the technical assessment, remediation design, and oversight of the Underground Storage Tank (UST) facilities at seven City

University campuses. Tanks sizes ranged from 550 Gal to 50,000 Gal. The work included design drawings and construction documents for the tanks and dispensing systems for vapor recovery, fire suppression, electronic monitoring/sensing, pumping/delivery, storage tank details, site restoration, subsurface investigation, and spill remediation. Construction Cost: $5 Million

- **Active Fuel Oil Terminal, Brooklyn, NY – Client: Bayside Fuel Oil Depot Corporation -** Managed the remedial investigation in connection with petroleum releases at an active fuel oil terminal located on Gravesend Bay. Developed and executed a strategy to manage client's liability relating to light non-aqueous phase liquid (LNAPL). Negotiated an alternative remedial action which benefitted the adjacent property and NYSDEC while eliminating client from liabilities at the adjacent property. Investigated and evaluated storm water infrastructure, and included an updated storm water management plan, as part of a sustainable groundwater remedy. Fees: $1.1 Million

- **54 Rutledge St, Insitu Bio-Remediation, Brooklyn, NY – Client: Fortis Property Group -** Managed the implementation of a remedial action for major petroleum and gasoline spills. The remedial action consisted of a multi-phased approach to site cleanup, which included excavation and removal of contaminated soil and groundwater, removal of underground storage tanks, injection of chemical oxidation compounds into the groundwater table, installation of permanent remedial injection and monitoring points, installation of a soil vapor mitigation system, and delineation of off-site contamination. Fees: $1.0 Million

- **Circuitron Corporation Superfund Site, Ground Water Treatment System, East Farmingdale, NY – Client: USACE -** Served as the Project Engineer and the Health and Safety Officer providing technical direction for on-site staff, guidance in hazardous waste/material management, and performing technical review of reports and contract deliverables. Coordinated with USEPA and USACE for the day-to-day operations and quality control matters. Fees: $1.6 Million

- **Constructability Review – Justice Sonia Sotomayor Houses, Bronx, NY – Client: NYCHA -** Constructability Review for the upgrading/rehabilitation of the Justice Sonia Sotomayor Houses in the Bronx for the New York City Housing Authority (NYCHA). The scope of work includes such repairs as Local Law 11 Brick Facade repair/waterproofing for areas of significant disrepair (including brick masonry, window sills/lintels, and brick parapet replacement with metal railing); roof replacement (asbestos abatement, 4-ply insulated roofing, roof drains); interior repairs/sheet rock/painting to apartments with water damage, new window installation at all locations; replacement of the water tanks, pumps, and repairs to the water tank structures in particular buildings; repairs to the property's main loop and improvements to entrances, lobbies and security. Construction Cost: $102 Millions

- **LCP Chemicals Inc. Superfund Site, Linden, NJ – Client: LCP Chemicals Inc. -** Served as the Project Manager and the Health and Safety Officer for the interim removal action program for mercury clean up and removal, petroleum contaminated soil excavation, storage tanks and steel structure demolition. The job also included a drum landfill investigation, done in level B PPE. Awarded the 74th Annual Governor's Occupational Safety & Health Award Citation of Merit of the State of New Jersey in 2002. Fees: $1.1 Million

- **FAA Technical Center, PCB Soil Remediation at Area 20A Superfund Site, Atlantic City, NJ – Client: USACE -** Served as a Laboratory Manager for the PCB contaminated soils removal project at FAA Technical Center. Responsibilities included the development of sampling and analysis plans, establishment of project data quality objectives, evaluation and selection of laboratories for testing programs, data quality assessment, and reports preparation. Fees: $3.2 Million

- **FAA Technical Center, Area D Jet Fuel Farm Superfund Site, Atlantic City, NJ – Client: USACE -** Served as the Quality Control Manager, supervising laboratory prequalification, fieldwork, and laboratory analysis. Evaluated and optimized the operation of the groundwater treatment system, CEM, and SVE bioremediation system, and prepared quarterly reports deliverables to the USEPA and the USACE. Also performed quality assurance audit and review for the pre-excavation sampling results performed by FAA subcontractors, using field test kits for PCB and TPH. Fees: $2.1 Million

- **US Federal Government, Anthrax Investigation, New Jersey and New York – Client: USPS -** Mr. Khouri was part of a team that was contracted by the Federal Government and the United States Postal Services (USPS) to perform Anthrax sampling and investigation throughout dozens of USPS facilities in the Northeast.

International Representative Projects

- **Global Infrastructure Project, Harare, Zimbabwe** – Provided owner representation services for conducting due diligence and feasibility studies for multibillion dollars infrastructure development projects. Projects are BOT and included a 120,000-bbd oil refinery, 300 Km oil pipeline, 20,000 unit's housing project, resorts, telecommunication improvement, and assessing mining concessions. Construction Cost: $7.2 Billion

- **OQYANA World First, Dubai, UAE** – Provided geotechnical and waterfront/marine engineering evaluations of the island's perimeter seawalls and ground improvement schemes, as well as seismic slope stability analysis at the edge of the islands. The proposed design effort and creative approach led to enormous budget and schedule savings for the client. Construction Cost: $1+ Billion

- **Normandy Landfill Treatment Project, Beirut, Lebanon -** Managed the remediation program of a 60 acres' landfill reclamation project. Additionally, I corresponded with management, owners, developers, and government representatives, and my involvement with the project from the design stage throughout the full remediation led to the project ultimate success with regard to the remediation design and schedule and budget compliance. Construction Cost: $65 Million

- **Beach Restoration, Al Athaiba Beach (Muscat, Oman) and Saint Germain sur Ay Beach (La Manche, France) -** Provided environmental engineering and site civil support for erosion control and restoration of the beach. Fees: $500,000

Publications

- Reductive Dehalogenation of Tetrachloroethylene by Soil Sulfate Reducing Microbes Under Various Electron Donor Conditions (2000).

- The Effect of Organic Substrates on Enhanced Biological Phosphorus Removal in Continuous Culture and Batch Experiments (1998).

- Comparison of Enhanced Biological Phosphorus Removal Populations under Ten Different Environmental Conditions (1998).

- Observations From Steady State and Batch Experiments Concerning the Effect on Enhanced Biological Phosphorus Removal of Volatile Fatty Acids and Glucose (1997).

- Single Stage Anaerobic and Aerobic Sequencing Biotransformation and Mineralization of Tetrachloroethylene (PCE) for the Remediation of Contaminated Soils and Groundwater (1996).

HydroTech Environmental
ENGINEERING AND GEOLOGY, DPC

Paul I. Matli, Ph.D., P.G.

VICE PRESIDENT

Ph.D., Environmental Sciences, Tokyo University of Agriculture and Technology, Japan, 2002

M.S., Environmental Sciences, International Center for Advanced Mediterranean Agronomic Studies, Greece, 1997

B.S. Agriculture Engineering, Saint Joseph University, Lebanon, 1994

Accredited US Educational Equivalence of Ph.D., M.S. and B.S. by Globe Language Services, Inc.

OSHA Certifications/Training

40-Hr HAZWOPER
8-Hr HAZWOPER Refresher
30-Hr Construction Safety and Health
10-Hr Construction Industry

Professional Licenses

New York State Professional Geologist (License # 000186)

Affiliations

Member of the American Institute of Professional Geologists since 2015 (Membership # 2784)

Summary of Experience

Mr. Matli has over sixteen (16) years' of experience in environmental engineering and geology with established records of project portfolio management of remedial investigations, design and oversight of remedial cleanup and remedial closures at inactive hazardous waste disposal sites, Brownfield Cleanup Program (BCP) sites, Voluntary Cleanup Program (VCP) sites, Little-E designation sites, petroleum spill sites, former landfills and Superfund sites. Mr. Matli's extensive experience involves the preparation of Environmental Assessment Statements (EAS), Phase I Environmental Site Assessment (ESA) reports, Phase II Remedial Investigations Reports/Site Characterization Reports (RIR), Pilot and Feasibility Studies, Remedial Action Work Plans (RAWP), Construction Completion Reports (CCR), Site Management Plans (SMP) , Remedial Action Reports (RAR) and Final Engineering Reports (FER) for commercial and residential development complexes, auto related workshops, dry cleaners, manufacturing and industrial blocks. Mr. Matli has been in charge of providing technical guidance of all aspects of fieldwork including geophysical and sub-surface drilling activities for installing soil probes, monitoring wells, soil/sub-slab vapor implants, media monitoring and sampling, petroleum bulk storage tanks assessments as well as designing and installing vapor barriers, Sub-Slab Depressurization Systems (SSDS) and Soil Vapor Extraction (SVE) systems.

Relevant Experience

Brownfield Cleanup Program Remediation Of DNAPL Via *In-Situ* Chemical Oxidation/Bioremedial Agents And Active Vapor Mitigation Systems, Vleigh Place, Flushing, NY - Client: United Properties Corp. & VP Capital Holdings, LLC – As an Environmental Project Manager for this site, I was involved in the initial soil and groundwater assessments to investigate environmental impacts associated with the presence of an on-site drycleaner. These investigations confirmed on-site discharges of chlorinated solvents impacting thirteen storefronts located on-site. The former owner expressed interest in the New York State Department of Environmental Conservation (NYSDEC) BCP and I worked with this owner to apply to the program as a Participant. I then prepared and coordinated all necessary documents for the transition of this site into the BCP. Under BCP, I performed additional subsurface delineation of soil and groundwater impact as well as the extent of vapor intrusion impacts on-site and off-site. Besides a I conducted receptor survey that confirmed the presence of a significant threat to the health of 13 commercial tenant located on-site and occupant of two adjacent residential complexes. Immediate remedial activities were required on-site and off-site. As environmental engineer I was involved the design and installation of interim vapor mitigation systems inside the 13 on-site tenant spaces prior to their destruction by a fire in 2016. I was then involved in the design and installation of an interim Soil Vapor Extraction (SVE) system to prevent the migration of chlorinated vapor into adjacent residential buildings. Under the directions of an NYS Licensed Professional Engineer (PE), I had the direct responsibility of preparing and implementing a NYSDEC-approved RAWP. RAWP activities consisted of a site-wide soil excavation, multiple rounds of in-situ groundwater treatment by chemical oxidation brand name PersulfOx and a bioremedial agent brand name 3_D Microemulsion Factory Elumlsified (3DME) followed by several rounds of post-groundwater remediation sampling events. A total of 48,830 cubic yards of non-hazardous fill material and a total of 1,080 cubic yards of former concrete foundations were also removed during site excavation for future redevelopment. In addition, monitoring of soil vapor intrusion has also been performed off-site in surrounding sidewalks and adjacent buildings including a daycare facility. The Site remediation was completed by achieving the Unrestricted Soil Cleanup Objectives for the soil cleanup and the Track 4 Cleanup Goal for the Site. Using an innovative and affordable remedial design, I was able to stay within budget, prepare an SMP and an FER and help my client receive the tangible tax credits by completing the BCP milestones and receive a NYSDEC-issued Certificate of Completion (COC) within two years of NYSDEC RAWP approval. The site is currently under a post-remediation Site Management Plan, which includes a groundwater sampling program, SVE monitoring program, an SSDS installation and monitoring at adjacent property (2014 - Ongoing).

Brownfield Cleanup Program Remediation Of Historic Railroad Freight Yard And Manufacturing Site, East 135th Street, Bronx NY – Client Deegan 125th Realty LLC – Project Site involved the redevelopment of a 1.112-acre site into two 25-story mixed residential and commercial use towers with full basements and parking/driveways over of two unexcavated public utility easements. With the active involvement of HydroTech, the Site was initially enrolled for remediation under the NYC Mayor's Office of Environmental Remediation (OER) VCP program. With its location in the En-Zone along with the presence of soil impacts from historic uses, I identified this Site as an opportunity for the NYSDEC BCP and I worked with the developer to apply to the program as a volunteer. Once the site was accepted into the BCP program, I performed a Focused Site Characterization and prepared a NYS Licensed PE – certified RAWP with a Track 1 Cleanup Goal. During remedial excavation into the interim unsaturated soil, residual soil contamination could not be removed over 63.6% of the Site perimeter and as such, Track 1 Cleanup Goal was achieved over 0.0405 acres and Track 4 cleanup was achieved over 0.707 acres. As the project manager and project geologist, I provided all necessary support during Site remediation including but not limited to obtaining a Quality and Quantity Dewatering Permit from NYCDEP, perform soil waste characterization and coordinate approvals by soil disposal facilities of 36,048 tons of non-hazardous soil disposed of this project, and also coordinate regulatory approvals of 7,680 tons of required backfill material imported to the site. At the completion of the remedial development, I prepared and submitted to NYSDEC an SMP and a NYS Licensed PE – certified FER. NYSDEC-issued a COC within 30 months of NYSDEC RAWP approval. The site is currently under the post-remediation site management inspection and reporting of a composite cover (2015 – Present).

Management Of Cleanup Of Hazardous Materials At A Former Rubber And Adhesives Factory, 9th Street, Long Island City, NY – Client 9th Street LIC – This project site was historically used for adhesives manufacturing for approximately 62 years and a site environmental characterization identified the presence of hazardous chemical waste beneath the property. After thirteen years of no response by former ownership to address site remediation pursuant to a NYSDEC consent order, a new ownership became involved as a respondent to the Consent order and has requested HydroTech to expedite a design for a site cleanup that should be completed within less than 3 months during the layout of a new building foundations. As a Project Manager, I prepared a NYS licensed PE-certified Interim Remedial

Measures Work Plan (IRM WP), which underwent within less than 3 months four revisions due to evolving site information related to underlying bedrock and perched water. The IRM WP included specific soil cleanup methods and selected remedies dictated by NYSDEC that included a design for an SVE system and subsequently a SSDS. IRM activities completed during a first phase included a further delineation of hazardous contamination in soil across the site, groundwater sampling for emerging contaminants and volatile organic compounds, soil waste characterization, acquisition of a dozen Contained-in Determination letters from NYSDEC for non-hazardous waste, proper disposal of 1,123.24 tons of hazardous soil and 5,362.54 of non-hazardous soil, disposal of 45,371 gallons of non -hazardous liquid from dewatering and truck wash/decontamination pad, closure and removal of 9 underground storage tanks (USTs) listed in the Petroleum Bulk Storage (PBS) database and Chemical Bulk Storage database. My project oversight included monitoring day-to-day construction operations by directing a field crew consisting of a geologist, a community air monitoring technician and a technician for odor suppression. The second phase of IRM activities were upgraded consistent with site development. These activities were detailed in an NYSDEC-approved IRM WP Addendum and will resume upon completion of building construction (2019 – Present).

Remedial Development And Spill Closure At A Gasoline Station, 11th Avenue, New York, NY – Client: Sam Ruv Operating Corp. – This project involved remedial redevelopment activities at a former gasoline filling station and an auto repair facility into a 10-story commercial building. My duties as a Qualified Environmental Professional (QEP) included the performance of a remedial investigation addressing a Little E-Designation for hazardous materials. The investigation was conducted per a NYCOER Remedial Investigation Work Plan. In-situ petroleum releases identified during this investigation lead to the opening of an NYSDEC petroleum spill case. I prepared a Remedial Action Work Plan which included a design for a waterproofing vapor barrier under the directions of a NYS Licensed PE and oversaw the implementation of remedial activities in coordination with OER as part of a Voluntary Clean-Up Program (VCP) and under the authority of NYSDEC as part of spill remediation. During site remediation, non-hazardous petroleum contaminated soil/fill was excavated and removed from the property pursuant to a soil Waste characterization exercise, which I conducted, beforehand. In addition, gasoline and diesel underground storage tanks were properly closed and removed from the properly in compliance with applicable laws and regulations. As part of site development, the vapor barrier system that consisted of a waterproofing membrane was installed beneath the hydrostatic slab across the footprint of the building. At the completion site remediation, a decision for a No Further Action was issued by NYSDEC for the spill incident and achieved a Track 1 Cleanup Goal was achieved under which condition, the Little E-Designation for hazardous materials was removed to the Satisfaction of the NYCOER (2015 - 2018).

Integrated Remedial Options For Mixed Use Site Redevelopment And Management, Canal Street, New York, NY – Client: CBCS Hudson Equities, LLC – As an Environmental Project Manager for this Site, I assisted a NYS Licensed PE during the preparation of RAWPs addressing the remediation of an NYSDEC petroleum spill case in accordance to NYSDEC requirements and also a Little E-designation for hazardous materials in accordance with NYCOER guidance and approvals. I designed, coordinated and directed the performance of remedial activities during site development into a 10-stroy hotel. The scope of these activities consisted of the performance of a soil waste characterization, *in-situ* groundwater treatment by Chemical Oxidation brand name RegenOx™ and bioremedial agent identified as Oxygen Releasing Compounds Advanced (ORCA), the proper closure and removal of a waste oil and gasoline USTs, soil waste characterization, excavation of impact fill material and petroleum impacted soil to below the depth of soil groundwater interface and disposal of non-hazardous regulated waste, collection and analysis of post-excavation endpoint sample, application of Oxygen Releasing Compound Advanced (ORCA) pellets at bottom of excavation, the installation of an active SSDS and a waterproofing vapor barrier and the institution of a groundwater monitoring and sampling program leading to the final closure of NYSDEC spill case. Performed annual inspection of installed engineering controls consisting of vapor barrier, SSDS and concrete slab to monitor their environmental function for the protection of the health of building occupants pursuant to an OER-approved Site Management Plan (SMP) (2010 - Ongoing).

Petroleum Spill Remediation And Soil Vapor Mitigation At A Former Gasoline Station, Cropsey Avenue, Brooklyn, NY – Client: Avo Construction – The project site is a former gasoline station and auto repair facility associated with an NYSDEC gasoline-related spill case. This site was then redeveloped into seven 3-story residential buildings. As a project geologist I managed the entire remediation of residual gasoline constituents in soil and groundwater beneath the new vacant building and the mitigation of gasoline vapors detected in the basement and first floor at this development. The mitigation of gasoline vapors were undertaken following a regulatory order issued by the New York State Department of Health (NYSDOH) through the NYSDEC and the New York City Department of Health (NYCDOH) preventing this site from being occupied before taking the necessary measures to render it protective to human health. I designed and installed individual active SSDS in each of the seven 3-story vacant residential buildings following a quantitative pre-mitigation diagnostic testing exercise, which I performed pursuant to NYSDEC and NYSDOH approvals. The seven SSDSs were adequately designed to eliminate the potential vapor intrusion pathway between the vapor source (soil and groundwater) and the receptor (indoor air within the building interior). Upon verifying the SSDS successfully prevented the sub-slab gasoline vapors from impacting the indoor air, the NYSDEC in consultation with NYSDOH and NYCDOH authorized the occupation of the seven new developments at this site. The remediation of gasoline constituents in soil and groundwater was then performed following a complete delineation of contamination on-site and off-site. This remediation involved three rounds of off-site groundwater treatment by RegenOx™ and also ORCA. Upon reducing the levels of contaminants to levels satisfactory to NYSDDEC, a decision for a No Further Action was issued by NYSDEC for the spill incident (2010 - 2017).

Site Cleanup For Affordable Residential Redevelopment, Third Avenue, Bronx, NY – Client : Strategic Development & Construction Group – This project consisted of a remedial development of a new 7-story low income/supportive housing residential building with a full cellar located on the west side of Third Avenue in the Morrisania Section of the Bronx that is mostly a low income residential neighborhood. The new building is owned and operated by Services for the UnderServed (SUS), a non-profit agency that provides housing and support services for formerly homeless and other qualified residents. As an Environmental Project Manager for this Site I had to complete several project milestones leading to the finishing of this remedial development. These project milestones included the preparation of an Environmental Assessment Statement (EAS) and Environmental Assessment (EA) to obtain funding from the U.S. Department of Housing and Urban Development's (HUD) HOME Investment Partnership Program (HOME) funding through HPD's Supportive Housing Loan Program. My duties also involved fulfilling the remedial requirements of a Little E-designation for hazardous materials in accordance with City Environmental Quality Review (CEQR) requirements and a NYCOER-approved RAWP pursuant to the NYC VCP. The implementation of RAWP during building construction lead to the identification of hazardous levels of lead in 60 percent of the site soil/fill material through soil waste characterization investigation and several delineation investigations. The project disposed of 2,474.4 tons of hazardous lead contaminated soil. The remedial goal of a Track 1 cleanup was achieved following site cleanup. I was the recipient for the 2016 Big Apple Brownfield Award for Supportive/ Affordable Housing issued for this project by the New York City Brownfield Partnership (2013 - 2015).

Landfill Remedial Monitoring, Paerdegat Basin Natural Area Park, Brooklyn, NY – Client : New York City Department of Environmental Protection (NYCDEP) – This project is an artificially created basin out of Bedford Creek, a freshwater tributary to Jamaica Bay. The basin was impacted by conveying street runoff directly from stormwater and combined sewer overflows from highly urbanized neighborhood and also by dredging conducted during the early twentieth century and historic fill in the South Natural Park Area. Approximately, 177 acres of Paerdegat Basin shoreline and submerged land were restored to parkland including a Natural Area Park and Ecology Park. In order to correct the degraded water quality conditions in Paerdegat Basin, groundwater sampling was performed to evaluate whether the designated contaminants identified by prior investigations within the urban fill material of the South Natural Park Area have potentially impacted the groundwater after the construction of the Natural Area Park and Ecology Park. As an Environmental Geologist for this site, I performed groundwater sampling per Investigation Work Plans, which I prepared and were approved by NYSDEC and NYCDEP. Groundwater investigations were performed once at pre-construction and several time at post-construction at the Natural Area Park and Ecology Park. These groundwater investigations involved the installation and development of monitoring wells, the sampling of monitoring wells per USEPA low flow samling methods and the sampling of surface water during periods of low tides and high tides with specially designated Quality Assurance Project Plans. I documented the findings of these investigations in groundwater investigation reports to the satisfaction of NYCDEP and NYSDEC (2014 - 2016)

Industrial Air Quality Assessment For Office Conversion Into A Daycare Facility, 40th Avenue, Queens, NY - Client: Peachy Enterprise, LLC - This project addressed the CEQR Technical Manual – Chapter 17 provisions for hazardous materials associated with suspect on-site and off-site historic uses and also an air quality impact assessment in anticipation of the conversion of an office space to a day care center within an existing office building located in M1-3 manufacturing zone under a special permit from the New York City Board of Standards and Appeals (BSA). As an Environmental Project Manager for this site, I performed a Hazardous materials investigation in accordance to NYCDEP-approved investigation work plan, which I prepared. I also prepared a NYCDEP-approved RAP, which was certified by a NYS Licensed PE. I also prepared an air quality impact assessment to the satisfaction of NYCDEP and this assessment involved a boiler screen analysis per CEQR guidance as well as a basic screening of industrial mobile and stationary sources using EPA's AERSCREEN screening dispersion models and detailed analysis using EPA's AERMODE dispersion model. Findings of air emissions provided by these models were compared to NYSDEC's Guidelines for the Evaluation and Control of Ambient Air Contaminants under 6 NYCRR Part 212 Process Operations DAR-1 Annual Guideline Concentrations (AGC) and Short-Term Guideline Concentrations (SGC) Tables Guidance documents. Upon verification that air pollutant concentrations are below the impact criteria, NYCDEP issued a sign-off on the submitted air quality impact assessment documents and back-up materials and issued a notice to proceed for the establishment of the day care facility (2013 - 2014).

RUIJIE XU
PROJECT MANAGER

Education

M.S., Environmental Science,
New York University,
Polytechnic Engineering School,
New York, NY, 2014

B.S., Biological Science,
Wuhan University,
College of Life Science, Wuhan,
Hubei, China, 2012

Certifications/Training

OSHA: 40 Hour HAZWOPER
OSHA 10 Hour Construction Safety and Health
OSHA 30 Hour for Construction Industry

Summary of Experience

Ms. Xu provides various types of environmental services for private clients. These services include conducting Phase I/II ESAs, remedial investigation, oversight of the implementation of remedial actions and post-remediation monitoring and sampling. Ms. Xu is also working on multiple NYC E-Designation sites and NYS Spill sites under the oversight of lead agencies such as NYSDEC, NYSDEP and NYCOER. The major responsibilities include guiding the client through the environmental petition process, facilitating the client to obtain related environmental approvals/permits, reporting to responsible agencies and ensure the compliance with regulatory requirements.

Relevant Experience

Remediation and Site Management at a Mixed-Use Development Site, Bronx, NY – Client: 2026 Westchester Realty – Project involved the redevelopment of a 1.16-acre site into a 7-story mixed residential, commercial and community building with a partial basement and adjoining ground level parking. The new development also provided 134 affordable rental units. Remediation and construction were completed in 2016 with the active involvement of HydroTech. The site is currently under the post-remediation site management. As the environmental engineer, I'm responsible for the annual inspection of the ECs and reporting to OER. (2018 – Present)

Mixed-Use Redevelopment Site, New York, NY – Client: 150 Wooster LLC – The site was developed into a 6-story mixed residential and commercial building with a full basement and enrolled in the New York City Voluntary Cleanup Program (VCP) due to the presence of E-Designation for Hazardous Materials. In the pre-development investigation, the site was assigned with a spill due to presence of petroleum impacted soil. In addition, lead was detected in soil exceeding the EPA hazardous level. Based upon communication with NYCOER, excavation and implementation of engineering controls (ECs) including vapor barrier and active Sub-Slab Depressurization System (SSDS) were required. As the environmental engineer of the site, I performed soil characterization and lead delineation, provided oversight over remedial activities including soil excavation, tank removal and installation of ECs. I'm currently involved in the post-remediation site management such as annual inspection of ECs and petition for spill closure. (2016 – Present)

Mixed-Use Redevelopment Site, New York, NY – Client: West 30th Street LLC – The project involved redevelopment of a 0.40-acre property located in the Hudson Yard under supervision of NYCOER. The new mixed-use building with full basement will be luxury rental with 25% of affordable units.

As the environmental engineer on the project, I performed remedial investigation including Phase I/II ESA, designed the ECs (vapor barrier system) and conducted waste characterization and delineation. I'm currently involved in the construction oversight over remediation activities such as soil disposal and EC installation. (2018 – Present)

LNAPL Remediation and Monitoring, Bronx, NY – Client: HB Bronx Realty, LLC – Project involved providing engineering support services related in accordance with Site Management Plan supervised by NYSDEC at a commercial parking facility. As environmental engineer on the project, I am currently involved in the periodical sampling and monitoring of the groundwater, LNAPL removal, inspection of engineering controls and reporting to NYSDEC for evaluation of the performance of the remedial system and petition for spill closure. (2018 – Present)

Multiple Affordable Residential Redevelopment, Bronx, NY – Client: SKF Development LLC – The project consists of redevelopment of multiple properties into affordable residential buildings located within the NYS Environmental Zones (En-Zones), which are anticipated to be enrolled in the Brownfield Cleanup Program (BCP). As the environmental engineer, I am currently involved in preparing BCP application for each site and will be responsible for future remedial investigation, remedial design and construction and remediation oversight once the BCP agreement is signed. (2019 – present)

Mixed-Use Development Site, Brooklyn, NY – Client: 540 Fulton Associates LLC – Project involved developing a 15,000-SF lot in Downtown Brooklyn into a 43-story mixed residential and commercial use high rise with full basement. I, as the environmental consultant, performed waste characterization and provided remediation oversight throughout the sub-grade construction. In addition, I also conducted required sampling and prepared the application and renewal package for a NYCDEP Dewatering Permit for discharging approximately 200,000 gallons of groundwater into the combined sewer. (2017 – 2019)

Spill Remediation and Closure at a Commercial Redevelopment Site, Manhattan, NY – Client: New York City Ambulatory – The project included vertical expansion of an existing 2-story theater into a 3-story building for plastic surgery. Soil with petroleum odor were encountered during the excavation for the new sub-cellar. HydroTech was then involved to delineate the extend of the impacted soil and reported the findings to NYSDEC as a spill. Air monitoring along with dust control and odor suppression were conducted throughout the excavation and removal of approx. 1,200 tons of soil and a vapor barrier system were installed under the supervision of HydroTech. As the environmental engineer, I performed the soil waste characterization/delineation and remediation oversight during soil excavation and vapor barrier installation and reported to NYSDEC to acquire spill closure. (2016 – 2018)

Remediation at a Mixed-Use Development Site, New York, NY – Client: Downtown RE Holdings LLC – Project involved the redevelopment of a 0.2-acre site into a 12-story mixed residential and commercial building with a full cellar and a sub-cellar. During the remedial investigation and soil characterization, hazardous lead was detected in soil underneath the Site from multiple locations and depths. HydroTech collected over 100 samples to delineate the vertical and horizontal extend of hazardous lead to help the client save the cost on soil disposal. As the environmental engineer, I conducted the soil sampling for lead delineation and communicated with soil brokers and disposal facilities for soil disposal approval. (2015 – 2016)

Technical Review and Construction Oversight at Multiple Development Sites – Served at New York City Office of Environmental Remediation and provided technical review of cleanup projects and projects documentation for development sites across the five boroughs. Attended meetings with consultants, contractors and developing team and performed site visit during the construction to supervise the implementation of required remedial actions. (2014 – 2015)

HANIBAL TAYEH, Ph.D - Data Validation and Forensic Geochemistry Expert
CURRICULUM VITAE – 2021

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EDUCATION

- **College of Engineering, University of Baghdad, Iraq.** B.S. in Chemical Engineering, 1988; B.S. Thesis: Modern Manufacturing of Methanol
- **Functional Equivalent: M.S. in Chemical Engineering, 1997** Granted by George J. Petrello, Ph.D., M.B.A., B.C.F.E.
- **Madison University**, **Gulport, MS** Master of Science in Environmental Engineering (Honors: Summa Cum Laude), 08/22/1988
- **Functional Equivalent: Doctor of Philosophy Degree in Environmental Engineering, 2001** granted by George J. Petrello, Ph.D., M.B.A., B.C.F.E – Former Dean and Professor of the School of Business Public Administration and Information of Science at Brooklyn, NY Campus of Long Island University and Associate Member of the American Association of Collegiate Registrars and Admissions offices
- **Madison University, Gulfport, MS:** Doctor of Philosophy in Environmental Engineering (Honors: Summa Cum Laude), July, 2001

PROFESSIONAL EXPERIENCE

- **GEO-SPECTROHUMANITY, LLC- APRIL 2015 UNTIL PRESENT TIME**
  FOUNDER, PRESIDENT AND CEO (FUNCTIONS AND RESPONSIBILITIES ARE SIMILAR TO THE ONES AT SPECTRUM ANALYTICAL, INC. FEATURING HANIBAL TECHNOLOGY REPORTED BELOW)

- **Spectrum Analytical, Inc. Featuring Hanibal Technology**

  2007 to 2015 - President-CEO-Treasurer-Secretary
  1995-to 2007- President-Laboratory Director – QA Officer
  1993 to 1995 - Technical Director/Quality Assurance Director
  1992 to 1993 - Quality Control Manager
  1991 to 1992 - Laboratory Analyst

<u>Technical and Quality Assurance Profile</u>:

Dr. Tayeh has more than Thirty (30) years of managerial, Quality Assurance/Quality Control (QA/QC) and Research and Development (R&D) experience. This included the development and implementation of various environmental analytical methods (USEPA Methods 608//8081/8082, 610/8100/8270, various volatile hydrocarbon EPA 502.2/524.2 GC/MS and Total Petroleum Hydrocarbons by GC). Dr. Tayeh developed analytical methods to identify and quantify total petroleum hydrocarbons (weathered and non-weathered fuel oils [#1, #2, #4, #6], motor/waste oils, gasoline, crude oil, and diesel) by gas chromatography (GC) in groundwater and soil using MeCl2 as a solvent extraction.

Also, Dr. Tayeh developed methods for quantitative analysis of Polynuclear aromatic hydrocarbons by gas chromatography/Mass Spectrometry (GC/MS) and polychlorinated biphenyls (PCBs) and chlorinated hydrocarbons pesticides by gas chromatography/Electron Capture Detector (GC/ECD). Dr. Tayeh performed all quality assurance/quality control (QA/QC) and method detection limit studies related to these methods and their implementation in the laboratory.

Dr. Tayeh has also developed the new MA DEP methods for petroleum hydrocarbon determination called Extractable Petroleum Hydrocarbon (EPH) and Volatile Petroleum Hydrocarbon (VPH) along with his direct involvement with the Mass DEP technical team in Lawrence and Boston, Massachusetts, to support the finalization of this particular method.

Dr. Tayeh has been invited by several New England environmental laboratories to present various aspects of new methodology being introduced to the environmental analytical field. Dr. Tayeh has perfected EPA methods with the approval and support of the Massachusetts Department of
Environmental Protection.

Business Management and Leadership:

Spectrum Analytical was founded in 1990 and staffed two employees. From 1990 until 1993, Spectrum's average annual revenue was approximately a few hundred thousand US dollars with an employment base of 4 employees.

Hanibal Tayeh was appointed as Acting Laboratory Director in 1993 and under his leadership,

Spectrum has grown to an average Seventeen Million US Dollar business and employs a staff of over one hundred and fifty professionals. He has personally expanded the geographical presence of this laboratory in both the State of Rhode Island (Warwick) and the State of Florida (Tampa) and achieved the highest quality standards through the National Environmental Laboratory Accreditation Certification (NELAC) program along with twelve other state certifications including New England, New York, and Florida.

International Business Interest

International business interests include the Major international regions. countries of Puerto Rico, Brazil, Bolivia, South Africa and most recently in both France and the Middle East Regions. Spectrum has received a soils permit from the United States Department of Agriculture (USDA) which will allow Spectrum to accept soils from other countries. Additionally, Spectrum Analytical, Inc is currently pursuing tow major projects in the Gulf region namely "The Environmental Center of Excellence which include the establishment of an environmental Testing Laboratory, Research and Development and consult advisory unit.

- **Kuwait, Iraq, 1989 - 1990: Al Hamra Kuwait Company, Kuwait City, Kuwait**
  Dr. Tayeh was responsible for waterproofing project design; management and implementation; direct client contact; and marketing. He was appointed as director of AL Hamra Kuwait branch in Baghdad-Iraq (1990)

- **BEIRUT, LEBANON, 1988 - 1989-KASSAB-MAROUN COMPANY, BEIRUT, LEBANON**
  Dr. Tayeh's responsibilities included research and development (R&D); and was in charge of quality control (QC) programs to maintain the highest quality standards of the company's plastic production. He conducted exclusive training sessions for the employees (Technicians and Engineers) during his employment regarding the day-to-day quality management followed by several internal audits to ensure the proper implementation of various critical quality procedures.

FORENSIC GEO-CHEMISTRY STUDIES

- "Petroleum Forensic Study" with Dr. Dahmani and Dr. Xie, for ECS, MA (SA22743-April 13, 2005)
- "Petroleum Forensic Study" with Dr. Dahmani, for ECS, MA (SA25996-May 3, 2005)
- "Petroleum Forensic Study" with Dr. Dahmani, for TEC, MA (SA25534-May 2005)
- "Petroleum Forensic Study" with Dr. Dahmani, for ECS, FL (SA31197-August 2005)
- "Petroleum Forensic Study" with Dr. Dahmani, for Lessard Environmental, MA (SA29530-November 7, 2005)
- "Petroleum Forensic Study" with Dr. Dahmani, for CEA, MA (SA36094-Nov 2005)
- "Petroleum Forensic Study" with Dr. Dahmani, for Lessard Environmental, MA (SA37176-December 23, 2005)
- "Petroleum Forensic Study" with Dr. Dahmani, for CEA, MA SA38134-(Jan 2006)
- "Petroleum Forensic Study" with Dr. Dahmani, for CEA, MA (SA38802-March 2006)
- "Petroleum Forensic Study" with Dr. Dahmani, for ECS, NH (SA40727-March 2006)
- "Petroleum Forensic Study" with Dr. Dahmani, for ECS, MA (SA41503-March 2006)
- "Petroleum Forensic Study" with Dr. Dahmani, for Posternak, Blankstein & Lund, LLP, MA (SA36739-May 12, 2006)
- "Petroleum Forensic Study" with Dr. Dahmani, for ECS, MA (SA43746-May 2006)
- "Petroleum Forensic Study" with Dr. Dahmani, for Response Environmental, MA (SA41225-41571-43482-May 22, 2006)
- "Petroleum Forensic Study" with Dr. Dahmani, for Analytical Engineering, MA (SA45399-June 5, 2006)
- "Petroleum Forensic Study" with Dr. Dahmani, for CMG, MA (SA35874-36119-36331-37139-37899-37719-June 30, 2006)
- "Petroleum Forensic Study" with Dr. Dahmani, for ECS, MA (SA47357-July 2006)
- "Petroleum Forensic Study" with Dr. Dahmani, for ECS, MA (SA20449-July 2006)

- “Petroleum Forensic Study” with Dr. Dahmani, for ECS, MA (SA45872-July 2006)
- “Petroleum Forensic Study” with Dr. Dahmani, for CEA, MA (SA44995-July 2006)
- “Petroleum Forensic Study” with Dr. Dahmani, for ECS, MA (SA46734-July 2006)
- “Petroleum Forensic Study” with Dr. Dahmani, for Response Environmental, VT (SA47102-July 26, 2006)
- “Petroleum Forensic Study” with Dr. Dahmani, for Environmental Services, CT (SA46865-July 31, 2006)
- “Petroleum Forensic Study” with Dr. Dahmani, for ECS, MA (SA48115-August 2006)
- “Petroleum Forensic Study” with Dr. Dahmani, for First Environmental, NJ (SB06700-01-February 26, 2010)
- “Petroleum Forensic Study” with Dr. Dahmani, for AECOM, MA (SB04206-01 &-02; SB04385-01; SB09763-01-June 25, 2010)
- “Petroleum Forensic Study” with Dr. Dahmani, for Engineering and Land Planning Associates, NJ (SB12428-01-June 29, 2010)
- “Petroleum Forensic Study” with Dr. Dahmani, for AECOM, MA (SB11555-July 2010)
- “Petroleum Forensic Study” with Dr. Dahmani, for First Environmental, NJ (SB13974-01-August 4, 2010)
- “Petroleum Forensic Study” with Dr. Dahmani, for First Environmental, NJ (SB14617-01-August 5, 2010)
- “Petroleum Forensic Study” with Dr. Dahmani, for Woodard & Curran, NY (SB15726-01-August 18, 2010)
- “Petroleum Forensic Study” with Dr. Dahmani, for Greenpeace, DC (SB18799-01-October 22, 2010)
- “Petroleum Forensic Study” with Dr. Dahmani, for Commonwealth Tank, Inc., MA (SB01841-01-October 27, 2010)
- “Petroleum Forensic Study” with Dr. Dahmani, for ECS, MA (SB21060-01 & -02-December 6, 2010)
- “Petroleum Forensic Study” with Dr. Dahmani, for Advanced Environmental Technologies, FL (SB23750-01 & -02-March 4, 2011)
- “Petroleum Forensic Study” with Dr. Dahmani, for TYREE, MA (SB24602-01 & -02-March 11, 2011)
- “Petroleum Forensic Study” with Dr. Dahmani, for AECOM, MA (SB24626-01; SB24699-01 & -02-March 16, 2011)
- “Petroleum Forensic Study” with Dr. Dahmani, for Engineering and Land Planning Associates, NJ (SB24935-01-March 23, 2011)
- “Petroleum Forensic Study” with Dr. Dahmani, for First Environmental, NJ (SB24638-01-May 2, 2011)

RESEARCH AND DEVELOPMENT

1. *“Modern Manufacturing of Methanol”*, University of Baghdad, 1988

2. *"Total Petroleum Hydrocarbon by Gas Chromatography*
a. *Modified EPA 8100"*, Spectrum Analytical, Inc., Massachusetts, 1992

3. *"TPH Modified EPA 8015 Method by Purge and Trap",* Spectrum Analytical, Inc., Massachusetts, 1992.

4. "*Volatile Organic Methods by EPA 502.2 and SW846 8021",* Spectrum Analytical, Inc., Massachusetts, 1992.

5. *"Total PCBs and Pesticides by Gas Chromatography SW846 8081-8082A Methods",* Spectrum Analytical, Inc., MA, 1993.

6. *"Total Poly-Nuclear Aromatic Hydrocarbon (PAHs)* by Gas Chromatography GC/FID and Mass Spectrometry (GC/MS)- SW846 8100/8270 Methods", Spectrum Analytical, Inc., MA, 1993.

7. *"Quality Control/Quality Assurance Plan-QA/QC",* Spectrum Analytical, Inc., Massachusetts, 1994.

8. *"Feasibility and Efficiency of Petroleum Hydrocarbon Dating Preliminary Study",* October, 1997.

9. *"Excerpts adopted by the Massachusetts Department of Environmental Protection* from two letters presented by Spectrum Analytical, Inc., 10/21/97 and 2/27/98 regarding the development of the MA Volatile Petroleum Hydrocarbon and Extractable Petroleum Hydrocarbon Method".

10. *"Volatile Petroleum Hydrocarbons (VPH) MA DEP Method",* Spectrum Analytical, Inc., Agawam, Massachusetts, 1996, Revisions 1998-1999.

11. *"Extractable Petroleum Hydrocarbons (EPH) MA DEP Method*, Spectrum Analytical, Inc., Agawam, Massachusetts, 1996, Revision 1998-1999.

12. *"Micro-Extractable Method by EPA Method 504.1",* Spectrum Analytical, Inc., 1999.

13. *"Semi-Volatile Organic Hydrocarbons by EPA Method 8270",* Spectrum Analytical, Inc., 1999.

14. *"Total Petroleum Hydrocarbon Technique (TPHT): Overview, Interferences -Constraints and New Development of Alternative Analytical Methods",* 2000-2001. This study was presented in the fourth international water conference (ARWATEX-4) in Beirut on June 2005

15. *"Variations in Analytical & Physical Parameter Values Observed Due to Changes in*

Sampling Methodology and Holding Times", Joint investigation conducted by Spectrum Analytical, Environmental Compliance Services and the Department of Civil and Environmental Engineering at the University of Massachusetts in Amherst, into the causes of variability observed in field screening and analytical data at sites undergoing frequent groundwater monitoring.

16. *Evaluation of Shot-Shell Shot Pellets Impact in Soil:* Physical Separation and Lead Content Determination", Joint Investigation with MA DEP –Western Region (June 2000).

17. *"Evaluation of MTBE in Middle Distillate Petroleum Products in the Northeastern United States",* Joint Research conducted by Edward J. Hinchey, Jon Fox and Hanibal Tayeh. This technical evaluation was accepted for the "National Focus Conference MTBE in Ground Water" in Maryland (June 2001).

18. *"The Effect of Coal Tar on Geo-Memberane/Geo-Synthetic Clay Liners in Coal Tar Impacted Soil;* Adam P. Chen, Joe A. Chittet, Joel D. Krueger, Joan V. Gonzalez, Burns & McDonnell Engineering, Inc, Amine Dahmani, Ph.D, Hanibal Tayeh, Ph.D, Spectrum Analytical, Inc.,"

19. *"Conceptual Designs for Establishment of Hanibal Technology Suitability Model and the New Beach Restoration Technology".* This paper was presented at the Union of Nigerians Engineers and Scientists from France (UNESF) on July 11, 2008 in the UNESCO-Main Auditorium-Paris

TECHNICAL SEMINARS

Dr. Tayeh has presented several seminars in his professional career. They are listed below:

1- US PetroChemical Materials in the Middle East Market, Baghdad, Iraq,1990. This seminar was in response of marketing strategies for Chem-Stab, Inc., NY, NY. The seminar also generated information concerning chemicals, such as: Permabind; emulsion sealer; plush sealer; dirt sealer; cement-concrete additives/admixtures; seepage Inhibitor; slope conditioner, called "aquatain"; soil life; minezyme; super cleaner; de greaser; sewage conditioner; and cutrine (family).

2- Volatile Petroleum Hydrocarbon and Extractable Petroleum Hydrocarbon, Massachusetts, 1996-1997. Dr. Tayeh was invited to present this seminar to the Western Massachusetts Licensed Site Professional Association, Westfield, MA, December, 1996; and Fugro-ENSR, Northborough, MA, March, 1997. This seminar involved in formation concerning: background and historical overviews; distinction between EPH/VPH and corresponding EPA methods; aged petroleum products.

3- EPA Environmental Methodologies and Sample Handling, Holding Time and Preservation, Corporate Environmental Advisors, Inc. (CEA), Worcester, MA, 1997 and ENSR International, Northborough, MA ,1997

4- Feasibility and Efficiency of Petroleum Hydrocarbon Dating, Environmental Compliance Services, Inc. (ECS), Agawam, MA, 1997

5- Quality Assurance and Quality Control: Interpretation and Validation, CDW Consultants, Inc., Framingham, MA, 1998 and SMC, Inc. Bethlehem, CT, 1998

6- Introduction to the Environmental Testing Field, James Clark Public School, First and Second Grade Students, 1998, Agawam, MA.

7- Evaluation of Various Petroleum Hydrocarbon Methodologies, GroundWater Environmental Services, Inc. (GES), Windsor Locks, CT, 1999.

8- The Use of Various Environmental Analyses: Efficiency and Sample Handling, ERM, Framingham, CT, 1999.

9- Quality Management and Leadership Impact in the Environmental Industry. MI, 1999

10- Total Petroleum Hydrocarbon: Method Efficiency; Fingerprinting, Weston & Sampson, Peabody, MA, 2000.

11- Total Petroleum Hydrocarbon Technique (TPHT): Overview, Interferences-Constraints and New Development of an Alternative Analytical Methods, University of Massachusetts, Amherst, MA, 2000 (This method is under development; remains strictly confidential; possible future endorsement by the EPA), 1999-2001

12- Total Petroleum Hydrocarbon Technique (TPHT): Data Accuracy, Fingerprinting and Dating, Various Clients in the Boston Metropolitan Area (This method is under development; remains strictly confidential possible future endorsement by the EPA), 1999-2001

13- Water Quality and Monitoring Seminar, in conjunction with the Massachusetts Department of Environmental Protection, Presented to Western Massachusetts Public Water Supply personnel, 2002.

14- The New Beach Restoration Technology: Sand-RX, in conjunction with Sable D'Or team, presented to Ecology team of the Poitou-Charentes in Rochelle, France on June 2008.

PROFESSIONAL AND COMMUNITY AFFILIATIONS

- Founder and President of Hanibal Technology, LLC (2001)

- Founder of The New Culture of Peace Philosophy “Humanity Attainment Theory”
- MIT Coordinator of both International Programs “MIT BLOSSOMS and MIT LINC (Learning International Networks Consortium” in Lebanon and the Middle East.
- Leading Coordinator of an International Academic Initiative between the University of Massachusetts-Amherst *(UMASS)* and The Lebanese American University *(LAU)* with respect to Implanting both the Environmental Sciences program-laboratory and the Legal Studies programs in the LAU Campuses in the Middle East.
- Stockbridge School of Agriculture, University of Massachusetts, Amherst, MA 2001 Invitation to Serve as Chairman of a Reinstatement of the Environmental Technology option and Obtained an Adjunct rofessorship to Stockbridge School of Agriculture.
- Environmental Sciences, University of Massachusetts, Amherst, MA 2005 through 2007- Obtained an Adjunct Professorship to the Environmental Sciences Department.
- ARAB HEALTHY WATER ASSOCIATION, 2004 Member of The ABROAD ADVISOR and EXPERT CONSULTANCY Committee
- Civil & Environmental Engineering Advisory Board, University of Connecticut, Storrs, CT 2005-Member of the Board of the Department of Civil and Environmental Engineering
- Member of American Chemical Society, November, 1998
- Member of International Society of Environmental Forensics (ISEF)
- Honoree Member of the Union of Nigerian Engineers and Scientists from France (UNESF)

PERSONAL COMMUNIQUÉ

Pope John Paul II, Vatican City, Rome, Italy, 2001 *Received an Honorable Letter from the Pope John Paul II in response to the correspondence that was written by Dr. Tayeh to the Pope, translated into Polish, verbalizing Dr. Tayeh’s human philosophy concept referencing the Culture of Peace. This letter was also published in Arabic and was provided to three other major powers; namely, His Beatitude Cardinal Nasrallah Boutros-Spheir-Patriarcat Maronite; His Beatitude Patriarch Ignatius IV, Hazim-Patriarcat Orthodox; and His Holiness Pope Shenouda III, Coptic Orthodox Church.*

INTERNATIONAL BUSINESS PROFILE

Dr. Tayeh's Humanity Attainment Theory was the driving force behind the development of his international philosophical and business network. This process led to the following intellectual engagement with:

President Robert Mugabe- The president of the Republic of Zimbabwe who appointed Dr. Tayeh in 2010 the General Director of the Global Project in Zimbabwe. As a result, Dr. Tayeh developed the overall Master Plan of the Global Project entailing Refinery and Pipeline - Development and processing of various Mining Resources - Hotel and 20,000 Apartment Units - Development of Tele-Communication System - Establishment of Environmental, Oil and Material Testing Laboratories and Development of Water and Agriculture System.

Dr. Tayeh has also completed Six Feasibility studies and successfully received Two Letter of Support from the ***US Administration*** especially from ***His Honorable Senator John Kerry***, The Chair of the Foreign Affairs Committee at the US Congress (2012) and ***His Honorable State Senator Michael Knapik*** of Massachusetts (January 2012).

Additionally, A New US Company "Storm Bridge Holding Company- USA, LLC was formed in the State of Massachusetts for the purpose of managing the overall project logistics according to the US Standards.

- ***President Segolene Royal***- The Chairman of the Socialist party in France-President of Poitou-Charentes Region-May 2008 who supported Dr. Tayeh for the implantation Spectrum Technology and his beach restoration technology in that region followed by a letter of intent.
- ***Madame Michele GENDREAU-MASSALOUX*** –President Sarkozy's Director of the Union of the Mediterranean (Recteur de la Francophonie)-Elysee Palace-Paris June 2008 who sponsored Dr. Tayeh for an active role in the GID and the Union of the Mediterranean
- ***Senator Jean Francois Le Grand***-Paris July 2008, who supported Dr. Tayeh's scientific and technical objectives in the Manche region followed by a letter of intent (LOI)
- ***Minister Fahme Ali Al-Jowder, Minister of Works*** in the Kingdom of Bahrain June 2008, who appointed Dr. Tayeh as "The Technical Advisor" of the Tubli project followed by a letter of intent (LOI)
- ***Minister of the Environment Engineer Abdallah*** in the Sultanate of Oman-March, 2008 who supported Dr. Tayeh's vision for beach restoration followed by a letter of Intent (LOI)
- ***Chinese Environmental Leaders*** of the Environmental Monitoring Center of Jiangsu Province in Nanjing (JSEMC), the Environmental Monitoring Center of Dalian and the Chinese Research Academy of Environmental Services in Beijing (CRAES). As a result, Dr. Tayeh signed three collaboration agreements with the three Chinese parties on January 2006.
- ***The Kingdom of Saudi Arabia Leaders***: Royal Princes; Ministers; Many Mayors especially in the Eastern Province Municipalities; Many Official Agencies (Consumer

Protection Association; Cooperative Societies Council) and Many Academic Authorities (King Saud University President).

PROFESSIONAL RECOGNITION

- ✓ Twenty (20) “*SUPPER SIXTY*” awards presented by the Greater Springfield Chamber of Commerce for one of the fastest growing companies in Western Massachusetts.

- ✓ University of Massachusetts (UMASS) for service and support for the Environmental Sciences Program on April 10, 2003

- ✓ ARWATEX Four Conference Award was presented to Dr. Tayeh for his achievement on June 2005 in Beirut-Lebanon.

- ✓ Union of Nigerian Engineers and Scientists from France (UNESF) for Dr. Tayeh’s presentation as a Keynote speaker at the “Transfer of Technologies and Co-development” conference in UNESCO-Paris July 2008. Dr. Tayeh was offered an honorary membership at the UNESF Union.

- ✓ Municipalities (The Cities of Agawam, West Springfield, and Westfield, Massachusetts) for supporting the community.

- ✓ Environmental Consulting Firms (CEA, Inc., ECS, Inc., Marin Environmental, SMC, Inc., OTO, TGG, Recon Engineering, CDW and many others) for Quality Responsiveness and providing emergency response actions and quality data deliverable.

PUBLICATIONS

1. “WHEN MY SOUL SPOKE IN MY OBLIVION” 2012
   "عندما حَكَتْ نَفْسي في غَيْبوبَتي"
   Dr. Tayeh wrote his philosophical book in 2012 in Arabic and English and incorporated His Four books in One Volume.

2. “INTRODUCTION TO HUMANITY ATTAINMENT AND THE CULTURE OF PEACE”-2011
   "ألموجز في تفسير البلوغ الانساني و ثقافة السلام"
   Dr. Tayeh wrote his philosophical book in 2010-2011 in Arabic and English

3. “A GLOW EMERGING FROM THE EPILOGUE” 2011
   "يَراعة من الخاتِمة"
   Dr. Tayeh wrote his philosophical book in 2010-2011 in Arabic and English

4. “MY SOUL'S LONGING IN HER ATTAINMENT JOURNEY” AND “MY SOUL'S TESTIMONY UNDER HER DOME” - 2012
   "من طَوايا البُلوغ على مَتْن نفسي" & "شَهادَةُ نَفْسي تحت رُواقِها"
   Dr. Tayeh wrote his philosophical book in 2012 in Arabic and translated in English

5. “THE CHARTER OF THE HUMANITY ATTAINMENT PROGRESSION (H2ACFCP) - 2012; Dr. Tayeh wrote this charter in 2012 in Arabic and translated in English

6. “Humanity Suitability Theory to the Idea and Scientific-Technical Step (Priorities & Direction); Dr. Tayeh developed the theory behind Technical, Economics and Social problems in the world, 1990 in Arabic and translated in English
7. Modern Manufacturing of Methanol, 1988

8. Evaluation of MTBE in Middle Distillate Petroleum Products in The Northeastern United States, Edward J. Hinchey, Jon Fox, and Hanibal Tayeh 2001

9. A Quantitative Evaluation of Petroleum Hydrocarbon Techniques in Groundwater: Overview, Interference-Constraints and New Development of Alternative Analytical Methods, presented at The ARWATEX 4 Conference – June 27-30, 2005 in Beirut-Lebanon

10. “THE GLOBAL, CIVILIZATIONAL AND WORD MODEL PROJECT: EXEMPLARY CHEMICAL WASTE LANDFILL; ENVIRONMENTAL LABORATORY OF EXCELLENCE; ADVANCED RESEARCH & DEVELOPMENT CENTER”

DOCTORAL DISSERTATION

Total Petroleum Hydrocarbon Technique (TPHT) – Overview, Interference-Constraints and New Development of Alternative Analytical Methods, presented to Dr. M.R. Mousighi of Madison University, Gulfport, MS-2001.

All documentation will be available upon request.

ATTACHMENT E
SAMPLE CHAIN OF CUSTODY FORM

YORK
ANALYTICAL LABORATORIES, INC.
120 RESEARCH DR. STRATFORD, CT 06615
(203) 325-1371 FAX (203) 357-0166

Field Chain-of-Custody Record

Page____ of ____

NOTE: York's Std. Terms & Conditions are listed on the back side of this document.
This document serves as your written authorization to York to proceed with the analyses requested and your signature binds you to York's Std. Terms & Conditions unless superseded by written contract.

York Project No.______________

Client Information

Company: ______________
Address: ______________
____
Phone No. ______________
Contact Person: ______________
E-Mail Address: ______________

Report To:

Company: ______________
Address: ______________
____
Phone No. ______________
Attention: ______________
E-Mail Address: ______________

Invoice To:

Company: ______________
Address: ______________
____
Phone No. ______________
Attention: ______________
E-Mail Address: ______________

Client Project ID

Purchase Order No.

Turn-Around Time

24 hr ________
48 hr ________
72 hr ________
5 Day ________
Standard______

Report Type/Deliverbles

Summary Results Only______ QA/QC Summary______
RCP Package______ ASP B Pkg ________
ASP A Pkg______ Excel format________
EDD ________ OTHER______________

Print Clearly and Legibly. All Information must be complete. Samples will NOT be logged in and the turn-around time clock will not begin until any questions by York are resolved.

____
Samples Collected/Authorized By (Signature)

____
Name (printed)

Matrix Codes
S - soil
Other - specify(oil, etc.)
WW - wastewater
GW - groundwater
DW - drinking water
Air-A - ambient air
Air-SV - soil vapor

Volatiles		**Semi-Vols.**	**Pest/PCB/Herb**	**Metals**	**Misc. Org.**	**Full Lists**	**Miscellaneous Parameters**		
8260 full	TICs	8270 or 625	8082PCB	RCRA8	TPH GRO	Pri.Poll.	Corrosivity	Nitrate	Color
624	Site Spec.	STARS	8081Pest	PP13	TPH DRO	TCL Organics	Reactivity	Nitrite	Phenols
STARS	SPLP or TCLP	BN Only	8151Herb	TAL	CT ETPH	TAL Met/CN-	Ignitability	TKN	Cyanide-T
BTEX	Benzene	Acids Only	CT RCP	CT15	NY 310-13	Full TCLP	Flash Point	Tot. Nitrogen	Cyanide-A
MTBE	Nassau Co.	PAH	App. IX	Total	TPH 418.1	Full App. IX	Sieve Anal.	Ammonia-N	BOD5
TCL list	Suffolk Co.	TAGM	Site Spec.	Dissolved	Air TO14A	Part 360-Routine	Heterotrophs	Chloride	CBOD5
TAGM	Ketones	CT RCP	SPLP or TCLP	SPLP or TCLP	Air TO15	Part 360-Baseline	TOX	Phosphate	BOD28
CT RCP	Oxygenates	TCL list	TCLP Pest	**Indiv. Metals**	Air STARS	Part 360-Expanded No Dioxins/Furans	BTU/lb.	Tot. Phos.	COD
Arom.	TCLP list	TICs	TCLP Herb	Hg, Pb, As, Cd	Air VPH	Part 360-Expanded Full List	Aquatic Tox.	Oil&Grease	TSS
Halog.	524.2	App. IX	Chlordane	Cr, Ni, Be, Fe,	Air TICs	NYCDEP Sewer	TOC	F.O.G.	Total Solids
App.IX	502.2	SPLP or TCLP	608 Pest	Se, Tl, Sb, Cu,	Methane	NYSDEC Sewer	Asbestos	pH	TDS
8021B list	5035	TCLP BNA	608 PCB	Na, Mn, Ag, etc.	Helium	TAGM	Silica	MBAS	TPH - IR

Special Instructions
Field Filtered ☐
Lab to Filter ☐

Sample Identification	**Date Sampled**	**Sample Matrix**	**Choose Analyses Needed from the Menu Above and Enter Below**								Container Description(s)

Comments

Preservation Check those Applicable	**4ºC**____ **Frozen**____ **HCl** **MeOH**	**4ºC**____	**4ºC**____	**HNO_3**____ **4ºC**	**4ºC**____ **H_2SO_4**____	**4ºC**____ **Other**	**4ºC**____ **H_2SO_4**____ **NaOH**____ **ZnAc** **Ascorbic** **Other**

______________________ ____________
Samples Relinquished By Date/Time

______________________ ____________
Samples Received By Date/Time

______________________ ____________
Samples Relinquished By Date/Time

______________________ ____________
Samples Received in LAB by Date/Time

Temperature on Receipt

_____ºC

ATTACHMENT F

CONVENTIONAL LABORATORY QA/QC

QUALITY SYSTEMS MANUAL

FOR ENVIRONMENTAL ANALYTICAL SERVICES

Revision 3.2
Effective Date: 09/12/2022

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

York Analytical Laboratories, Inc. (II)
132-02 89th Avenue Suite 217
Richmond Hill, NY 11418

203-325-1371
www.yorklab.com

Name	Title	Signature	Date
Cassie Mosher	Laboratory Manager-CT		09/12/2022
Krys Trafalski	Laboratory Manager, QA Officer-NY		09/12/2022
Sarah Widomski	QA Officer-CT	Sarah Widomski	09/12/2022

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.

4.3 Scope of Management System

The management system covers activities in the laboratory’s permanent facilities at 120 Research Drive, Stratford, CT 06615 and 132-02 89th Avenue Richmond Hill. NY 11418. The fields of activities include:

Analysis of environmental samples (water, wastewater, soil, sludge, and air) for Federal and State regulated contaminants in support of private clients.

The laboratory’s scope of tests is listed in the specific Certifications and encompasses volatile organics, semi-volatile organics, pesticides, herbicides, PCBs, metals, and various general chemistryparameters.

Methods under which York Analytical Laboratories, Inc. performs its accredited testing include:

EPA 120.1
EPA 1311
EPA 1312
EPA 1664
EPA 180.1, Rev. 2.0
EPA 200.7, Rev. 4.4
EPA 200.8, Rev. 5.4
EPA 245.1, Rev. 3.0
EPA 245.2
EPA 300.0, Rev. 2.1
EPA 3005A
EPA 3010A
EPA 3015A
EPA 3050B
EPA 3060A
EPA 3510C
EPA 3545A
EPA 3546
EPA 3550C
EPA 3580A
EPA 420.1
EPA 5030C
EPA 5035A-H
EPA 5035A-L
EPA 524.2
EPA 6010C
EPA 6010D
EPA 6020A
EPA 6020B
EPA 608.3
EPA 624.1
EPA 625.1
EPA 7196A
EPA 7470A
EPA 7471B
EPA 7473
EPA 8011
EPA 8015D
EPA 8081B
EPA 8082A
EPA 8151A
EPA 8260C
EPA 8260D

EPA 8270D
EPA 8270D SIM
EPA 8270E
EPA 8270E SIM
EPA 9010C
EPA 9014
EPA 9023
EPA 9045D
EPA 9095B
SM 19, 21-23 4500-P E
SM 2120B-2011
SM 21-23 2120B
SM 21-23 2320B
SM 21-23 2540C
SM 2320B-2011
SM 2540 B-2011
SM 2540 C-2011
SM 2540 D-2011
SM 2540 F-2011
SM 3500-Cr B-2011
SM 4500-CN B-2011 and C-2011
SM 4500-CN E-2011
SM 4500-N Org B-2011 or C-2011
SM 4500-N Org D-2011
SM 4500-NH3 D-2011 or E-2011
SM 4500-P B(5)-2011
SM 4500-P E-2011
SM 4500-S2 F-2011
SM 5210B-2011
SM 5220D-2011
SM 5310C-2011
SM 6640B-2006

Methods under which York Analytical Laboratories, Inc. (II) performs its accredited testing include:

EPA 8260C
EPA 8260D
EPA 5030C
EPA 5035A-I
EPA 5035A-H
EPA TO-15
EPA 537
EPA 537.1

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

LIMS Database

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 Vice President/Chief Scientific 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 Vice President/Chief Scientific 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 Vice President/Chief Scientific 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 Vice President/Chief Scientific 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 Officers:

The Quality Assurance Officer (QAO) has full authority through the Vice President/Chief Scientific Officer in all matters relating to quality assurance and quality control systems. The QAO can make recommendations to the Vice President/Chief Scientific 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:
    - accreditations/certifications;
    - analytical method management;
    - internal and external audits;
    - documentation;
    - training;
    - 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 resource for 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 specific 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 Vice President/Chief Scientific 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 packages and internal audits/training.	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 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.	B.S. in IT discipline	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.

Liquid Chromatography/Mass Spectrometry/Mass Spectrometry (LC/MSMS). These systems are used for determination of target PFAS species in Potable water, non-potable water and soil matrices. Systems are tuned according to manufacturer specifications and challenged each day by running CCV standards at various method or SOP dictated levels. For initial calibration 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) standards. All target analytes are represented in the calibration. For the initial calibration to be deemed acceptable, all target compounds must show average Response factor RSDs

<30% or for regressions >0.995 and must be re-evaluated and meet the acceptance criteria, at a minimum, every 10 sample injections and at the end of an analytical sequence.

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 as required. 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 Client 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. Client notification should occur as soon as practical or within 72 hours of discovery. 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.

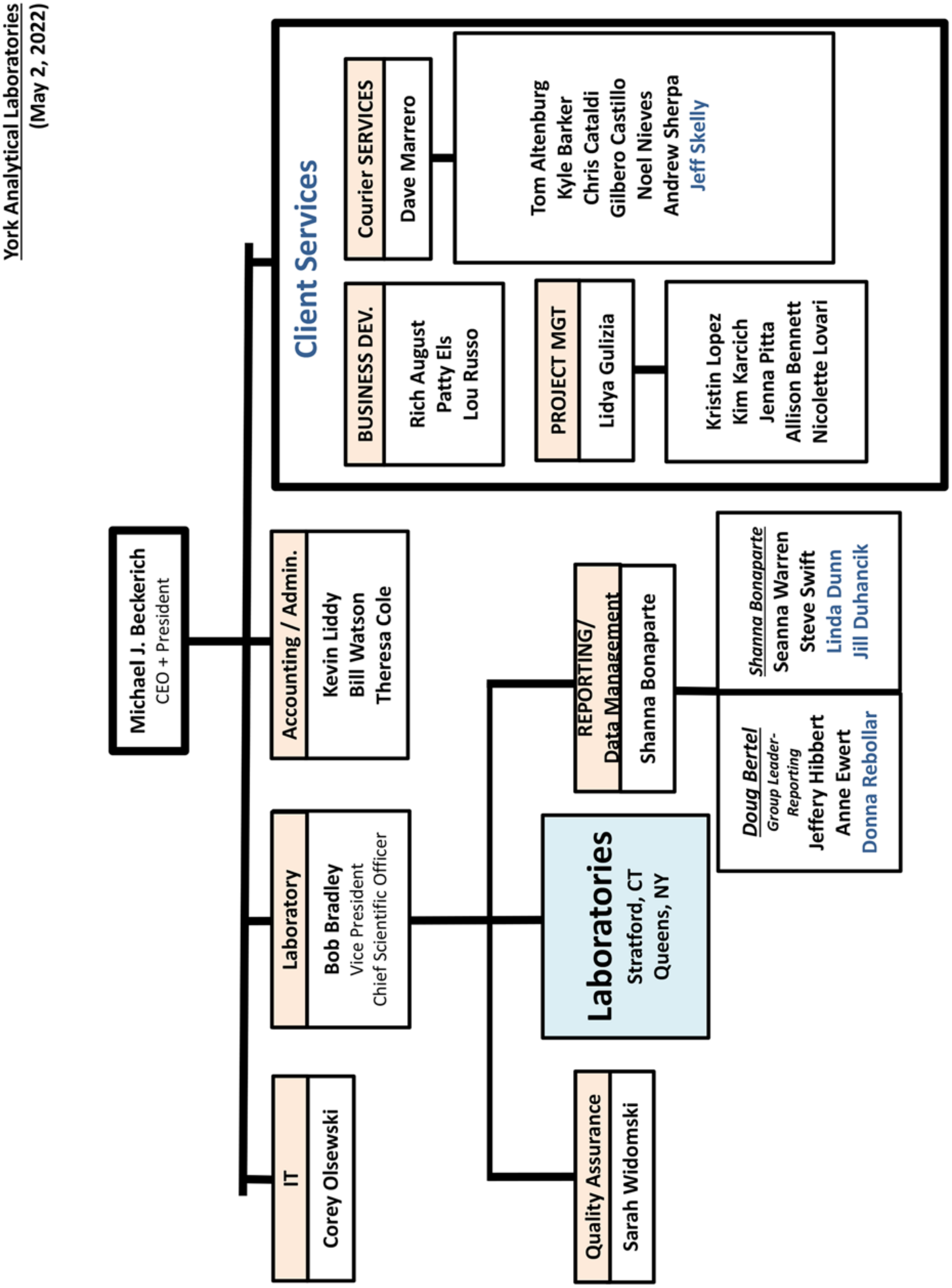
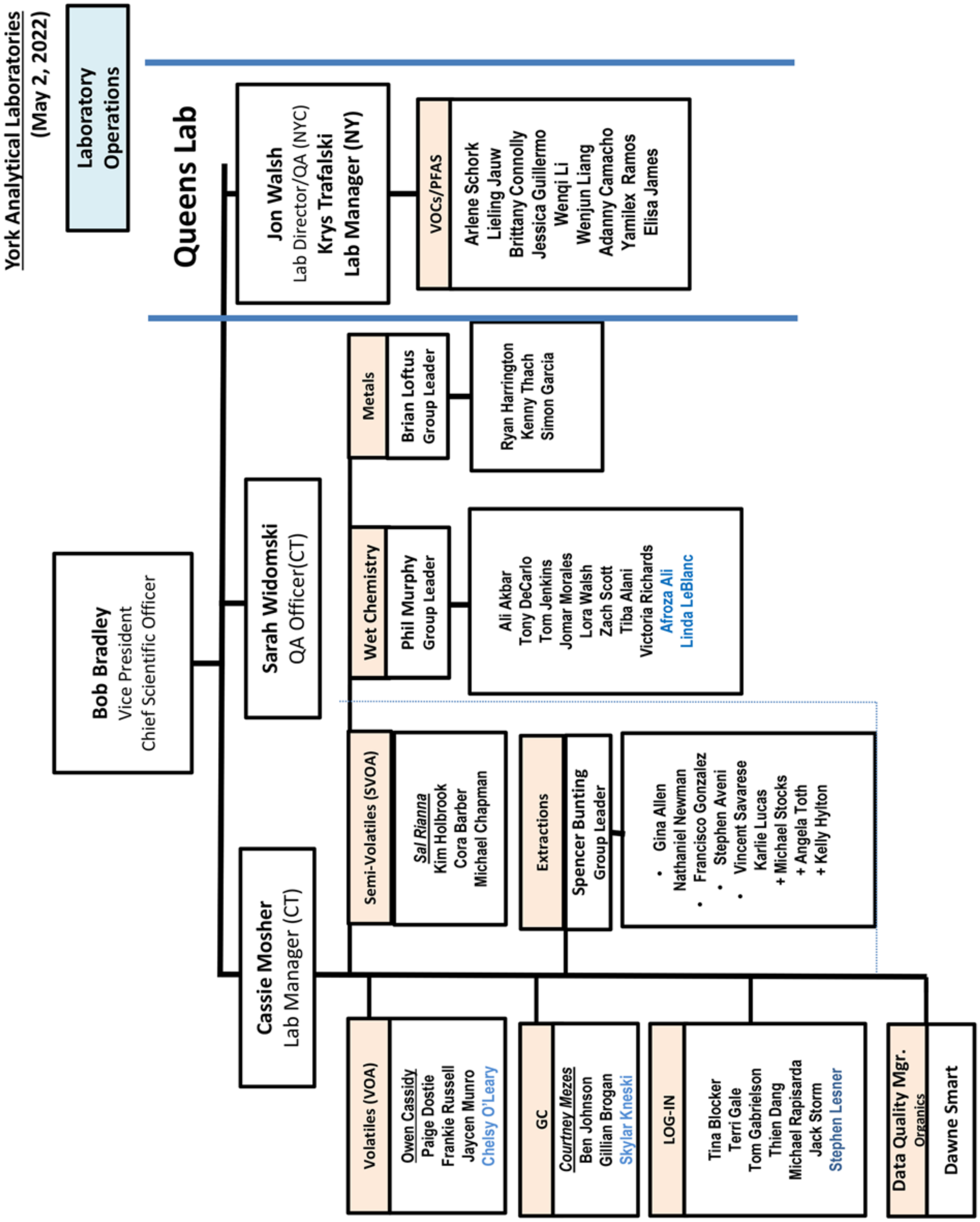


Figure 1. Company Organizational Chart

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. During health crises, such as pandemics or other similar disease outbreaks, Internal Audits may be suspended until such time as management deems the threat to health is no longer an issue. As a substitute, a desk internal audit may be done to accomplish these tasks,

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 (typically 30 days) as indicated in the quality manual and/or SOPs. Specific Audit checklists are employed 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);

i) In-depth data integrity assessments.

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 NIST-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 $\geq$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.

9.5.1 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.

9.5.2 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.

9.5.2.1 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.

9.5.2.2 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.

10.2.1 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.

10.2.2 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

10.3 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.

10.4 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.

10.5 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.

10.6 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).

10.7 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.

10.8 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.

10.9 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 while others may be logbook 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.

10.10 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.

11.3.1 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.

11.4 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.

11.5 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.

11.6 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 to 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:

- Vice President/Chief Scientific 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:

- Vice President/Chief Scientific 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 Vice President/Chief Scientific 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.

American Association for Laboratory Accreditation April 1996. General Requirements for Accreditation.

“American National Standards Speficiationn and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC E-4),” 1994.

EPA 2185 - Good Automated Laboratory Practices, 1995 available at www.epa.gov/docs/etsdwe1/irm_galp/

EPA/600/3-89/013 Ecological Assessment of Hazardous Waste Sites, Office of Research and Development, Washington, DC, 1991.

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 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 relative 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 relative 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.

D.1.11 Proficiency Testing

The purpose of proficiency testing is to ensure the quality of analytical work carried out in the laboratory. These control measures test the analysts as well as the laboratory procedures for their accuracy.

The list of proficiency programs the laboratory participates in is maintained by the QA officer and includes NYSDOH ELAP, CTDOH Proficiency Program and NJDEP Office of Quality Assurance for TO-15 Air and NJDEP EPH.

The PT samples MUST be received, processed and tested as routine samples in the laboratory. Instruction sheets associated with the PT samples MUST be followed. PT studies MUST be analyzed in the same manner as regular samples. The same test method procedures and the same internal QC protocol MUST be used when analyzing PT studies.

NEVER send PT samples to another laboratory for any reason. NEVER discuss PT results with another laboratory (including intra-laboratory communication).

Laboratories are responsible for submitting PT results to the PT provider by the deadline listed on the instruction form. Results are entered online to the PT provider and the laboratory must retain a copy of the data submission form and any attestation sheets, if provided by the PT provider. Attestation sheets must be signed by the appropriate designee.

The QA Officer reviews the evaluated results from the PT program and circulates the results to the Laboratory Director, Technical Director and Laboratory Management for final review. The QA Officer maintains records of all PT results and Corrective Actions due to any PT failure.

The laboratory must retain a copy of all PT records for a minimum of 5 years from the date of testing. This includes raw data, the data submission for, evaluation report, and corrective actions if required.

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
- **Connecticut Dept. of Health –PH-0723 (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
    - Wet Chemistry parameters - soil, non-potable water

- **Connecticut Dept. of Health –PH-0721 (NY Lab)**
    - Volatiles Organics – soil, non-potable water
    - PFAS in potable water

APPENDIX F – LIST OF PHYSICAL LOCATIONS

F.1 Connecticut Laboratories

- 120 Research Drive Stratford, CT 06615
- 203-325-1371 Fax 203-357-0166
  - clientservices@yorklab.com

- 56 Church Hill Road #2 Newtown, CT 06470
- 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

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F.4 New York Service Center (Long Island)

- 163 Bridge Road, Suite 102, Islandia, NY 11749
- 203-325-1371 Fax 203-357-0166
  - clientservices@yorklab.com

F.5 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, 2022	3
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

Equipment & Instrumentation	*Year Acquired*	*Quantity*
Gas Chromatograph (HP 5890 Dual Inj/Dual FID, HP Chem Sta.)	2011-2014	3
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/MS-MS- Agilent 1260/6460C triple Quad system w/ autosampler	2022	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

Equipment & Instrumentation	*Year Acquired*	*Quantity*
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
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

Equipment & Instrumentation	*Year Acquired*	*Quantity*
Soxhlet Extraction Apparati/hot plates	2010	24
Specific Ion Electrode, Chloride (Orion)	2001	1
Specific Ion Electrode, Chlorine (Orion)	2004	1
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 H – 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_ LCMSMS537.1 Rev 1.5	01/22/2022
GC/MS-TO-15			
1	VOCs in AIR by EPA TO-15	GCMSAIRQTO15-Rev 9.9	03/01/2022
2	Cleaning of Summa Canisters	SummaClean Rev 1.5	03/01/2022
3	Calibration of Flow Controllers	FLOWCONT Rev 1.4	03/01/2022
GC/MS - Volatiles			
1	Volatile Organics using GC/MS by EPA method 8260C	GCMS QVOC8260C-Rev 3.8	04/01/2021
2	Volatile Organics using GC/MS by EPA method 8260D	GCMS QVOC8260D – Rev 1.0	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

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2025
Issued April 01, 2024

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. CATHERINE L. MOSHER
YORK ANALYTICAL LABORATORIES INC
120 RESEARCH DRIVE
STRATFORD, CT 06615

NY Lab Id No: 10854

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Fuel Additives

Methyl tert-butyl ether	EPA 524.2
Naphthalene	EPA 524.2

Metals I

Arsenic, Total	EPA 200.8 Rev. 5.4
Barium, Total	EPA 200.7 Rev. 4.4
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Chromium, Total	EPA 200.7 Rev. 4.4
Copper, Total	EPA 200.7 Rev. 4.4
Iron, Total	EPA 200.7 Rev. 4.4
Lead, Total	EPA 200.8 Rev. 5.4
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Mercury, Total	EPA 245.1 Rev. 3.0
Selenium, Total	EPA 200.8 Rev. 5.4
Silver, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

Metals II

Aluminum, Total	EPA 200.7 Rev. 4.4
Antimony, Total	EPA 200.8 Rev. 5.4
Beryllium, Total	EPA 200.7 Rev. 4.4
Molybdenum, Total	EPA 200.8 Rev. 5.4
Nickel, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

Serial No.: 68592

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Metals II

Thallium, Total	EPA 200.8 Rev. 5.4
Vanadium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

Metals III

Calcium, Total	EPA 200.7 Rev. 4.4
Magnesium, Total	EPA 200.7 Rev. 4.4
Potassium, Total	EPA 200.7 Rev. 4.4
Sodium, Total	EPA 200.7 Rev. 4.4

Miscellaneous

1,4-Dioxane	EPA 522
Turbidity	EPA 180.1 Rev. 2.0

Non-Metals

Alkalinity	SM 21-23 2320B (-97)
Calcium Hardness	EPA 200.7 Rev. 4.4
Chloride	EPA 300.0 Rev. 2.1
Color	SM 21-23 2120B (-01)
Fluoride, Total	EPA 300.0 Rev. 2.1
Orthophosphate (as P)	SM 19, 21-23 4500-P E (-99)
Solids, Total Dissolved	SM 21-23 2540C (-97)
Specific Conductance	EPA 120.1 Rev. 1982
Sulfate (as SO4)	EPA 300.0 Rev. 2.1

Volatile Aromatics

1,2,3-Trichlorobenzene	EPA 524.2
1,2,4-Trichlorobenzene	EPA 524.2
1,2,4-Trimethylbenzene	EPA 524.2
1,2-Dichlorobenzene	EPA 524.2

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Volatile Aromatics

1,3,5-Trimethylbenzene	EPA 524.2
1,3-Dichlorobenzene	EPA 524.2
1,4-Dichlorobenzene	EPA 524.2
2-Chlorotoluene	EPA 524.2
4-Chlorotoluene	EPA 524.2
Benzene	EPA 524.2
Bromobenzene	EPA 524.2
Chlorobenzene	EPA 524.2
Ethyl benzene	EPA 524.2
Hexachlorobutadiene	EPA 524.2
Isopropylbenzene	EPA 524.2
n-Butylbenzene	EPA 524.2
n-Propylbenzene	EPA 524.2
p-Isopropyltoluene (P-Cymene)	EPA 524.2
sec-Butylbenzene	EPA 524.2
Styrene	EPA 524.2
tert-Butylbenzene	EPA 524.2
Toluene	EPA 524.2
Total Xylenes	EPA 524.2

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 524.2
1,1,1-Trichloroethane	EPA 524.2
1,1,2,2-Tetrachloroethane	EPA 524.2
1,1,2-Trichloroethane	EPA 524.2
1,1-Dichloroethane	EPA 524.2
1,1-Dichloroethene	EPA 524.2
1,1-Dichloropropene	EPA 524.2

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Volatile Halocarbons

1,2,3-Trichloropropane	EPA 524.2
1,2-Dichloroethane	EPA 524.2
1,2-Dichloropropane	EPA 524.2
1,3-Dichloropropane	EPA 524.2
2,2-Dichloropropane	EPA 524.2
Bromochloromethane	EPA 524.2
Bromomethane	EPA 524.2
Carbon tetrachloride	EPA 524.2
Chloroethane	EPA 524.2
Chloromethane	EPA 524.2
cis-1,2-Dichloroethene	EPA 524.2
cis-1,3-Dichloropropene	EPA 524.2
Dibromomethane	EPA 524.2
Dichlorodifluoromethane	EPA 524.2
Methylene chloride	EPA 524.2
Tetrachloroethene	EPA 524.2
trans-1,2-Dichloroethene	EPA 524.2
trans-1,3-Dichloropropene	EPA 524.2
Trichloroethene	EPA 524.2
Trichlorofluoromethane	EPA 524.2
Vinyl chloride	EPA 524.2

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Acrylates

Acrolein (Propenal)	EPA 8260D
	EPA 8260C
	EPA 624.1
Acrylonitrile	EPA 8260D
	EPA 8260C
	EPA 624.1
Methyl methacrylate	EPA 8260D
	EPA 8260C

Amines

1,2-Diphenylhydrazine	EPA 8270D
	EPA 8270E
2-Nitroaniline	EPA 8270D
	EPA 8270E
3-Nitroaniline	EPA 8270D
	EPA 8270E
4-Chloroaniline	EPA 8270D
	EPA 8270E
4-Nitroaniline	EPA 8270D
	EPA 8270E
Aniline	EPA 625.1
	EPA 8270D
	EPA 8270E
Carbazole	EPA 625.1
	EPA 8270D
	EPA 8270E
Diphenylamine	EPA 8270D
	EPA 8270E

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Amines

Pyridine	EPA 625.1
	EPA 8270D
	EPA 8270E

Benzidines

3,3'-Dichlorobenzidine	EPA 625.1
	EPA 8270D
	EPA 8270E
Benzidine	EPA 625.1
	EPA 8270D
	EPA 8270E

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B
	EPA 608.3
4,4'-DDE	EPA 8081B
	EPA 608.3
4,4'-DDT	EPA 8081B
	EPA 608.3
Aldrin	EPA 8081B
	EPA 608.3
alpha-BHC	EPA 8081B
	EPA 608.3
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 8081B
	EPA 608.3
Chlordane Total	EPA 8081B
	EPA 608.3

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Chlorinated Hydrocarbon Pesticides

delta-BHC	EPA 8081B
	EPA 608.3
Dieldrin	EPA 8081B
	EPA 608.3
Endosulfan I	EPA 8081B
	EPA 608.3
Endosulfan II	EPA 8081B
	EPA 608.3
Endosulfan sulfate	EPA 8081B
	EPA 608.3
Endrin	EPA 8081B
	EPA 608.3
Endrin aldehyde	EPA 8081B
	EPA 608.3
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
	EPA 608.3
Heptachlor epoxide	EPA 8081B
	EPA 608.3
Lindane	EPA 8081B
	EPA 608.3
Methoxychlor	EPA 8081B
	EPA 608.3
Mirex	EPA 8081B
Toxaphene	EPA 8081B
	EPA 608.3

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Chlorinated Hydrocarbons

1,2,3-Trichlorobenzene	EPA 8260D
	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
	EPA 8270E
1,2,4-Trichlorobenzene	EPA 625.1
	EPA 8270D
	EPA 8270E
2-Chloronaphthalene	EPA 625.1
	EPA 8270D
	EPA 8270E
Hexachlorobenzene	EPA 8270D
	EPA 8270E
Hexachlorobutadiene	EPA 625.1
	EPA 8270D
	EPA 8270E
Hexachlorocyclopentadiene	EPA 625.1
	EPA 8270D
	EPA 8270E
Hexachloroethane	EPA 625.1
	EPA 8270D
	EPA 8270E
Pentachlorobenzene	EPA 8270D
	EPA 8270E

Chlorophenoxy Acid Pesticides

2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
	SM 6640B-2006

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Chlorophenoxy Acid Pesticides

2,4-D	EPA 8151A
Dicamba	EPA 8151A

Demand

Biochemical Oxygen Demand	SM 5210B-2016
Carbonaceous BOD	SM 5210B-2016
Chemical Oxygen Demand	SM 5220D-2011

Fuel Oxygenates

Di-isopropyl ether	EPA 8260D
	EPA 8260C
Ethanol	EPA 8260D
	EPA 8260C
Methyl tert-butyl ether	EPA 8260D
	EPA 8260C
tert-amyl alcohol	EPA 8260D
	EPA 8260C
tert-amyl methyl ether (TAME)	EPA 8260D
	EPA 8260C
tert-butyl alcohol	EPA 8260D
	EPA 8260C
tert-butyl ethyl ether (ETBE)	EPA 8260D
	EPA 8260C

Haloethers

2,2'-Oxybis(1-chloropropane)	EPA 625.1
	EPA 8270D
	EPA 8270E
4-Bromophenylphenyl ether	EPA 625.1

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Haloethers

4-Bromophenylphenyl ether	EPA 8270D
	EPA 8270E
4-Chlorophenylphenyl ether	EPA 625.1
	EPA 8270D
	EPA 8270E
Bis(2-chloroethoxy)methane	EPA 625.1
	EPA 8270D
	EPA 8270E
Bis(2-chloroethyl)ether	EPA 625.1
	EPA 8270D
	EPA 8270E

Low Level Halocarbons

1,2,3-Trichloropropane, Low Level	EPA 8011
1,2-Dibromo-3-chloropropane, Low Le	EPA 8011
1,2-Dibromoethane, Low Level	EPA 8011

Low Level Polynuclear Aromatics

Acenaphthene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Acenaphthylene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Anthracene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Benzo(a)anthracene Low Level	EPA 8270D

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Low Level Polynuclear Aromatics

Benzo(a)anthracene Low Level	EPA 8270E
	EPA 8270E SIM
Benzo(a)pyrene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Benzo(b)fluoranthene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Benzo(g,h,i)perylene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Benzo(k)fluoranthene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Chrysene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Dibenzo(a,h)anthracene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Fluoranthene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Fluorene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270D

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Low Level Polynuclear Aromatics

Indeno(1,2,3-cd)pyrene Low Level	EPA 8270E
	EPA 8270E SIM
Naphthalene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Phenanthrene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM
Pyrene Low Level	EPA 8270D
	EPA 8270E
	EPA 8270E SIM

Metals I

Barium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
Cadmium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Calcium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
Chromium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D

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Metals I

Chromium, Total	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Copper, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Iron, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Lead, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Magnesium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
Manganese, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D

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Metals I

Manganese, Total	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Nickel, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Potassium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
Silver, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Sodium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D

Metals II

Aluminum, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B

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Issued April 01, 2024

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. CATHERINE L. MOSHER
YORK ANALYTICAL LABORATORIES INC
120 RESEARCH DRIVE
STRATFORD, CT 06615

NY Lab Id No: 10854

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Metals II

Aluminum, Total	EPA 200.8, Rev. 5.4 (1994)
Antimony, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Arsenic, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Beryllium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Chromium VI	EPA 7196A
	SM 3500-Cr B-2011
Mercury, Total	EPA 245.1, Rev. 3.0 (1994)
	EPA 245.2 (Issued 1974, Rev. 1983)
	EPA 7470A
	EPA 7473
Vanadium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C

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Metals II

Vanadium, Total	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Zinc, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D

Metals III

Cobalt, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Molybdenum, Total	EPA 6020A
	EPA 200.8, Rev. 5.4 (1994)
Thallium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Tin, Total	EPA 6020A
	EPA 200.8, Rev. 5.4 (1994)
Titanium, Total	EPA 6020A
	EPA 200.8, Rev. 5.4 (1994)

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Mineral

Alkalinity	SM 2320B-2011
Calcium Hardness	EPA 200.7, Rev. 4.4 (1994)
Chloride	EPA 300.0, Rev. 2.1 (1993)
Fluoride, Total	EPA 300.0, Rev. 2.1 (1993)
Hardness, Total	SM 2340B-2011
Sulfate (as SO4)	EPA 300.0, Rev. 2.1 (1993)

Miscellaneous

Boron, Total	EPA 6020A
	EPA 200.8, Rev. 5.4 (1994)
Bromide	EPA 300.0, Rev. 2.1 (1993)
Color	SM 2120B-2011
Cyanide, Total	SM 4500-CN E-2016
Oil and Grease Total Recoverable	EPA 1664A
Phenols	EPA 420.1 (Rev. 1978)
Specific Conductance	EPA 120.1 (Rev. 1982)
Sulfide (as S)	SM 4500-S2- F-2011
Surfactant (MBAS)	SM 5540C-2011
Turbidity	EPA 180.1, Rev. 2.0 (1993)

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	EPA 625.1
	EPA 8270D
	EPA 8270E
2,6-Dinitrotoluene	EPA 625.1
	EPA 8270D
	EPA 8270E
Isophorone	EPA 625.1

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Nitroaromatics and Isophorone

Isophorone	EPA 8270D
	EPA 8270E
Nitrobenzene	EPA 625.1
	EPA 8270D
	EPA 8270E

Nitrosoamines

N-Nitrosodimethylamine	EPA 625.1
	EPA 8270D
	EPA 8270E
N-Nitrosodi-n-propylamine	EPA 625.1
	EPA 8270D
	EPA 8270E
N-Nitrosodiphenylamine	EPA 625.1
	EPA 8270D
	EPA 8270E

Nutrient

Ammonia (as N)	SM 4500-NH3 D-2011 or E-2011
Kjeldahl Nitrogen, Total	SM 4500-N Org D-2011
	SM 4500-NH3 D-2011 or E-2011
Nitrate (as N)	EPA 300.0, Rev. 2.1 (1993)
Nitrate-Nitrite (as N)	EPA 300.0, Rev. 2.1 (1993)
Nitrite (as N)	EPA 300.0, Rev. 2.1 (1993)
Orthophosphate (as P)	EPA 300.0, Rev. 2.1 (1993)
	SM 4500-P E-2011

Organophosphate Pesticides

Atrazine	EPA 8270D

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Organophosphate Pesticides

Atrazine	EPA 8270E
Parathion ethyl	EPA 8270D
	EPA 8270E

Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015D
Gasoline Range Organics	EPA 8015D

Phthalate Esters

Benzyl butyl phthalate	EPA 625.1
	EPA 8270D
	EPA 8270E
Bis(2-ethylhexyl) phthalate	EPA 625.1
	EPA 8270D
	EPA 8270E
Diethyl phthalate	EPA 625.1
	EPA 8270D
	EPA 8270E
Dimethyl phthalate	EPA 625.1
	EPA 8270D
	EPA 8270E
Di-n-butyl phthalate	EPA 625.1
	EPA 8270D
	EPA 8270E
Di-n-octyl phthalate	EPA 625.1
	EPA 8270D
	EPA 8270E

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Polychlorinated Biphenyls

Aroclor 1016 (PCB-1016)	EPA 8082A
	EPA 608.3
Aroclor 1221 (PCB-1221)	EPA 8082A
	EPA 608.3
Aroclor 1232 (PCB-1232)	EPA 8082A
	EPA 608.3
Aroclor 1242 (PCB-1242)	EPA 8082A
	EPA 608.3
Aroclor 1248 (PCB-1248)	EPA 8082A
	EPA 608.3
Aroclor 1254 (PCB-1254)	EPA 8082A
	EPA 608.3
Aroclor 1260 (PCB-1260)	EPA 8082A
	EPA 608.3
Aroclor 1262 (PCB-1262)	EPA 8082A
Aroclor 1268 (PCB-1268)	EPA 8082A

Polynuclear Aromatics

Acenaphthene	EPA 625.1
	EPA 8270D
	EPA 8270E
Acenaphthylene	EPA 625.1
	EPA 8270D
	EPA 8270E
Anthracene	EPA 625.1
	EPA 8270D
	EPA 8270E
Benzo(a)anthracene	EPA 625.1

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Polynuclear Aromatics

Benzo(a)anthracene	EPA 8270D
	EPA 8270E
Benzo(a)pyrene	EPA 625.1
	EPA 8270D
	EPA 8270E
Benzo(b)fluoranthene	EPA 625.1
	EPA 8270D
	EPA 8270E
Benzo(g,h,i)perylene	EPA 625.1
	EPA 8270D
	EPA 8270E
Benzo(k)fluoranthene	EPA 625.1
	EPA 8270D
	EPA 8270E
Chrysene	EPA 625.1
	EPA 8270D
	EPA 8270E
Dibenzo(a,h)anthracene	EPA 625.1
	EPA 8270D
	EPA 8270E
Fluoranthene	EPA 625.1
	EPA 8270D
	EPA 8270E
Fluorene	EPA 625.1
	EPA 8270D
	EPA 8270E
Indeno(1,2,3-cd)pyrene	EPA 625.1

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Property of the New York State Department of Health. Certificates are valid only at the address shown and must be conspicuously posted by the laboratory. Continued accreditation depends on the laboratory's successful ongoing participation in the Program. Consumers may verify a laboratory's accreditation status online at https://apps.health.ny.gov/pubdoh/applinks/wc/elappublicweb/, by phone (518) 485-5570 or by email to elap@health.ny.gov.

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Polynuclear Aromatics

Indeno(1,2,3-cd)pyrene	EPA 8270D
	EPA 8270E
Naphthalene	EPA 625.1
	EPA 8270D
	EPA 8270E
Phenanthrene	EPA 8270D
	EPA 8270E
Pyrene	EPA 625.1
	EPA 8270D
	EPA 8270E

Priority Pollutant Phenols

2,3,4,6 Tetrachlorophenol	EPA 8270D
	EPA 8270E
2,4,5-Trichlorophenol	EPA 625.1
	EPA 8270D
	EPA 8270E
2,4,6-Trichlorophenol	EPA 625.1
	EPA 8270D
	EPA 8270E
2,4-Dichlorophenol	EPA 625.1
	EPA 8270D
	EPA 8270E
2,4-Dimethylphenol	EPA 625.1
	EPA 8270D
	EPA 8270E
2,4-Dinitrophenol	EPA 8270E
2-Chlorophenol	EPA 625.1

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Priority Pollutant Phenols

2-Chlorophenol	EPA 8270D
	EPA 8270E
2-Methyl-4,6-dinitrophenol	EPA 625.1
	EPA 8270D
	EPA 8270E
2-Methylphenol	EPA 625.1
	EPA 8270D
	EPA 8270E
2-Nitrophenol	EPA 625.1
	EPA 8270D
	EPA 8270E
4-Chloro-3-methylphenol	EPA 625.1
	EPA 8270D
	EPA 8270E
4-Methylphenol	EPA 625.1
	EPA 8270D
	EPA 8270E
4-Nitrophenol	EPA 625.1
	EPA 8270D
	EPA 8270E
Cresols, Total	EPA 8270D
	EPA 8270E
Pentachlorophenol	EPA 625.1
	EPA 8270D
	EPA 8270E
Phenol	EPA 625.1
	EPA 8270D

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Priority Pollutant Phenols

Phenol	EPA 8270E

Residue

Settleable Solids	SM 2540 F-2015
Solids, Total	SM 2540 B-2015
Solids, Total Dissolved	SM 2540 C-2015
Solids, Total Suspended	SM 2540 D-2015

Semi-Volatile Organics

1,1'-Biphenyl	EPA 8270D
	EPA 8270E
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
	EPA 8270E
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
	EPA 8270E
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
	EPA 8270E
2-Methylnaphthalene	EPA 8270D
	EPA 8270E
Acetophenone	EPA 8270D
	EPA 8270E
alpha-Terpineol	EPA 625.1
	EPA 8270E
Benzaldehyde	EPA 8270D
	EPA 8270E
Benzoic Acid	EPA 8270D
	EPA 8270E
Benzyl alcohol	EPA 8270D

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Semi-Volatile Organics

Benzyl alcohol	EPA 8270E
Caprolactam	EPA 8270D
	EPA 8270E
Dibenzofuran	EPA 8270D
	EPA 8270E

Volatile Aromatics

1,2,4-Trichlorobenzene, Volatile	EPA 8260D
	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260D
	EPA 8260C
1,2-Dichlorobenzene	EPA 8260D
	EPA 8260C
	EPA 624.1
1,3,5-Trimethylbenzene	EPA 8260D
	EPA 8260C
1,3-Dichlorobenzene	EPA 8260D
	EPA 8260C
	EPA 624.1
1,4-Dichlorobenzene	EPA 8260D
	EPA 8260C
	EPA 624.1
2-Chlorotoluene	EPA 8260D
	EPA 8260C
4-Chlorotoluene	EPA 8260D
	EPA 8260C
Benzene	EPA 8260D
	EPA 8260C

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Volatile Aromatics

Benzene	EPA 624.1
Bromobenzene	EPA 8260D
	EPA 8260C
Chlorobenzene	EPA 8260D
	EPA 8260C
	EPA 624.1
Ethyl benzene	EPA 8260D
	EPA 8260C
	EPA 624.1
Isopropylbenzene	EPA 8260D
	EPA 8260C
m/p-Xylenes	EPA 8260D
	EPA 8260C
	EPA 624.1
Naphthalene, Volatile	EPA 8260D
	EPA 8260C
n-Butylbenzene	EPA 8260D
	EPA 8260C
n-Propylbenzene	EPA 8260D
	EPA 8260C
o-Xylene	EPA 8260D
	EPA 8260C
	EPA 624.1
p-Isopropyltoluene (P-Cymene)	EPA 8260D
	EPA 8260C
sec-Butylbenzene	EPA 8260D
	EPA 8260C

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Volatile Aromatics

Styrene	EPA 8260D
	EPA 8260C
	EPA 624.1
tert-Butylbenzene	EPA 8260D
	EPA 8260C
Toluene	EPA 8260D
	EPA 8260C
	EPA 624.1
Total Xylenes	EPA 8260D
	EPA 8260C
	EPA 624.1

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 8260D
	EPA 8260C
1,1,1-Trichloroethane	EPA 8260D
	EPA 8260C
	EPA 624.1
1,1,2,2-Tetrachloroethane	EPA 8260D
	EPA 8260C
	EPA 624.1
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260D
	EPA 8260C
1,1,2-Trichloroethane	EPA 8260D
	EPA 8260C
	EPA 624.1
1,1-Dichloroethane	EPA 8260D
	EPA 8260C

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Volatile Halocarbons

1,1-Dichloroethane	EPA 624.1
1,1-Dichloroethene	EPA 8260D
	EPA 8260C
	EPA 624.1
1,1-Dichloropropene	EPA 8260D
	EPA 8260C
1,2,3-Trichloropropane	EPA 8260D
	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260D
	EPA 8260C
1,2-Dibromoethane	EPA 8260D
	EPA 8260C
1,2-Dichloroethane	EPA 8260D
	EPA 8260C
	EPA 624.1
1,2-Dichloropropane	EPA 8260D
	EPA 8260C
	EPA 624.1
1,3-Dichloropropane	EPA 8260D
	EPA 8260C
2,2-Dichloropropane	EPA 8260D
	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260D
	EPA 8260C
	EPA 624.1
Bromochloromethane	EPA 8260D
	EPA 8260C

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Volatile Halocarbons

Bromodichloromethane	EPA 8260D
	EPA 8260C
	EPA 624.1
Bromoform	EPA 8260D
	EPA 8260C
	EPA 624.1
Bromomethane	EPA 8260D
	EPA 8260C
	EPA 624.1
Carbon tetrachloride	EPA 8260D
	EPA 8260C
	EPA 624.1
Chloroethane	EPA 8260D
	EPA 8260C
	EPA 624.1
Chloroform	EPA 8260D
	EPA 8260C
	EPA 624.1
Chloromethane	EPA 8260D
	EPA 8260C
	EPA 624.1
cis-1,2-Dichloroethene	EPA 8260D
	EPA 8260C
	EPA 624.1
cis-1,3-Dichloropropene	EPA 8260D
	EPA 8260C
	EPA 624.1

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Volatile Halocarbons

Dibromochloromethane	EPA 8260D
	EPA 8260C
	EPA 624.1
Dibromomethane	EPA 8260D
	EPA 8260C
Dichlorodifluoromethane	EPA 8260D
	EPA 8260C
	EPA 624.1
Hexachlorobutadiene, Volatile	EPA 8260D
	EPA 8260C
Methylene chloride	EPA 8260D
	EPA 8260C
	EPA 624.1
Tetrachloroethene	EPA 8260D
	EPA 8260C
	EPA 624.1
trans-1,2-Dichloroethene	EPA 8260D
	EPA 8260C
	EPA 624.1
trans-1,3-Dichloropropene	EPA 8260D
	EPA 8260C
	EPA 624.1
trans-1,4-Dichloro-2-butene	EPA 8260D
	EPA 8260C
Trichloroethene	EPA 8260D
	EPA 8260C
	EPA 624.1

Serial No.: 68593

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

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Issued April 01, 2024

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. CATHERINE L. MOSHER
YORK ANALYTICAL LABORATORIES INC
120 RESEARCH DRIVE
STRATFORD, CT 06615

NY Lab Id No: 10854

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Volatile Halocarbons

Trichlorofluoromethane	EPA 8260D
	EPA 8260C
	EPA 624.1
Vinyl chloride	EPA 8260D
	EPA 8260C
	EPA 624.1

Volatiles Organics

1,4-Dioxane	EPA 8260D
	EPA 8260C
	EPA 8270D SIM
	EPA 8270E
	EPA 8270E SIM
2-Butanone (Methylethyl ketone)	EPA 8260D
	EPA 8260C
2-Hexanone	EPA 8260D
	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260D
	EPA 8260C
Acetone	EPA 8260D
	EPA 8260C
Carbon Disulfide	EPA 8260D
	EPA 8260C
Cyclohexane	EPA 8260D
	EPA 8260C
Methyl acetate	EPA 8260D
	EPA 8260C
Methyl cyclohexane	EPA 8260D

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Volatiles Organics

Methyl cyclohexane	EPA 8260C
Vinyl acetate	EPA 8260D
	EPA 8260C

Sample Preparation Methods

	SM 4500-P B(5)-2011
	EPA 5030C
	SM 4500-CN B-2016 and C-2016
	EPA 3015A
	EPA 3010A
	EPA 3005A
	EPA 3510C
	SM 4500-N Org B-2011 or C-2011

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All approved subcategories and/or analytes are listed below:

Miscellaneous

non-Polar Extractable Material (TPH)	EPA 1664A
Organic Carbon, Total	SM 5310B-2014

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ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
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Acrylates

Acrolein (Propenal)	EPA 8260D
	EPA 8260C
Acrylonitrile	EPA 8260D
	EPA 8260C
Methyl methacrylate	EPA 8260D
	EPA 8260C

Amines

1,2-Diphenylhydrazine	EPA 8270D
	EPA 8270E
2-Nitroaniline	EPA 8270D
	EPA 8270E
3-Nitroaniline	EPA 8270D
	EPA 8270E
4-Chloroaniline	EPA 8270D
	EPA 8270E
4-Nitroaniline	EPA 8270D
	EPA 8270E
Aniline	EPA 8270D
	EPA 8270E
Carbazole	EPA 8270D
	EPA 8270E
Diphenylamine	EPA 8270D
	EPA 8270E

Benzidines

3,3'-Dichlorobenzidine	EPA 8270D
	EPA 8270E

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Benzidines

Benzidine	EPA 8270D
	EPA 8270E

Characteristic Testing

Corrosivity (pH)	EPA 9045D
Free Liquids	EPA 9095B
Ignitability	EPA 1010A
Synthetic Precipitation Leaching Proc.	EPA 1312
TCLP	EPA 1311

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B
4,4'-DDE	EPA 8081B
4,4'-DDT	EPA 8081B
Aldrin	EPA 8081B
alpha-BHC	EPA 8081B
alpha-Chlordane	EPA 8081B
Atrazine	EPA 8270D
	EPA 8270E
beta-BHC	EPA 8081B
Chlordane Total	EPA 8081B
delta-BHC	EPA 8081B
Dieldrin	EPA 8081B
Endosulfan I	EPA 8081B
Endosulfan II	EPA 8081B
Endosulfan sulfate	EPA 8081B
Endrin	EPA 8081B
Endrin aldehyde	EPA 8081B

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Chlorinated Hydrocarbon Pesticides

Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
Heptachlor epoxide	EPA 8081B
Lindane	EPA 8081B
Mirex	EPA 8081B
Toxaphene	EPA 8081B

Chlorinated Hydrocarbons

1,2,3-Trichlorobenzene	EPA 8260D
	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
	EPA 8270E
1,2,4-Trichlorobenzene	EPA 8270D
	EPA 8270E
2-Chloronaphthalene	EPA 8270D
	EPA 8270E
Hexachlorobenzene	EPA 8270D
	EPA 8270E
Hexachlorobutadiene	EPA 8270D
	EPA 8270E
Hexachlorocyclopentadiene	EPA 8270D
	EPA 8270E
Hexachloroethane	EPA 8270D
	EPA 8270E

Chlorophenoxy Acid Pesticides

2,4,5-T	EPA 8151A

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Chlorophenoxy Acid Pesticides

2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
Dicamba	EPA 8151A

Haloethers

2,2'-Oxybis(1-chloropropane)	EPA 8270D
	EPA 8270E
4-Bromophenylphenyl ether	EPA 8270D
	EPA 8270E
4-Chlorophenylphenyl ether	EPA 8270D
	EPA 8270E
Bis(2-chloroethoxy)methane	EPA 8270D
	EPA 8270E
Bis(2-chloroethyl)ether	EPA 8270D
	EPA 8270E

Metals I

Barium, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Cadmium, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Calcium, Total	EPA 6010C
	EPA 6010D
Chromium, Total	EPA 6010C

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Metals I

Chromium, Total	EPA 6010D
	EPA 6020A
	EPA 6020B
Copper, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Iron, Total	EPA 6010C
	EPA 6010D
Lead, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Magnesium, Total	EPA 6010C
	EPA 6010D
Manganese, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Nickel, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Potassium, Total	EPA 6010C
	EPA 6010D
Silver, Total	EPA 6010C
	EPA 6010D

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Metals I

Silver, Total	EPA 6020A
	EPA 6020B
Sodium, Total	EPA 6010C
	EPA 6010D

Metals II

Aluminum, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Antimony, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Arsenic, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Beryllium, Total	EPA 6010C
	EPA 6010D
Chromium VI	EPA 7196A
Mercury, Total	EPA 7471B
	EPA 7473
Selenium, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Vanadium, Total	EPA 6010C

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Metals II	
Vanadium, Total	EPA 6010D
	EPA 6020A
	EPA 6020B
Zinc, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Metals III	
Cobalt, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Molybdenum, Total	EPA 6020A
Thallium, Total	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
Tin, Total	EPA 6020A
	EPA 6020B
Titanium, Total	EPA 6020A
Miscellaneous	
Boron, Total	EPA 6020A
	EPA 6020B
Cyanide, Total	EPA 9014
Extractable Organic Halides	EPA 9023

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Nitroaromatics and Isophorone

2,4-Dinitrotoluene	EPA 8270D
	EPA 8270E
2,6-Dinitrotoluene	EPA 8270D
	EPA 8270E
Isophorone	EPA 8270D
	EPA 8270E
Nitrobenzene	EPA 8270D
	EPA 8270E
Pyridine	EPA 8270D
	EPA 8270E

Nitrosoamines

N-Nitrosodimethylamine	EPA 8270D
	EPA 8270E
N-Nitrosodi-n-propylamine	EPA 8270D
	EPA 8270E
N-Nitrosodiphenylamine	EPA 8270D
	EPA 8270E

Organophosphate Pesticides

Parathion ethyl	EPA 8270D
	EPA 8270E

Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015D
Gasoline Range Organics	EPA 8015D

Phthalate Esters

Benzyl butyl phthalate	EPA 8270D
	EPA 8270E

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Phthalate Esters

Bis(2-ethylhexyl) phthalate	EPA 8270D
	EPA 8270E
Diethyl phthalate	EPA 8270D
	EPA 8270E
Dimethyl phthalate	EPA 8270D
	EPA 8270E
Di-n-butyl phthalate	EPA 8270D
	EPA 8270E
Di-n-octyl phthalate	EPA 8270D
	EPA 8270E

Polychlorinated Biphenyls

Aroclor 1016 (PCB-1016)	EPA 8082A
Aroclor 1016 (PCB-1016) in Oil	EPA 8082A
Aroclor 1221 (PCB-1221)	EPA 8082A
Aroclor 1221 (PCB-1221) in Oil	EPA 8082A
Aroclor 1232 (PCB-1232)	EPA 8082A
Aroclor 1232 (PCB-1232) in Oil	EPA 8082A
Aroclor 1242 (PCB-1242)	EPA 8082A
Aroclor 1242 (PCB-1242) in Oil	EPA 8082A
Aroclor 1248 (PCB-1248)	EPA 8082A
Aroclor 1248 (PCB-1248) in Oil	EPA 8082A
Aroclor 1254 (PCB-1254)	EPA 8082A
Aroclor 1254 (PCB-1254) in Oil	EPA 8082A
Aroclor 1260 (PCB-1260)	EPA 8082A
Aroclor 1260 (PCB-1260) in Oil	EPA 8082A
Aroclor 1262 (PCB-1262)	EPA 8082A
Aroclor 1262 (PCB-1262) in Oil	EPA 8082A

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Polychlorinated Biphenyls

Aroclor 1268 (PCB-1268)	EPA 8082A
Aroclor 1268 (PCB-1268) in Oil	EPA 8082A

Polynuclear Aromatic Hydrocarbons

Acenaphthene	EPA 8270D
	EPA 8270E
Acenaphthylene	EPA 8270D
	EPA 8270E
Anthracene	EPA 8270D
	EPA 8270E
Benzo(a)anthracene	EPA 8270D
	EPA 8270E
Benzo(a)pyrene	EPA 8270D
	EPA 8270E
Benzo(b)fluoranthene	EPA 8270D
	EPA 8270E
Benzo(g,h,i)perylene	EPA 8270D
	EPA 8270E
Benzo(k)fluoranthene	EPA 8270D
	EPA 8270E
Dibenzo(a,h)anthracene	EPA 8270D
	EPA 8270E
Fluoranthene	EPA 8270D
	EPA 8270E
Fluorene	EPA 8270D
	EPA 8270E
Indeno(1,2,3-cd)pyrene	EPA 8270D
	EPA 8270E

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Polynuclear Aromatic Hydrocarbons

Naphthalene	EPA 8270D
	EPA 8270E
Phenanthrene	EPA 8270D
	EPA 8270E
Pyrene	EPA 8270D
	EPA 8270E

Priority Pollutant Phenols

2,3,4,6 Tetrachlorophenol	EPA 8270D
	EPA 8270E
2,4,5-Trichlorophenol	EPA 8270D
	EPA 8270E
2,4,6-Trichlorophenol	EPA 8270D
	EPA 8270E
2,4-Dichlorophenol	EPA 8270D
	EPA 8270E
2,4-Dimethylphenol	EPA 8270D
	EPA 8270E
2,4-Dinitrophenol	EPA 8270D
	EPA 8270E
2-Chlorophenol	EPA 8270D
	EPA 8270E
2-Methyl-4,6-dinitrophenol	EPA 8270D
	EPA 8270E
2-Methylphenol	EPA 8270D
	EPA 8270E
2-Nitrophenol	EPA 8270D
	EPA 8270E

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Priority Pollutant Phenols

4-Chloro-3-methylphenol	EPA 8270D
	EPA 8270E
4-Methylphenol	EPA 8270D
	EPA 8270E
4-Nitrophenol	EPA 8270D
	EPA 8270E
Pentachlorophenol	EPA 8270D
	EPA 8270E
Phenol	EPA 8270D
	EPA 8270E

Semi-Volatile Organics

1,1'-Biphenyl	EPA 8270D
	EPA 8270E
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
	EPA 8270E
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
	EPA 8270E
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
	EPA 8270E
2-Methylnaphthalene	EPA 8270D
	EPA 8270E
Acetophenone	EPA 8270D
	EPA 8270E
Benzaldehyde	EPA 8270D
	EPA 8270E
Benzoic Acid	EPA 8270D
	EPA 8270E

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Semi-Volatile Organics

Benzyl alcohol	EPA 8270D
	EPA 8270E
Caprolactam	EPA 8270D
	EPA 8270E
Dibenzofuran	EPA 8270D
	EPA 8270E

Volatile Aromatics

1,2,4-Trichlorobenzene, Volatile	EPA 8260D
	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260D
	EPA 8260C
1,2-Dichlorobenzene	EPA 8260D
	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260D
	EPA 8260C
1,3-Dichlorobenzene	EPA 8260D
	EPA 8260C
1,4-Dichlorobenzene	EPA 8260D
	EPA 8260C
2-Chlorotoluene	EPA 8260D
	EPA 8260C
4-Chlorotoluene	EPA 8260D
	EPA 8260C
Benzene	EPA 8260D
	EPA 8260C
Bromobenzene	EPA 8260D
	EPA 8260C

Serial No.: 68595

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2025
Issued April 01, 2024

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. CATHERINE L. MOSHER
YORK ANALYTICAL LABORATORIES INC
120 RESEARCH DRIVE
STRATFORD, CT 06615

NY Lab Id No: 10854

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE All approved analytes are listed below:

Volatile Aromatics

Chlorobenzene	EPA 8260D
	EPA 8260C
Ethyl benzene	EPA 8260D
	EPA 8260C
Isopropylbenzene	EPA 8260D
	EPA 8260C
m/p-Xylenes	EPA 8260D
	EPA 8260C
Naphthalene, Volatile	EPA 8260D
	EPA 8260C
n-Butylbenzene	EPA 8260D
	EPA 8260C
n-Propylbenzene	EPA 8260D
	EPA 8260C
o-Xylene	EPA 8260D
	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260D
	EPA 8260C
sec-Butylbenzene	EPA 8260D
	EPA 8260C
Styrene	EPA 8260D
	EPA 8260C
tert-Butylbenzene	EPA 8260D
	EPA 8260C
Toluene	EPA 8260D
	EPA 8260C
Total Xylenes	EPA 8260D

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Volatile Aromatics

Total Xylenes	EPA 8260C

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 8260D
	EPA 8260C
1,1,1-Trichloroethane	EPA 8260D
	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 8260D
	EPA 8260C
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260D
	EPA 8260C
1,1,2-Trichloroethane	EPA 8260D
	EPA 8260C
1,1-Dichloroethane	EPA 8260D
	EPA 8260C
1,1-Dichloroethene	EPA 8260D
	EPA 8260C
1,1-Dichloropropene	EPA 8260D
	EPA 8260C
1,2,3-Trichloropropane	EPA 8260D
	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260D
	EPA 8260C
1,2-Dibromoethane	EPA 8260D
	EPA 8260C
1,2-Dichloroethane	EPA 8260D
	EPA 8260C
1,2-Dichloropropane	EPA 8260D

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Volatile Halocarbons

1,2-Dichloropropane	EPA 8260C
1,3-Dichloropropane	EPA 8260D
	EPA 8260C
2,2-Dichloropropane	EPA 8260D
	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260D
	EPA 8260C
Bromochloromethane	EPA 8260D
	EPA 8260C
Bromodichloromethane	EPA 8260D
	EPA 8260C
Bromoform	EPA 8260D
	EPA 8260C
Bromomethane	EPA 8260D
	EPA 8260C
Carbon tetrachloride	EPA 8260D
	EPA 8260C
Chloroethane	EPA 8260D
	EPA 8260C
Chloroform	EPA 8260D
	EPA 8260C
Chloromethane	EPA 8260D
	EPA 8260C
cis-1,2-Dichloroethene	EPA 8260D
	EPA 8260C
cis-1,3-Dichloropropene	EPA 8260D
	EPA 8260C

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Volatile Halocarbons

Dibromochloromethane	EPA 8260D
	EPA 8260C
Dibromomethane	EPA 8260D
	EPA 8260C
Dichlorodifluoromethane	EPA 8260D
	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260D
	EPA 8260C
Methylene chloride	EPA 8260D
	EPA 8260C
Tetrachloroethene	EPA 8260D
	EPA 8260C
trans-1,2-Dichloroethene	EPA 8260D
	EPA 8260C
trans-1,3-Dichloropropene	EPA 8260D
	EPA 8260C
Trichloroethene	EPA 8260D
	EPA 8260C
Trichlorofluoromethane	EPA 8260D
	EPA 8260C
Vinyl chloride	EPA 8260D
	EPA 8260C

Volatile Organics

1,4-Dioxane	EPA 8260D
	EPA 8260C
	EPA 8270D SIM
	EPA 8270E

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Volatile Organics

1,4-Dioxane	EPA 8270E SIM
2-Butanone (Methylethyl ketone)	EPA 8260D
	EPA 8260C
2-Hexanone	EPA 8260D
	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260D
	EPA 8260C
Acetone	EPA 8260D
	EPA 8260C
Carbon Disulfide	EPA 8260D
	EPA 8260C
Cyclohexane	EPA 8260D
	EPA 8260C
Methyl acetate	EPA 8260D
	EPA 8260C
Methyl cyclohexane	EPA 8260D
	EPA 8260C
Methyl tert-butyl ether	EPA 8260D
	EPA 8260C
tert-butyl alcohol	EPA 8260D
	EPA 8260C
Vinyl acetate	EPA 8260D
	EPA 8260C

Sample Preparation Methods

	EPA 5035A-L
	EPA 5035A-H
	EPA 3580A

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Sample Preparation Methods

EPA 3010A
EPA 3050B
EPA 3550C
EPA 3546
EPA 3545A
EPA 9010C

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Miscellaneous

Lead in Dust Wipes	EPA 6010C
Lead in Paint	EPA 6010C

Sample Preparation Methods

	EPA 3050B

Serial No.: 68596

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MR. KRZYSZTOF TRAFALSKI
YORK ANALYTICAL LABORATORIES, INC. (II)
132-02 89TH AVENUE SUITE 217
RICHMOND HILL, NY 11418

NY Lab Id No: 12058

is hereby APPROVED as an Environmental Laboratory for the category
ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved subcategories and/or analytes are listed below:

Perfluorinated Alkyl Acids

8:2FTS	EPA 1633 (Draft)
NETFOSAA	EPA 1633 (Draft)
NMEFOSAA	EPA 1633 (Draft)
Perflourotridecanoic Acid (PFTRDA)	EPA 1633 (Draft)
Perfluordecanoic Acid (PFDA)	EPA 1633 (Draft)
Perfluorobutanoic Acid (PFBA)	EPA 1633 (Draft)
Perfluorododecanoic Acid (PFDOA)	EPA 1633 (Draft)
Perfluoroheptanoic Acid (PFHPA)	EPA 1633 (Draft)
Perfluorohexanoic Acid (PFHXA)	EPA 1633 (Draft)
Perfluorononanoic Acid (PFNA)	EPA 1633 (Draft)
Perfluorooctanesulfonic Acid (PFOS)	EPA 1633 (Draft)
Perfluorooctanoic Acid (PFOA)	EPA 1633 (Draft)
Perfluoropentanoic Acid (PFPEA)	EPA 1633 (Draft)
Perfluorotetradecanoic Acid (PFTA)	EPA 1633 (Draft)
Perfluoroundecanoic Acid (PFUNA)	EPA 1633 (Draft)

Serial No.: 69092

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YORK ANALYTICAL LABORATORIES, INC. (II)
132-02 89TH AVENUE SUITE 217
RICHMOND HILL, NY 11418

NY Lab Id No: 12058

is hereby APPROVED as an Environmental Laboratory for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved subcategories and/or analytes are listed below:

Perfluorinated Alkyl Acids

11CL-PF3OUDS	EPA 1633 (Draft)
4:2FTS	EPA 1633 (Draft)
6:2FTS	EPA 1633 (Draft)
8:2FTS	EPA 1633 (Draft)
9CL-PF3ONS	EPA 1633 (Draft)
ADONA	EPA 1633 (Draft)
Hexafluoropropylene Oxide Dimer Aci	EPA 1633 (Draft)
NETFOSAA	EPA 1633 (Draft)
NMEFOSAA	EPA 1633 (Draft)
Nonafluoro-3,6-Dioxaheptanoic Acid	EPA 1633 (Draft)
Perflourotridecanoic Acid (PFTRDA)	EPA 1633 (Draft)
Perfluordecanoic Acid (PFDA)	EPA 1633 (Draft)
Perfluoro-3-Methoxypropanoic Acid	EPA 1633 (Draft)
Perfluoro-4-Methoxybutanoic Acid	EPA 1633 (Draft)
Perfluorobutanesulfonic Acid (PFBS)	EPA 1633 (Draft)
Perfluorobutanoic Acid (PFBA)	EPA 1633 (Draft)
Perfluorododecanoic Acid (PFDOA)	EPA 1633 (Draft)
Perfluoroheptanesulfonic Acid (PFHPS	EPA 1633 (Draft)
Perfluoroheptanoic Acid (PFHPA)	EPA 1633 (Draft)
Perfluorohexanesulfonic Acid (PFHXS	EPA 1633 (Draft)
Perfluorohexanoic Acid (PFHXA)	EPA 1633 (Draft)
Perfluorononanoic Acid (PFNA)	EPA 1633 (Draft)
Perfluorooctanesulfonic Acid (PFOS)	EPA 1633 (Draft)
Perfluorooctanoic Acid (PFOA)	EPA 1633 (Draft)
Perfluoropentanesulfonic Acid (PFPES	EPA 1633 (Draft)
Perfluoropentanoic Acid (PFPEA)	EPA 1633 (Draft)
Perfluoroundecanoic Acid (PFUNA)	EPA 1633 (Draft)

Serial No.: 69090

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Perfluorinated Alkyl Acids

PFEESA	EPA 1633 (Draft)

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APPENDIX F

RESUMES OF KEY PERSONNEL INVOLVED IN THIS PROJECT

TAREK Z. KHOURI, P.E. *Principal Environmental Engineer*

Education

M.S. Environmental Engineering, University of Central Florida

B.S. Chemistry, University of Central Florida

Professional Registration

Professional Engineer (P.E.)
Connecticut # 0031583
D.C. # 908711
Maryland # 49155
Massachusetts # 52601
New Jersey # 24GE04697200
New York # 086611
Pennsylvania # PE084919
Rhode Island # 12059
Texas # 125442
Virginia # 0402056415

Certifications

OSHA: 40 Hour HAZWOPER; 8 Hour Supervisor Management; 10 Hour Construction Safety

USACE Construction Quality Management

Affiliations

Transportation & Infrastructure Committee, NY Building Congress (NYBC), NY, USA

Environmental and Energy Committee, American Society of Engineering Companies (ACEC) NY, USA

Chairman (2013), Solid Waste Committee, Qatar Green Building Council (QGBC) Qatar

Legislative Committee (2008-2010), National Brownfield Association (NBA), NY, USA

Environmental Council (2008-2010), The Business Council of NY State (BCNY), NY, USA

Summary of Experience

Mr. Khouri has more than 20 years of experience in the real estate development, construction and engineering industries.

He has been a trusted partner, providing environmental consulting services to public and private sector clients including developers, real estate owners, investors, facility managers and city, state and federal agencies and municipalities.

Mr. Khouri has participated and managed the remediation and reuse of contaminated properties for over 20 years. He has performed, directed, and overseen environmental investigations and remedial actions at petroleum and chlorinated solvent spill sites, fuel farms, refineries, former manufactured gas, landfills, and a variety of residential, commercial and industrial settings.

Mr. Khouri integrates environmental risk management with land use planning and sustainable development to meet the needs and objectives of diverse clients and stakeholders for residential, commercial, and industrial real estate, in urban and rural environment. Mr. Khouri utilizes his technical expertise as well as his leadership and management skills to direct and oversee teams of professionals for the successful completion of these complex projects.

Relevant Experience

- **Principal Environmental Engineer** – Hydro Tech Environmental Engineering and Geology, DPC (2017-Present)
- **Senior Vice President** – HAKS (2015-2017)
- **Vice President** – Langan Engineering and Environmental Services, USA. (2013-2015)
- **Managing Director** – Averda Environmental Services, Qatar. (2011-2013)
- **Managing Director** – Clean Planet International, USA, Africa and Middle East. (2010-2011)
- **Associate** – Langan Engineering and Environmental Services, USA and Middle East. (2004-2010)
- **Senior Project Manager** – URS Corporation, USA and Middle East. (1998-2004)
- **Senior Scientist** – Solidere, Lebanon. (1996-1998)
- **Environmental Engineer** – University of Central Florida, USA. (1994-1996)

- **Environmental Impact Assessments, Phase I ESAs, and Phase II ESIs - Clients: Developers, Property Managers, Environmental Attorneys, Architects, Banks, and Insurance Firms -** Conducted 100s of environmental assessments for various entities specializing in urban renewal: Mixed use, residential, commercial, retail, warehouses, manufacturing facilities, gas stations and vacant lands. I also designed and executed subsurface investigations for soil, groundwater, and soil gas.

- **Remedial Investigation, Remedial Design and Associated Remediation Projects - Clients: Developers, Property Managers, Environmental Attorneys, Architects, Banks, Insurance Firms -** Managed myriads of environmental investigations and remedial actions at petroleum and chlorinated solvent spill sites, former manufactured gas and a variety of other commercial and industrial settings. Constituents of concern have included LNAPLs and DNAPLs, petroleum hydrocarbons, chlorinated solvents, soil vapor, coal tar, creosote, PCBs, and metals. Managed and participated in historical research, sample collection and data evaluation, synthesis of information to determine site-specific cleanup levels, remedial technology evaluation, design of treatment systems, site cleanup, installation and operation of treatment systems, optimizing systems, and performance monitoring.

- **LIRR/MTA East Side Access Project, New York, NY - Client: MTA -** The project involves the construction of new metro tunnels system in densely developed areas of midtown Manhattan, new tunnels system construction beneath active Amtrak, Metro North and NYCTA facilities, construction of new terminals, ventilation facilities, off street entrances, and yards development. In addition to establishing the guidelines of the project specific environmental management system, I provided direct and extensive public and community relations outreach, educational and awareness programs, as well technical support for the design engineering and construction teams, inspectors, and environmental sub consultants, so that construction of the project proceeds in compliance with environmental commitments, be conducted under budget and on time, while maintaining the utmost quality. Another key component of the project success was the direct and constant coordination between the environmental department and the multiple agencies and operators/owners of the project, such as USEPA, NYSDEC, NYSDOH, NYCDOT, NYCDEP, NYCDOB, MTA, LIRR, NYCTA, Amtrak, and Metro North. Construction Cost: $8.4 Billion

- **Hudson Yards, Proposed New York Jets Stadium, New York, NY – Client: NY Jets -** Served as the environmental project manager for the due diligence, investigation, and preliminary design phases of the proposed Jets Stadium. The work included subsurface investigation for soil, groundwater, and soil gas, and required close interaction with multiple entities including the MTA, LIRR, NYCTA, NYCDOS, NYSDEC, and Amtrak. Construction Cost: $1.4 Billion

- **Columbia University Manhattanville Expansion Project, New York, NY – Client: Columbia University -** Columbia University new campus will be built within a 17-acre area and will be comprised of academic and research facilities, housing, as well as commercial retail stores and open space areas. As the senior environmental project manager, I oversaw all environmental engineering related activities, including site assessment prior to the development, pre-construction support for demolition, recycling, soil and groundwater management, air quality controls, and LEED certification support. Construction Cost: $2+ Billion

- **Potable Water System Testing for Lead, New York, NY – Client: NYCSCA -** Directly managed the emergency work for the sampling, testing, evaluation and reporting of lead in the potable water of approximately 300 public schools in New York City. HAKS was one of the main consultants working for NYCSCA to implement a potable water system testing protocol which included coordination with school facilities, field work encompassing flushing and sampling, laboratory testing, analyzing, and reporting sample results. The project was conducted on a tight 24/7 timetable. The project was completed successfully under the direct supervision and daily coordination with the NYCSCA, with limited to no disturbance to schools' schedule and extracurricular activities, on time and on budget.

- **City University of New York, Tank Rehabilitation, Remediation and Closure Program, New York, NY – Client: DASNY -** Served as the project manager for the technical assessment, remediation design, and oversight of the Underground Storage Tank (UST) facilities at seven City

University campuses. Tanks sizes ranged from 550 Gal to 50,000 Gal. The work included design drawings and construction documents for the tanks and dispensing systems for vapor recovery, fire suppression, electronic monitoring/sensing, pumping/delivery, storage tank details, site restoration, subsurface investigation, and spill remediation. Construction Cost: $5 Million

- **Active Fuel Oil Terminal, Brooklyn, NY – Client: Bayside Fuel Oil Depot Corporation -** Managed the remedial investigation in connection with petroleum releases at an active fuel oil terminal located on Gravesend Bay. Developed and executed a strategy to manage client's liability relating to light non-aqueous phase liquid (LNAPL). Negotiated an alternative remedial action which benefitted the adjacent property and NYSDEC while eliminating client from liabilities at the adjacent property. Investigated and evaluated storm water infrastructure, and included an updated storm water management plan, as part of a sustainable groundwater remedy. Fees: $1.1 Million

- **54 Rutledge St, Insitu Bio-Remediation, Brooklyn, NY – Client: Fortis Property Group -** Managed the implementation of a remedial action for major petroleum and gasoline spills. The remedial action consisted of a multi-phased approach to site cleanup, which included excavation and removal of contaminated soil and groundwater, removal of underground storage tanks, injection of chemical oxidation compounds into the groundwater table, installation of permanent remedial injection and monitoring points, installation of a soil vapor mitigation system, and delineation of off-site contamination. Fees: $1.0 Million

- **Circuitron Corporation Superfund Site, Ground Water Treatment System, East Farmingdale, NY – Client: USACE -** Served as the Project Engineer and the Health and Safety Officer providing technical direction for on-site staff, guidance in hazardous waste/material management, and performing technical review of reports and contract deliverables. Coordinated with USEPA and USACE for the day-to-day operations and quality control matters. Fees: $1.6 Million

- **Constructability Review – Justice Sonia Sotomayor Houses, Bronx, NY – Client: NYCHA -** Constructability Review for the upgrading/rehabilitation of the Justice Sonia Sotomayor Houses in the Bronx for the New York City Housing Authority (NYCHA). The scope of work includes such repairs as Local Law 11 Brick Facade repair/waterproofing for areas of significant disrepair (including brick masonry, window sills/lintels, and brick parapet replacement with metal railing); roof replacement (asbestos abatement, 4-ply insulated roofing, roof drains); interior repairs/sheet rock/painting to apartments with water damage, new window installation at all locations; replacement of the water tanks, pumps, and repairs to the water tank structures in particular buildings; repairs to the property's main loop and improvements to entrances, lobbies and security. Construction Cost: $102 Millions

- **LCP Chemicals Inc. Superfund Site, Linden, NJ – Client: LCP Chemicals Inc. -** Served as the Project Manager and the Health and Safety Officer for the interim removal action program for mercury clean up and removal, petroleum contaminated soil excavation, storage tanks and steel structure demolition. The job also included a drum landfill investigation, done in level B PPE. Awarded the 74th Annual Governor's Occupational Safety & Health Award Citation of Merit of the State of New Jersey in 2002. Fees: $1.1 Million

- **FAA Technical Center, PCB Soil Remediation at Area 20A Superfund Site, Atlantic City, NJ – Client: USACE -** Served as a Laboratory Manager for the PCB contaminated soils removal project at FAA Technical Center. Responsibilities included the development of sampling and analysis plans, establishment of project data quality objectives, evaluation and selection of laboratories for testing programs, data quality assessment, and reports preparation. Fees: $3.2 Million

- **FAA Technical Center, Area D Jet Fuel Farm Superfund Site, Atlantic City, NJ – Client: USACE -** Served as the Quality Control Manager, supervising laboratory prequalification, fieldwork, and laboratory analysis. Evaluated and optimized the operation of the groundwater treatment system, CEM, and SVE bioremediation system, and prepared quarterly reports deliverables to the USEPA and the USACE. Also performed quality assurance audit and review for the pre-excavation sampling results performed by FAA subcontractors, using field test kits for PCB and TPH. Fees: $2.1 Million

- **US Federal Government, Anthrax Investigation, New Jersey and New York – Client: USPS -** Mr. Khouri was part of a team that was contracted by the Federal Government and the United States Postal Services (USPS) to perform Anthrax sampling and investigation throughout dozens of USPS facilities in the Northeast.

International Representative Projects

- **Global Infrastructure Project, Harare, Zimbabwe** – Provided owner representation services for conducting due diligence and feasibility studies for multibillion dollars infrastructure development projects. Projects are BOT and included a 120,000-bbd oil refinery, 300 Km oil pipeline, 20,000 unit's housing project, resorts, telecommunication improvement, and assessing mining concessions. Construction Cost: $7.2 Billion

- **OQYANA World First, Dubai, UAE** – Provided geotechnical and waterfront/marine engineering evaluations of the island's perimeter seawalls and ground improvement schemes, as well as seismic slope stability analysis at the edge of the islands. The proposed design effort and creative approach led to enormous budget and schedule savings for the client. Construction Cost: $1+ Billion

- **Normandy Landfill Treatment Project, Beirut, Lebanon -** Managed the remediation program of a 60 acres' landfill reclamation project. Additionally, I corresponded with management, owners, developers, and government representatives, and my involvement with the project from the design stage throughout the full remediation led to the project ultimate success with regard to the remediation design and schedule and budget compliance. Construction Cost: $65 Million

- **Beach Restoration, Al Athaiba Beach (Muscat, Oman) and Saint Germain sur Ay Beach (La Manche, France) -** Provided environmental engineering and site civil support for erosion control and restoration of the beach. Fees: $500,000

Publications

- Reductive Dehalogenation of Tetrachloroethylene by Soil Sulfate Reducing Microbes Under Various Electron Donor Conditions (2000).

- The Effect of Organic Substrates on Enhanced Biological Phosphorus Removal in Continuous Culture and Batch Experiments (1998).

- Comparison of Enhanced Biological Phosphorus Removal Populations under Ten Different Environmental Conditions (1998).

- Observations From Steady State and Batch Experiments Concerning the Effect on Enhanced Biological Phosphorus Removal of Volatile Fatty Acids and Glucose (1997).

- Single Stage Anaerobic and Aerobic Sequencing Biotransformation and Mineralization of Tetrachloroethylene (PCE) for the Remediation of Contaminated Soils and Groundwater (1996).

HydroTech Environmental
ENGINEERING AND GEOLOGY, DPC

Paul I. Matli, Ph.D., P.G.

VICE PRESIDENT

Ph.D., Environmental Sciences, Tokyo University of Agriculture and Technology, Japan, 2002

M.S., Environmental Sciences, International Center for Advanced Mediterranean Agronomic Studies, Greece, 1997

B.S. Agriculture Engineering, Saint Joseph University, Lebanon, 1994

Accredited US Educational Equivalence of Ph.D., M.S. and B.S. by Globe Language Services, Inc.

OSHA Certifications/Training

40-Hr HAZWOPER
8-Hr HAZWOPER Refresher
30-Hr Construction Safety and Health
10-Hr Construction Industry

Professional Licenses

New York State Professional Geologist (License # 000186)

Affiliations

Member of the American Institute of Professional Geologists since 2015 (Membership # 2784)

Summary of Experience

Mr. Matli has over sixteen (16) years' of experience in environmental engineering and geology with established records of project portfolio management of remedial investigations, design and oversight of remedial cleanup and remedial closures at inactive hazardous waste disposal sites, Brownfield Cleanup Program (BCP) sites, Voluntary Cleanup Program (VCP) sites, Little-E designation sites, petroleum spill sites, former landfills and Superfund sites. Mr. Matli's extensive experience involves the preparation of Environmental Assessment Statements (EAS), Phase I Environmental Site Assessment (ESA) reports, Phase II Remedial Investigations Reports/Site Characterization Reports (RIR), Pilot and Feasibility Studies, Remedial Action Work Plans (RAWP), Construction Completion Reports (CCR), Site Management Plans (SMP) , Remedial Action Reports (RAR) and Final Engineering Reports (FER) for commercial and residential development complexes, auto related workshops, dry cleaners, manufacturing and industrial blocks. Mr. Matli has been in charge of providing technical guidance of all aspects of fieldwork including geophysical and sub-surface drilling activities for installing soil probes, monitoring wells, soil/sub-slab vapor implants, media monitoring and sampling, petroleum bulk storage tanks assessments as well as designing and installing vapor barriers, Sub-Slab Depressurization Systems (SSDS) and Soil Vapor Extraction (SVE) systems.

Relevant Experience

Brownfield Cleanup Program Remediation Of DNAPL Via *In-Situ* Chemical Oxidation/Bioremedial Agents And Active Vapor Mitigation Systems, Vleigh Place, Flushing, NY - Client: United Properties Corp. & VP Capital Holdings, LLC – As an Environmental Project Manager for this site, I was involved in the initial soil and groundwater assessments to investigate environmental impacts associated with the presence of an on-site drycleaner. These investigations confirmed on-site discharges of chlorinated solvents impacting thirteen storefronts located on-site. The former owner expressed interest in the New York State Department of Environmental Conservation (NYSDEC) BCP and I worked with this owner to apply to the program as a Participant. I then prepared and coordinated all necessary documents for the transition of this site into the BCP. Under BCP, I performed additional subsurface delineation of soil and groundwater impact as well as the extent of vapor intrusion impacts on-site and off-site. Besides a I conducted receptor survey that confirmed the presence of a significant threat to the health of 13 commercial tenant located on-site and occupant of two adjacent residential complexes. Immediate remedial activities were required on-site and off-site. As environmental engineer I was involved the design and installation of interim vapor mitigation systems inside the 13 on-site tenant spaces prior to their destruction by a fire in 2016. I was then involved in the design and installation of an interim Soil Vapor Extraction (SVE) system to prevent the migration of chlorinated vapor into adjacent residential buildings. Under the directions of an NYS Licensed Professional Engineer (PE), I had the direct responsibility of preparing and implementing a NYSDEC-approved RAWP. RAWP activities consisted of a site-wide soil excavation, multiple rounds of in-situ groundwater treatment by chemical oxidation brand name PersulfOx and a bioremedial agent brand name 3_D Microemulsion Factory Elumlsified (3DME) followed by several rounds of post-groundwater remediation sampling events. A total of 48,830 cubic yards of non-hazardous fill material and a total of 1,080 cubic yards of former concrete foundations were also removed during site excavation for future redevelopment. In addition, monitoring of soil vapor intrusion has also been performed off-site in surrounding sidewalks and adjacent buildings including a daycare facility. The Site remediation was completed by achieving the Unrestricted Soil Cleanup Objectives for the soil cleanup and the Track 4 Cleanup Goal for the Site. Using an innovative and affordable remedial design, I was able to stay within budget, prepare an SMP and an FER and help my client receive the tangible tax credits by completing the BCP milestones and receive a NYSDEC-issued Certificate of Completion (COC) within two years of NYSDEC RAWP approval. The site is currently under a post-remediation Site Management Plan, which includes a groundwater sampling program, SVE monitoring program, an SSDS installation and monitoring at adjacent property (2014 - Ongoing).

Brownfield Cleanup Program Remediation Of Historic Railroad Freight Yard And Manufacturing Site, East 135th Street, Bronx NY – Client Deegan 125th Realty LLC – Project Site involved the redevelopment of a 1.112-acre site into two 25-story mixed residential and commercial use towers with full basements and parking/driveways over of two unexcavated public utility easements. With the active involvement of HydroTech, the Site was initially enrolled for remediation under the NYC Mayor's Office of Environmental Remediation (OER) VCP program. With its location in the En-Zone along with the presence of soil impacts from historic uses, I identified this Site as an opportunity for the NYSDEC BCP and I worked with the developer to apply to the program as a volunteer. Once the site was accepted into the BCP program, I performed a Focused Site Characterization and prepared a NYS Licensed PE – certified RAWP with a Track 1 Cleanup Goal. During remedial excavation into the interim unsaturated soil, residual soil contamination could not be removed over 63.6% of the Site perimeter and as such, Track 1 Cleanup Goal was achieved over 0.0405 acres and Track 4 cleanup was achieved over 0.707 acres. As the project manager and project geologist, I provided all necessary support during Site remediation including but not limited to obtaining a Quality and Quantity Dewatering Permit from NYCDEP, perform soil waste characterization and coordinate approvals by soil disposal facilities of 36,048 tons of non-hazardous soil disposed of this project, and also coordinate regulatory approvals of 7,680 tons of required backfill material imported to the site. At the completion of the remedial development, I prepared and submitted to NYSDEC an SMP and a NYS Licensed PE – certified FER. NYSDEC-issued a COC within 30 months of NYSDEC RAWP approval. The site is currently under the post-remediation site management inspection and reporting of a composite cover (2015 – Present).

Management Of Cleanup Of Hazardous Materials At A Former Rubber And Adhesives Factory, 9th Street, Long Island City, NY – Client 9th Street LIC – This project site was historically used for adhesives manufacturing for approximately 62 years and a site environmental characterization identified the presence of hazardous chemical waste beneath the property. After thirteen years of no response by former ownership to address site remediation pursuant to a NYSDEC consent order, a new ownership became involved as a respondent to the Consent order and has requested HydroTech to expedite a design for a site cleanup that should be completed within less than 3 months during the layout of a new building foundations. As a Project Manager, I prepared a NYS licensed PE-certified Interim Remedial

Measures Work Plan (IRM WP), which underwent within less than 3 months four revisions due to evolving site information related to underlying bedrock and perched water. The IRM WP included specific soil cleanup methods and selected remedies dictated by NYSDEC that included a design for an SVE system and subsequently a SSDS. IRM activities completed during a first phase included a further delineation of hazardous contamination in soil across the site, groundwater sampling for emerging contaminants and volatile organic compounds, soil waste characterization, acquisition of a dozen Contained-in Determination letters from NYSDEC for non-hazardous waste, proper disposal of 1,123.24 tons of hazardous soil and 5,362.54 of non-hazardous soil, disposal of 45,371 gallons of non -hazardous liquid from dewatering and truck wash/decontamination pad, closure and removal of 9 underground storage tanks (USTs) listed in the Petroleum Bulk Storage (PBS) database and Chemical Bulk Storage database. My project oversight included monitoring day-to-day construction operations by directing a field crew consisting of a geologist, a community air monitoring technician and a technician for odor suppression. The second phase of IRM activities were upgraded consistent with site development. These activities were detailed in an NYSDEC-approved IRM WP Addendum and will resume upon completion of building construction (2019 – Present).

Remedial Development And Spill Closure At A Gasoline Station, 11th Avenue, New York, NY – Client: Sam Ruv Operating Corp. – This project involved remedial redevelopment activities at a former gasoline filling station and an auto repair facility into a 10-story commercial building. My duties as a Qualified Environmental Professional (QEP) included the performance of a remedial investigation addressing a Little E-Designation for hazardous materials. The investigation was conducted per a NYCOER Remedial Investigation Work Plan. In-situ petroleum releases identified during this investigation lead to the opening of an NYSDEC petroleum spill case. I prepared a Remedial Action Work Plan which included a design for a waterproofing vapor barrier under the directions of a NYS Licensed PE and oversaw the implementation of remedial activities in coordination with OER as part of a Voluntary Clean-Up Program (VCP) and under the authority of NYSDEC as part of spill remediation. During site remediation, non-hazardous petroleum contaminated soil/fill was excavated and removed from the property pursuant to a soil Waste characterization exercise, which I conducted, beforehand. In addition, gasoline and diesel underground storage tanks were properly closed and removed from the properly in compliance with applicable laws and regulations. As part of site development, the vapor barrier system that consisted of a waterproofing membrane was installed beneath the hydrostatic slab across the footprint of the building. At the completion site remediation, a decision for a No Further Action was issued by NYSDEC for the spill incident and achieved a Track 1 Cleanup Goal was achieved under which condition, the Little E-Designation for hazardous materials was removed to the Satisfaction of the NYCOER (2015 - 2018).

Integrated Remedial Options For Mixed Use Site Redevelopment And Management, Canal Street, New York, NY – Client: CBCS Hudson Equities, LLC – As an Environmental Project Manager for this Site, I assisted a NYS Licensed PE during the preparation of RAWPs addressing the remediation of an NYSDEC petroleum spill case in accordance to NYSDEC requirements and also a Little E-designation for hazardous materials in accordance with NYCOER guidance and approvals. I designed, coordinated and directed the performance of remedial activities during site development into a 10-stroy hotel. The scope of these activities consisted of the performance of a soil waste characterization, *in-situ* groundwater treatment by Chemical Oxidation brand name RegenOx™ and bioremedial agent identified as Oxygen Releasing Compounds Advanced (ORCA), the proper closure and removal of a waste oil and gasoline USTs, soil waste characterization, excavation of impact fill material and petroleum impacted soil to below the depth of soil groundwater interface and disposal of non-hazardous regulated waste, collection and analysis of post-excavation endpoint sample, application of Oxygen Releasing Compound Advanced (ORCA) pellets at bottom of excavation, the installation of an active SSDS and a waterproofing vapor barrier and the institution of a groundwater monitoring and sampling program leading to the final closure of NYSDEC spill case. Performed annual inspection of installed engineering controls consisting of vapor barrier, SSDS and concrete slab to monitor their environmental function for the protection of the health of building occupants pursuant to an OER-approved Site Management Plan (SMP) (2010 - Ongoing).

Petroleum Spill Remediation And Soil Vapor Mitigation At A Former Gasoline Station, Cropsey Avenue, Brooklyn, NY – Client: Avo Construction – The project site is a former gasoline station and auto repair facility associated with an NYSDEC gasoline-related spill case. This site was then redeveloped into seven 3-story residential buildings. As a project geologist I managed the entire remediation of residual gasoline constituents in soil and groundwater beneath the new vacant building and the mitigation of gasoline vapors detected in the basement and first floor at this development. The mitigation of gasoline vapors were undertaken following a regulatory order issued by the New York State Department of Health (NYSDOH) through the NYSDEC and the New York City Department of Health (NYCDOH) preventing this site from being occupied before taking the necessary measures to render it protective to human health. I designed and installed individual active SSDS in each of the seven 3-story vacant residential buildings following a quantitative pre-mitigation diagnostic testing exercise, which I performed pursuant to NYSDEC and NYSDOH approvals. The seven SSDSs were adequately designed to eliminate the potential vapor intrusion pathway between the vapor source (soil and groundwater) and the receptor (indoor air within the building interior). Upon verifying the SSDS successfully prevented the sub-slab gasoline vapors from impacting the indoor air, the NYSDEC in consultation with NYSDOH and NYCDOH authorized the occupation of the seven new developments at this site. The remediation of gasoline constituents in soil and groundwater was then performed following a complete delineation of contamination on-site and off-site. This remediation involved three rounds of off-site groundwater treatment by RegenOx™ and also ORCA. Upon reducing the levels of contaminants to levels satisfactory to NYSDDEC, a decision for a No Further Action was issued by NYSDEC for the spill incident (2010 - 2017).

Site Cleanup For Affordable Residential Redevelopment, Third Avenue, Bronx, NY – Client : Strategic Development & Construction Group – This project consisted of a remedial development of a new 7-story low income/supportive housing residential building with a full cellar located on the west side of Third Avenue in the Morrisania Section of the Bronx that is mostly a low income residential neighborhood. The new building is owned and operated by Services for the UnderServed (SUS), a non-profit agency that provides housing and support services for formerly homeless and other qualified residents. As an Environmental Project Manager for this Site I had to complete several project milestones leading to the finishing of this remedial development. These project milestones included the preparation of an Environmental Assessment Statement (EAS) and Environmental Assessment (EA) to obtain funding from the U.S. Department of Housing and Urban Development's (HUD) HOME Investment Partnership Program (HOME) funding through HPD's Supportive Housing Loan Program. My duties also involved fulfilling the remedial requirements of a Little E-designation for hazardous materials in accordance with City Environmental Quality Review (CEQR) requirements and a NYCOER-approved RAWP pursuant to the NYC VCP. The implementation of RAWP during building construction lead to the identification of hazardous levels of lead in 60 percent of the site soil/fill material through soil waste characterization investigation and several delineation investigations. The project disposed of 2,474.4 tons of hazardous lead contaminated soil. The remedial goal of a Track 1 cleanup was achieved following site cleanup. I was the recipient for the 2016 Big Apple Brownfield Award for Supportive/ Affordable Housing issued for this project by the New York City Brownfield Partnership (2013 - 2015).

Landfill Remedial Monitoring, Paerdegat Basin Natural Area Park, Brooklyn, NY – Client : New York City Department of Environmental Protection (NYCDEP) – This project is an artificially created basin out of Bedford Creek, a freshwater tributary to Jamaica Bay. The basin was impacted by conveying street runoff directly from stormwater and combined sewer overflows from highly urbanized neighborhood and also by dredging conducted during the early twentieth century and historic fill in the South Natural Park Area. Approximately, 177 acres of Paerdegat Basin shoreline and submerged land were restored to parkland including a Natural Area Park and Ecology Park. In order to correct the degraded water quality conditions in Paerdegat Basin, groundwater sampling was performed to evaluate whether the designated contaminants identified by prior investigations within the urban fill material of the South Natural Park Area have potentially impacted the groundwater after the construction of the Natural Area Park and Ecology Park. As an Environmental Geologist for this site, I performed groundwater sampling per Investigation Work Plans, which I prepared and were approved by NYSDEC and NYCDEP. Groundwater investigations were performed once at pre-construction and several time at post-construction at the Natural Area Park and Ecology Park. These groundwater investigations involved the installation and development of monitoring wells, the sampling of monitoring wells per USEPA low flow samling methods and the sampling of surface water during periods of low tides and high tides with specially designated Quality Assurance Project Plans. I documented the findings of these investigations in groundwater investigation reports to the satisfaction of NYCDEP and NYSDEC (2014 - 2016)

Industrial Air Quality Assessment For Office Conversion Into A Daycare Facility, 40th Avenue, Queens, NY - Client: Peachy Enterprise, LLC - This project addressed the CEQR Technical Manual – Chapter 17 provisions for hazardous materials associated with suspect on-site and off-site historic uses and also an air quality impact assessment in anticipation of the conversion of an office space to a day care center within an existing office building located in M1-3 manufacturing zone under a special permit from the New York City Board of Standards and Appeals (BSA). As an Environmental Project Manager for this site, I performed a Hazardous materials investigation in accordance to NYCDEP-approved investigation work plan, which I prepared. I also prepared a NYCDEP-approved RAP, which was certified by a NYS Licensed PE. I also prepared an air quality impact assessment to the satisfaction of NYCDEP and this assessment involved a boiler screen analysis per CEQR guidance as well as a basic screening of industrial mobile and stationary sources using EPA's AERSCREEN screening dispersion models and detailed analysis using EPA's AERMODE dispersion model. Findings of air emissions provided by these models were compared to NYSDEC's Guidelines for the Evaluation and Control of Ambient Air Contaminants under 6 NYCRR Part 212 Process Operations DAR-1 Annual Guideline Concentrations (AGC) and Short-Term Guideline Concentrations (SGC) Tables Guidance documents. Upon verification that air pollutant concentrations are below the impact criteria, NYCDEP issued a sign-off on the submitted air quality impact assessment documents and back-up materials and issued a notice to proceed for the establishment of the day care facility (2013 - 2014).

RUIJIE XU
PROJECT MANAGER

Education

M.S., Environmental Science,
New York University,
Polytechnic Engineering School,
New York, NY, 2014

B.S., Biological Science,
Wuhan University,
College of Life Science, Wuhan,
Hubei, China, 2012

Certifications/Training

OSHA: 40 Hour HAZWOPER
OSHA 10 Hour Construction Safety and Health
OSHA 30 Hour for Construction Industry

Summary of Experience

Ms. Xu provides various types of environmental services for private clients. These services include conducting Phase I/II ESAs, remedial investigation, oversight of the implementation of remedial actions and post-remediation monitoring and sampling. Ms. Xu is also working on multiple NYC E-Designation sites and NYS Spill sites under the oversight of lead agencies such as NYSDEC, NYSDEP and NYCOER. The major responsibilities include guiding the client through the environmental petition process, facilitating the client to obtain related environmental approvals/permits, reporting to responsible agencies and ensure the compliance with regulatory requirements.

Relevant Experience

Remediation and Site Management at a Mixed-Use Development Site, Bronx, NY – Client: 2026 Westchester Realty – Project involved the redevelopment of a 1.16-acre site into a 7-story mixed residential, commercial and community building with a partial basement and adjoining ground level parking. The new development also provided 134 affordable rental units. Remediation and construction were completed in 2016 with the active involvement of HydroTech. The site is currently under the post-remediation site management. As the environmental engineer, I'm responsible for the annual inspection of the ECs and reporting to OER. (2018 – Present)

Mixed-Use Redevelopment Site, New York, NY – Client: 150 Wooster LLC – The site was developed into a 6-story mixed residential and commercial building with a full basement and enrolled in the New York City Voluntary Cleanup Program (VCP) due to the presence of E-Designation for Hazardous Materials. In the pre-development investigation, the site was assigned with a spill due to presence of petroleum impacted soil. In addition, lead was detected in soil exceeding the EPA hazardous level. Based upon communication with NYCOER, excavation and implementation of engineering controls (ECs) including vapor barrier and active Sub-Slab Depressurization System (SSDS) were required. As the environmental engineer of the site, I performed soil characterization and lead delineation, provided oversight over remedial activities including soil excavation, tank removal and installation of ECs. I'm currently involved in the post-remediation site management such as annual inspection of ECs and petition for spill closure. (2016 – Present)

Mixed-Use Redevelopment Site, New York, NY – Client: West 30th Street LLC – The project involved redevelopment of a 0.40-acre property located in the Hudson Yard under supervision of NYCOER. The new mixed-use building with full basement will be luxury rental with 25% of affordable units.

As the environmental engineer on the project, I performed remedial investigation including Phase I/II ESA, designed the ECs (vapor barrier system) and conducted waste characterization and delineation. I'm currently involved in the construction oversight over remediation activities such as soil disposal and EC installation. (2018 – Present)

LNAPL Remediation and Monitoring, Bronx, NY – Client: HB Bronx Realty, LLC – Project involved providing engineering support services related in accordance with Site Management Plan supervised by NYSDEC at a commercial parking facility. As environmental engineer on the project, I am currently involved in the periodical sampling and monitoring of the groundwater, LNAPL removal, inspection of engineering controls and reporting to NYSDEC for evaluation of the performance of the remedial system and petition for spill closure. (2018 – Present)

Multiple Affordable Residential Redevelopment, Bronx, NY – Client: SKF Development LLC – The project consists of redevelopment of multiple properties into affordable residential buildings located within the NYS Environmental Zones (En-Zones), which are anticipated to be enrolled in the Brownfield Cleanup Program (BCP). As the environmental engineer, I am currently involved in preparing BCP application for each site and will be responsible for future remedial investigation, remedial design and construction and remediation oversight once the BCP agreement is signed. (2019 – present)

Mixed-Use Development Site, Brooklyn, NY – Client: 540 Fulton Associates LLC – Project involved developing a 15,000-SF lot in Downtown Brooklyn into a 43-story mixed residential and commercial use high rise with full basement. I, as the environmental consultant, performed waste characterization and provided remediation oversight throughout the sub-grade construction. In addition, I also conducted required sampling and prepared the application and renewal package for a NYCDEP Dewatering Permit for discharging approximately 200,000 gallons of groundwater into the combined sewer. (2017 – 2019)

Spill Remediation and Closure at a Commercial Redevelopment Site, Manhattan, NY – Client: New York City Ambulatory – The project included vertical expansion of an existing 2-story theater into a 3-story building for plastic surgery. Soil with petroleum odor were encountered during the excavation for the new sub-cellar. HydroTech was then involved to delineate the extend of the impacted soil and reported the findings to NYSDEC as a spill. Air monitoring along with dust control and odor suppression were conducted throughout the excavation and removal of approx. 1,200 tons of soil and a vapor barrier system were installed under the supervision of HydroTech. As the environmental engineer, I performed the soil waste characterization/delineation and remediation oversight during soil excavation and vapor barrier installation and reported to NYSDEC to acquire spill closure. (2016 – 2018)

Remediation at a Mixed-Use Development Site, New York, NY – Client: Downtown RE Holdings LLC – Project involved the redevelopment of a 0.2-acre site into a 12-story mixed residential and commercial building with a full cellar and a sub-cellar. During the remedial investigation and soil characterization, hazardous lead was detected in soil underneath the Site from multiple locations and depths. HydroTech collected over 100 samples to delineate the vertical and horizontal extend of hazardous lead to help the client save the cost on soil disposal. As the environmental engineer, I conducted the soil sampling for lead delineation and communicated with soil brokers and disposal facilities for soil disposal approval. (2015 – 2016)

Technical Review and Construction Oversight at Multiple Development Sites – Served at New York City Office of Environmental Remediation and provided technical review of cleanup projects and projects documentation for development sites across the five boroughs. Attended meetings with consultants, contractors and developing team and performed site visit during the construction to supervise the implementation of required remedial actions. (2014 – 2015)