### 100 EAST 149<sup>TH</sup> STREET SITE 100 EAST 149<sup>TH</sup> STREET BRONX, NEW YORK Block 2351 Lot 35

### REMEDIAL INVESTIGATION WORK PLAN

### NYSDEC SPILL NUMBER 18-10498

### **BCP Agreement Number C203159**

MAY 2023

Prepared for: RGDC 149 LLC 214 West 39<sup>th</sup> Street, Suite 1200 New York, NY 10018

Prepared By: Touchstone Environmental Geology, PC 1919 Middle Country Road, Suite 205 Centereach, NY 11720

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- Attachment B Resumes
- Attachment C Sampling, Analysis and Assessment of Polyfluoroalkyl Substances (PFAS) November 2022 guidance
- Attachment D Quality Assurance Project Plan
- Attachment E Health and Safety Plan
- Attachment F Community Air Monitoring Plan

Acronym AWQS

BCA

BCP

BGS

BOA

BTEX

# Definition Ambient Water Quality Standards Brownfield Cleanup Agreement Brownfield Cleanup Program Below ground surface Brownfield Opportunity Area Benzene, Toluene, Ethyl benzene, Xylenes

#### LIST OF ACRONYMS

CAMP	Community Air Monitoring Plan		
CVOC	Chlorinated Volatile Organic Compounds		
CY	Cubic Yards		
DER-10-NYSDEC DER-10	Technical Guidance for Site Investigation and Remediation		
DUSR	Data Usability Summary Report		
EDD	Electronic Data Deliverable		
EES	Eastern Environmental Solutions		
EIMS	Environmental Information Management System		
ELAP	Environmental Laboratory Accreditation Program		
EPA	Environmental Protection Agency		
ESA	Environmental Site Assessment		
FSSI	Focused Subsurface Site Investigation		
GPR	Ground Penetrating Radar		
HASP	Health and Safety Plan		
HAZWOPER	Hazardous Waste Operations Emergency Response		
LCS	Laboratory Control Sample		
LCSD	Laboratory Control Sample Duplicate		
LQG	Large Quantity Generator		
MB	Method Blank		
NGVD	National Geodetic Vertical Datum		
NYC DEP	New York City Department of Environmental Protection		
NYC DOB	New York City Department of Buildings		
NYC DOH	New York State Department of Health		
NYC OER	New York City Office of Environmental Remediation		
NYCRR	New York Codes Rules and Regulations		
NYS DEC	New York State Department of Environmental Conservation		
NYS DEC DER	New York State Department of Environmental Conservation Division of		
	Environmental Remediation		
PAHs	Polyaromatic Hydrocarbons		
PCB	Polychlorinated Biphenyls		
PFAS	Per-and Polyfluoroalkyl Substances		
PID	Photoionization Detector		
PM	Project Manager		
PVEC	Potential Vapor Encroachment Condition		
QA/QC	Quality Assistance / Quality Control		

QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
RI	Remedial Investigation
RIR	Remedial Investigation Report
RIWP	Remedial Investigation Work Plan
RRSCO	Restricted Residential Soil Cleanup Objective
SCOs	Soil Cleanup Objectives
SCGs	Standards, Criteria, and Guidance
SSM	Site Safety Manager
SVOCs	Semi Volatile Organic Compounds
TAL	Target Analyte List
TCL	Target Compound List
USDOT	United States Department of Transportation
USGS	United States Geological Survey
USTs	Underground Storage Tanks
UUSCO	Unrestricted Use Soil Cleanup Objective
VOCs	Volatile Organic Compounds
VSQG	Very Small Quantity Generator

#### CERTIFICATION

I, Rachel Ataman, certify that I am a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Remedial Investigation Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Karhol

Name

05/23/2023 Date



#### **1.0 INTRODUCTION**

This Remedial Investigation Work Plan (RIWP) was prepared on behalf of RGDC 149 LLC for the property known as the 100 East 149<sup>th</sup> Street Site, located at 100 East 149<sup>th</sup> Street in Bronx, New York. RGDC 149 LLC entered into a Brownfield Cleanup Agreement (Index No. C203159) with the New York State Department of Environmental Conservation (NYSDEC) on February 24, 2023.

The Site has confirmed contamination in the soil, groundwater, and soil vapor which is related to historic on-site operations. The purpose of this Remedial Investigation Work Plan (RIWP) is to collect data of sufficient quality and quantity to characterize the nature and extent of residual contamination associated with the historic operations at the Site and the surrounding community to evaluate alternatives to remediate the contamination.

The overall objectives of the project are to prepare the Site for future use and to remediate known and unknown environmental conditions at the Site to the satisfaction of the NYSDEC and the New York State Department of Health (NYSDOH).

#### **1.1 Site Location and Description**

The street address for the Site is 100 East 149<sup>th</sup> Street, Bronx, New York (**Figure 1**). The Site is located in the City of New York in the Mott Haven neighborhood of the Borough of the Bronx. The Site is known as the 100 East 149<sup>th</sup> Street Site and is identified as Block 2351, Lot 35. The irregular-shaped Site consists of approximately 104-feet of frontage along Exterior Street and 47 feet of frontage along East 149<sup>th</sup> Street. The Site is a vacant lot formerly used as a gasoline station.

According to the USGS topographic map for the area (Brooklyn Quadrangle), the elevation of the property is approximately 8-feet above the National Geodetic Vertical Datum (NGVD) (**Figure 2**). The area topography is generally flat with little relief and no significant elevation changes. According to previous investigations conducted at the Site, groundwater occurs beneath the Site at a depth of approximately 10 to 14 feet below grade under perched water table conditions. Groundwater is expected to flow to the west across the Site, towards Exterior Street.

The entire Site is zoned as M1-4/R8A and MX-13, for Light Manufacturing and Residential Use. The M1 district is often a buffer between M2 or M3 districts and adjacent residential or commercial districts. Light industries typically found in M1 areas include woodworking shops, auto storage and repair shops, and wholesale service and storage facilities. Offices, hotels, and most retail uses are also permitted. The M1-4 district is not subject to parking requirements. Contextual Quality Housing bulk regulations are mandatory in R8A zoning districts which typically results in "high lot coverage 10 to 12-story apartment buildings." The floor to area ratio in R8A Districts is 6.02 and parking in this district is required for 40% of dwelling units. The parking requirement is waived if 15 or fewer spaces are required or if the lot is less than or equal to 10,000-square feet.

Surrounding land use include a residential property to the south of the Site, commercial properties to the east and north of the Site, vacant land to the northwest of the Site, a public

facility to the north, and a property associated with the New York Recycling plant to the west of the Site. **Figure 3** depicts the configuration of the Site and adjoining properties.

The closest school (KIPP Elements Primary School) is located approximately 51 feet east of the Site.

#### **1.2 Redevelopment Plans**

The majority of the Site is expected to be excavated to approximately 11-feet below grade with the exception of some areas which may need to be excavated to approximately 14-feet below grade for the construction of a new eight-story mixed-use residential and commercial building with a below-grade basement (9-floors total). The proposed building will contain retail units on the ground floor and the basement will contain a bicycle room, storage areas, and utility areas. The proposed building foundation will cover approximately 90% of the Site. The final building plans for the proposed building have not been finalized as of yet but may include either a green roof, solar panels, or a combination of the two. The remaining 10% of the Site may not be excavated will likely be capped in some capacity if needed and will include a 400 square foot backyard area.

#### **1.3 Site History**

The environmental history of the Site was identified through the review of prior investigation reports, Federal and State Environmental Databases, and Environmental Sanborn Fire Insurance Maps. According to prior reports, the Site was historically developed with a gasoline station in circa 1935. Sanborn Maps indicate a gasoline station was present at the Site from at least 1935 through 1989 and a review of historic City Directories indicates service station occupants were listed from at least 1956 through 1976. Furthermore, the 1935, 1944, and 1946 Sanborn Maps depict five 550-gallon buried underground storage tanks (USTs) at the Site. Most recently, a tire company (149 Tire Center Corp), occupied the Site in 2017. A demolition permit for the structure was filed with the NYC DOB in 2019. The Site currently contains vacant land.

#### **1.4 Summary of Previous Investigations**

Environmental investigations performed at the Site include the following:

- Phase I Environmental Site Assessment (ESA) and a Focused Subsurface Site Investigation (MECC, May 2017)
- Remedial Investigation Report (EES, July 2019)
- Phase II Environmental Site Assessment (Touchstone, October 2020)
- Phase I Environmental Site Assessment (Touchstone, April 2022)

A copy of each of the reports listed above is included in Attachment A and are described below.

## 1.4.1 Focused Subsurface Site Investigation (Merritt Environmental Consulting Corp, May 2017)

Touchstone has not been provided with a copy of the Phase I Environmental Site Assessment or Focused Subsurface Site Investigation prepared by Merritt Environmental Consulting, Corp.

(MECC). However, these reports are referred to in the Remedial Investigation Report (RIR) prepared by Eastern Environmental Solutions (EES), dated July 2019. According to the EES RIR, MECC conducted the FSSI based upon the Phase I ESA for the Site. The MECC investigation included the installation of four soil borings (identified as B-1 through B-4) in the northwest portion of the Site. MECC measurements indicated that the water table was encountered at a depth of 14 feet below grade. MECC additionally reported that the subsurface consists of fill material to a depth of at least 20 feet and bedrock was not encountered during the investigation. The Site elevation was reported to be approximately 20 feet above mean sea level and generally level.

Borings B-1 through B-3 (at the northwest portion of the Site) encountered refusal at depths ranging from 7 to 11 feet and boring B-4 (near the center of the Site) was advanced to 20 feet below grade. Vadose zone soil samples were obtained from borings B-1, B-2, and B-4. The results of the investigation in B-2 at 7 feet and B-4 at 12 feet, minor concentrations of petroleum-related VOCs were detected. VOCs were not detected at B-1 at 11 feet. At Boring B-4, a temporary groundwater monitoring well was installed and sampled. The results indicated several petroleum VOCs were detected at concentrations above the NYSDEC Class GA groundwater standards [including a total BTEX concentration of 4,860 micrograms per liter (ug/l)]. No chlorinated VOCs were detected in the soil or groundwater. Free floating product was not identified.

#### 1.4.2 Remedial Investigation Report (Eastern Environmental Solutions, July 2019)

Eastern Environmental Solutions (EES) prepared a Remedial Investigation Report (RIR) for the property located at 100 East 149th Street. At the time of the assessment, the Site consisted of one irregular-shaped parcel with an estimated area of 4,105-square feet (0.094-acres). The Site contained one 200-square foot vacant building with no basement. EES reported that the Site was identified as an E Designation Site under E Designation number E-227 with an effective date of June 30, 2009. No remediation date is listed. The E Designation at the Site is related to Air Quality -#2 Fuel or #4 Fuel Oil or Natural Gas for HVAC Systems, Exhaust Stack Location Limitation, and Hazardous Materials\* Phase I and Phase II Testing Protocol. The Remedial Investigation (RI) fieldwork consisted of a Site inspection to identify Site conditions, Site layout, potential areas of concern, and the locations of buildings or other physical structures; the performance of a geophysical investigation to determine the locations of subsurface structures and utilities; the installation of 15 soil borings throughout the Site; the collection of four subsurface soil vapor samples; and the installation of four monitoring wells and the collection and analysis of four groundwater samples. The soil samples collected from 10 to 15-feet below grade from soil boring locations SB-1, SB-5, SB-8, and SB-11 were analyzed for volatile organic compounds (VOCs) via EPA Method 8260C and soil samples collected from 0 to 2-feet and 10feet below grade from soil boring locations SB-2, SB-3, and SB-4 were analyzed for VOCs via EPA Method 8260C, semi volatile organic compounds (SVOCs) via EPA Method 8270D, pesticides via EPA Method 8081B, metals via EPA Method 6010C, and PCBs via EPA Method 8082A. Samples from soil boring locations SB-6, SB-7, SB-9, SB-10, SB-12, SB-13, SB-14, and SB-15 were not collected or analyzed during the July 2019 Remedial Investigation. The groundwater samples were analyzed for VOCs via EPA Method 8260C, SVOCs via EPA Method 8270D, PCBs via EPA Method 8082A, metals via EPA Method 6010C, pesticides via

EPA Method 8081B, and emerging contaminants (1,4-dioxane and per-and polyfluoroalkyl substances (PFAS)). Soil vapor samples were analyzed for VOCs via EPA Method TO-15.

The results of the RI indicated a geophysical anomaly was identified at the south-central portion of the Site which appeared to be an area of underground storage tanks (USTs). Additionally, the results of the soil samples collected in January 2019 (SB-1, SB-5, SB-8, and SB-11, collected from the southern and central portions of the Site) indicated that petroleum-related VOCs were present at all four locations at concentrations above the 6 NYCRR Part 375 Unrestricted Soil Cleanup Objectives (SCOs). Furthermore, the results of the samples obtained in March 2019 (SB-1, SB-2, SB-3, and SB-4 from 0 to 2-feet and 10-feet below grade) indicated that petroleum related compounds were detected in the 10-foot sample from SB-2 collected from the southern portion of the Site at concentrations above the Unrestricted SCOs, SVOC exceedances above the Unrestricted SCOs were identified in SB-1 (0-2'), SB-2 (10'), and SB-3 (0-2' and 10'), and a minor exceedance of 4,4-DDD was detected in SB-2 (0-2'). Soil boring locations SB-1, SB-2, SB-3 were collected from the southern portion of the Site. Additionally, the results of the groundwater samples indicated that petroleum-related VOCs and SVOCs and various metals were detected in all of the monitoring wells located throughout the Site at concentrations exceeding the New York State Department of Environmental Conservation (NYSDEC) Class GA Groundwater Standards. EES additionally noted that "generally low concentrations" of several PFAS compounds were identified in monitoring well MW-3 located in the westerncentral portion of the Site (MW3-Sample: PFOA: 19 ug/L; MW3-Duplicate: PFOA: 19 ug/L), PFOS: 8.2 ug/L). The results of the soil vapor analysis indicated that the vadose zone soil vapor at the Site contains petroleum and non-petroleum-related VOCs at concentrations ranging from 1.40 ug/m3 (cis-1,2-Dichloroethylene) to 370 ug/m3 (chloroform). EES reported that there were no standards or guidance values for the VOCs in soil vapor and that the petroleum VOCs were likely to be attributable to the petroleum releases at the Site however, EES noted that there may be an off-Site contribution to the contamination at the Site.

EES reported that the results of the investigation indicated the underground storage tanks (USTs) were likely to be the primary source of contamination at the site and that vadose zone soil contamination appeared to be present throughout most or all of the site and was primarily present in the area just above the water table. EES additionally noted that no soil borings at the Site were preformed to a depth greater than 20 feet below grade.

NYSDEC Spill Number 18-10498 was assigned to the release on January 15, 2019 in connection with the presence of petroleum impacted soil at the site.

# 1.4.2 Phase II Environmental Site Assessment (Touchstone Environmental Geology, PC, October 30, 2020)

Touchstone Environmental Geology, PC (Touchstone) conducted a Phase II Environmental Site Assessment (ESA) at the property identified as 100 East 149<sup>th</sup> Street in Bronx, New York in October 2020. The fieldwork performed during the Touchstone October 202 Phase II ESA was performed in accordance with NYSDEC requirements to investigate NYSDEC Spill number 18-10498.

The Phase II ESA fieldwork consisted of the performance of a Ground Penetrating Radar (GPR) survey using a GSSI SIR-3000 fitted with a 400 MHz antenna, the installation of four (4) soil probes to 10-feet below grade or until refusal was encountered, and the analysis of eight (6) soil samples for volatile organic compounds (VOCs) via EPA Method 8260 and semi-volatile organic compounds (SVOCs) via EPA Method 8270 (base neutrals). Additionally, four monitoring wells were installed; the four newly installed monitoring wells and one existing monitoring well located on the sidewalk to the west of the Site were sampled. The five groundwater samples were analyzed for VOCs via EPA Method 8260 and SVOCs via EPA Method 8270 (base neutrals).

The results of the Phase II ESA indicated an anomaly was identified in the western-central portion of the Site, as evidenced by the results of the GPR survey. Additionally, it was determined that the historical use of the Site as a gasoline station appears to have impacted upon the environmental quality of the Site as evidenced by the analytical results of soil probes SP-2 (12.5 to 15 feet), SP-3 (10 to 12.5-feet), and SP-4 (5 to 7.5 feet) and groundwater samples from MW-1 through MW-5. The soil analytical results of the Phase II ESA further indicated that levels of gasoline compounds and petroleum impacts were identified in the shallow soils and within the vadose zone in the central and northern portions of the Site as well as in the soil within the vadose zone in the central portion of the Site at concentrations greater than their respective Unrestricted Use Soil Cleanup Objectives (UUSCO). Additionally, the groundwater analytical results indicated levels of gasoline compounds were detected at concentrations exceeding the GQS indicating the groundwater beneath the Site appears to have been impacted and extends to the sidewalk to the west (downgradient of the Site). The greatest concentration of BTEX (benzene, ethyl benzene, toluene, and xylenes) compounds was identified in the central portion of the Site with lower concentrations of total VOCs and BTEX compounds detected in the sidewalk downgradient of the Site and in the northern and southern portions of the Site.

Touchstone noted the soil probes were installed to a depth of 10 feet below grade as groundwater was encountered at this depth.

Elevated levels of several polyaromatic hydrocarbons (PAHs) including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a, h)anthracene, and indeno(1,2,3-cd)pyrene were detected in in the soil as evidenced by the analytical results of SP-1 (2.5 to 5 feet and 7.5 to 10 feet), SP-2 (12.5 to 15 feet), SP-3 (7.5 to 10 feet), and SP-4 (5 to 7.5 feet and 10 to 12.5 feet). The compounds benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a, h)anthracene, and indeno(1,2,3-cd)pyrene were detected at concentrations greater than their respective UUSCO and Restricted Residential Use Soil Cleanup Objectives (RRSCO). The presence of these compounds in the soil was considered to be representative of typical urban fill materials.

# 1.4.3 Phase I Environmental Site Assessment (Touchstone Environmental Geology, P.C. April 21, 2022)

Touchstone Environmental Geology, P.C. conducted a Phase I Environmental Site Assessment (ESA) at the property identified as 100 East 149<sup>th</sup> Street. The Phase I ESA was performed in accordance with the scope and limitations of ASTM Standard E 1527-13. At the time of the assessment, the Site consisted of one irregular-shaped parcel with an estimated area of 0.094

acres. The Site contained a vacant lot and was historically used in connection with the operation of a gasoline station at the Site. Touchstone reported that the Site was identified in the E-designation database under E-designation number E-227 with an effective date of June 30, 2009. The E-designation is related to the Air Quality - #2 Fuel Oil or # 4 Fuel Oil or Natural Gas for HVAC systems, Exhaust Stack Location Limitation, and Hazardous Materials\* Phase I and Phase II Testing Protocol. A satisfaction/remediation date for the E-Designation listing was not identified.

Touchstone reported that the Site appeared to have operated as a gasoline station from at least 1935 through 1989 and is associated with open NYSDEC Spill Number 18-10498. Touchstone additionally noted that Sanborn maps for the Site dated 1935, 1944, and 1946 depicted the presence of five 550-gallon underground storage tanks (USTs) at the Site and former uses of the Site have included the operation of an automotive service station, auto sales, a junk and salvage yard, auto wrecking public parking and an auto and truck parts dealer in 1971 according to a review of the New York City Department of Buildings records.

Touchstone identified the following Recognized Environmental Conditions:

- The listing of the Subject Property with open NYSDEC Spill Number 18-10498 including the NYSDEC's requirement for site remediation, the presence of petroleum compounds in the groundwater at concentrations exceeding the state groundwater standards and the historic use of the site as a gasoline station and suspect auto repair facility from 1935 to 1989 is considered to represent a Recognized Environmental Condition (REC) and a Potential Vapor Encroachment Condition (PVEC).
- The Subject Property is identified in the E-designation database under E-designation number E-227 with an effective date of June 30, 2009. The E-designation is related to the Air Quality #2 Fuel Oil or # 4 Fuel Oil or Natural Gas for HVAC systems, Exhaust Stack Location Limitation, and Hazardous Materials\* Phase I and Phase II Testing Protocol. A satisfaction/remediation date is not listed. The listing of the Subject Property in the E Designation database is considered to represent a Recognized Environmental Condition (REC).
- The adjacent property to the east, Patella Woodworking located at 99 South Street, is listed in the RCRA generators database as a conditionally exempt small quantity generator (VSQG). According to the database, the facility generates ignitable waste, lead and benzene, and Patella woodworking is historically listed as a large quantity generator (LQG) in 1991 and as a conditionally exempt small quantity generator in 2011. No violations are reported. The listing of the adjacent property to the east in the RCRA generators database is considered to represent a Recognized Environmental Condition (REC).

Touchstone recommended the remediation of NYSDEC Spill Number 18-10498 in accordance with NYSDEC requirements. Touchstone further recommended that any future development of the Subject Property should be done in accordance with the New York City Office of Environmental Remediation (NYC OER) E Designation requirements.

#### 1.5 Site Geology/Hydrogeology

Based upon previous subsurface investigations, the subsurface soil at the Site consists of historic fill material containing concrete, brick, and asphalt in a matrix of silty sand to a depth of approximately 10 to 15-feet below ground surface (bgs). According to the Touchstone October 2020 Phase II Environmental Site Assessment (ESA), groundwater was encountered at approximately 10-feet bgs. Additionally, the July 2019 EES RIR indicated that groundwater was encountered at the Site at approximately 10 to 14-feet bgs. According to the USGS topographic map for the area (Central Park, NY Quadrangle), the elevation of the property is approximately 8 feet above the National Geodetic Vertical Datum (NGVD) (**Figure 2**). The area topography is generally flat with little relief and no significant elevation changes. Groundwater occurs beneath the Site at a depth of approximately 10 to 14-feet below grade under perched water table conditions. Groundwater is expected to flow to the west across the Site. No portion of the Site is located within a designated flood zone area.

#### 1.6 Summary Site Conceptual Model

Previous investigations at the Site have identified contaminants at the Site in the soil (VOCs, SVOCs, metals, and PCBs), soil vapor (CVOCs), and groundwater (VOCs, SVOCs, and Metals). It was previously determined that the contamination at the Site related to NYSDEC Spill Number 18-10498 should be remediated.

#### 2.0 SAMPLING AND ANALYSIS PLAN

The purpose of this work plan will be to determine the nature and extent of the on-Site contamination and identify all sources of contamination (horizontal/vertical) that may be present at the Site. The investigation must produce data of sufficient quality and quantity to allow the NYSDEC and NYSDOH to complete a Significant Threat Determination as per Part 375.2.7 and enable the performance of a qualitative human health exposure assessment as per DER-10, 3.3(c)4.

The subsurface investigation will consist of the following elements:

- The installation of ten (10) soil borings to obtain additional information on soil quality with respect to Soil Cleanup Objectives (SCOs);
- The installation of ten (10) monitoring wells and the collection of groundwater samples to assess groundwater impacts;
- The installation of six (6) soil vapor implants to assess vapor phase VOCs.

#### 2.1 Standards, Criteria, and Guidance for Remedial Actions

A criterion for remedy selections for conformance with Standards, Criteria, and Guidance (SCGs) that are applicable, relevant, and appropriate. Principal SCGs that are applicable, relevant, and appropriate for evaluating the alternatives for remediation of this BCP Site include the following:

- 6 NYCRR Part 371 Identification and Listing of Hazardous Wastes (November 1998)
- 6 NYCRR Part 372 Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (November 1998)
- 6 NYCRR Subpart 374-1 Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities (November 1998)
- 6 NYCRR Part 375 6 NYCRR Part 375 Environmental Remediation Programs Subparts 375-1, 375-3 and 375-6 (December 2006)
- 6 NYCRR Part 376 Land Disposal Restrictions
- 6 NYCRR Parts 700-706 Water Quality Standards (June 1998)
- 6 NYCRR Part 375-6 Soil Cleanup Objectives
- New York State Groundwater Quality Standards 6 NYCRR Part 703;
- NYSDEC Ambient Water Quality Standards and Guidance Values TOGS 1.1.1;
- NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation May 2010;
- NYSDEC Draft Brownfield Cleanup Program Guide May 2004;
- New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan
- NYS Waste Transporter Permits 6 NYCRR Part 364;
- NYS Solid Waste Management Requirements 6 NYCRR Part 360 and Part 364.
- DER-10, Technical Guidance for Site Investigation and Remediation, May 2010 DER-23
- Citizen Participation Handbook for Remedial Programs

- DER-31 / Green Remediation, DEC Program Policy dated August 11, 2010
- DER-33/Institutional Controls: A Guide to Drafting and Recording Institutional
- Controls, DEC Program Policy dated December 3, 2010
- Guidance for Evaluating Soil Vapor Intrusion in the State of New York, New York State Department of Health, October 2006 (as amended)
- CP-51/Soil Cleanup Guidance, DEC Policy, October 21, 2010
- Making Changes to Selected Remedies, NYSDEC, April 1, 2008
- Sampling, Analysis and Assessment of Polyfluoroalkyl Substances (PFAS) November 2022
- Public Health Law Section 225, 10 NYCRR Subpart 5-1.52 Table 3 Maximum Contaminant Levels (MCLs)

Additional regulations and guidance are applicable, relevant, and appropriate to the remedial alternatives and will be complied in connection with implementation of the remedial program; however, the list above is intended to represent the principal SCGs which should be considered in evaluating the remedial alternatives for the BCP site.

Conformance with the appropriate standards for remediation of contaminated soil is an important criterion in evaluating the remedial alternatives for the BCP site. Presently, in New York State 6 NYCRR Part 375 establishes the primary SCGs associated with remediation of contaminated soil at sites which are in the BCP. If proposing remediation pursuant to a Track other than Track 1 (Unrestricted Use), 6 NYCRR Part 375 requires evaluation of at least one remedial alternative pursuant to Track I (Unrestricted Use) and one other alternative developed by the applicant for the proposed use of the BCP site.

#### 2.2 Project Organization

The Project Manager for the Remedial Investigation (RI) will be Rachel Ataman, PG. Overall responsibility for the BCP Project will be George J. Cambourakis, PE., of Structural Engineering Technologies, PC. Resumes and certificates of key personnel and businesses involved in the RI are included in **Appendix C**. Key personnel are additionally highlighted in the table below:

Project Role	Name	
Qualified Environmental Professional (QEP),	Rachel Ataman, Touchstone Environmental	
Project Manager	Geology, PC	
Professional Engineer also responsible for the	George J. Cambourakis, PE., Structural	
implementation of the RIWP	Engineering Technologies, PC	
Field Team Leader	Mehmet Firat Ataman, Touchstone Environmental	
	Geology, PC	
Analytical Laboratory	York Analytical Laboratories, Inc., Stratford, CT	
DUSR	Renee G. Cohen, Premier Environmental Services	
Site Safety Officer	To Be Determined	
Quality Assurance Officer	Gabrielle Castro, Touchstone Environmental	
	Geology, PC	
Project Manager for Drilling Company	Carlos Quiñonez, PG Environmental Services, Inc.	

#### 2.3 Soil Sampling

A total of ten soil borings (23SP1 through 23SP10) will be advanced across the Site. Soil borings 23SP1 through 23SP7 will be installed on-site. Soil borings 23SP1 and 23SP2 will be installed in the northern portion of the Site, soil borings 23SP3 and 23SP4 will be installed in the central portion of the Site, and soil borings 23SP5 through 23SP7 will be installed in the southern portion of the Site. Soil borings 23SP8, 23SP9 and 23SP10 will be installed on the sidewalks adjacent to the Site. Soil borings 23SP8 and 23SP9 will be installed on the sidewalks adjacent to the Site. Soil borings 23SP8 and 23SP9 will be installed on the sidewalk along Exterior Street, adjacent to the west of the Site. Soil probe 23SP10 will be installed on the sidewalk along soil samples will be collected continuously in 2-foot intervals using a Geoprobe<sup>TM</sup> dual-tube system. The Geoprobe<sup>TM</sup> uses a direct push hydraulic percussion system to drive and retrieve core samples.

Soil samples will be retrieved using a 1.5-inch diameter, 5-foot-long core sampler with disposable acetate liners and the dual-tube method to preserve sample integrity. At each soil boring location, sampling will continue until a clean endpoint sample or until no contamination is observed (approximately 18-20 feet bgs based upon previous investigations). (No contamination meaning no visual or olfactory evidence of petroleum and no elevated levels of organic vapor readings with a photoionization detector (PID)). If refusal is encountered in a boring, then the boring will be moved to a different location or different drilling technique other than a Geoprobe will be used. If refusal continues to be encountered, then the inability to drill past such refusal will be discussed with the NYSDEC. Soil screening will be conducted until no contamination is identified. Based upon regional groundwater contour maps, and measurements made previously onsite, the depth to groundwater beneath the Site is approximately 10 to 14 feet below grade under perched water table conditions.

Collected soil samples will be characterized by an experienced environmental professional and field screened for the presence of volatile organic compounds (VOCs) using a photo-ionization detector (PID). All observations will be recorded in a bound project dedicated field book which will be used to prepare a boring log for each soil boring location. Recorded observations will include sample depth, sample recovery, soil type evidence of water (if encountered), PID reading and physical evidence of contamination (odor, staining, sheen, etc.). Resumes will be provided for all personnel responsible for field screening (i.e., those representing the Remedial Engineer) of ground intrusive work for unknown contaminated sources during remediation and development work. **Attachment B** provides copies of Key Personnel Resumes.

In order to ensure that the collection of soil samples is uniform throughout the Site, all borings will be sampled at the following four intervals:

- 0 to 2 feet below grade in At the highest PID reading At the groundwater interface unexcavated areas
- Just below the deepest observed contamination, staining, odors, PID reding (clean endpoint sample)

See section 2.8.1 for soil analysis discussion.

A sample matrix showing the number, type, and analysis of samples collected during the Remedial Investigation is provided as **Table 1**. **Table 2** includes the sample collection and analysis protocols. The proposed location of the soil borings is shown on **Figure 4**.

#### 2.4 Monitoring Well Installation

Ten monitoring wells (23MW1 through 23MW10) will be installed to determine the site-specific groundwater flow direction and to further evaluate groundwater quality. Seven monitoring wells (23MW1 through 23MW7) will be installed within the Site boundary in the locations of 23SP1 through 23SP7, respectively; two monitoring wells (23MW8 and 23MW9) will be installed in the sidewalk to the west of the Site along Exterior Street in the locations of 23SP8 and 23SP9, respectively; and one monitoring well will be installed in the sidewalk to the north of the Site along East 149<sup>th</sup> Street (23MW10) in the location of 23SP10. The proposed location of the monitoring wells is shown on **Figure 5**.

The monitoring wells will be installed to a depth of 20 to 24 feet below grade or ten (10) feet into the groundwater which is anticipated to be 10 to 14 feet below grade. The monitoring wells will be installed using Geoprobe<sup>TM</sup> using direct push technology. Existing monitoring wells, if present, will not be used for this Remedial Investigation.

The monitoring wells will be constructed of 2-inch diameter PVC casing and 0.010-inch slotted PVC well screen. The wells will have 15 feet of screen place from approximately 5 feet-above the groundwater level and 10-feet below the groundwater level. A No. 00 Morie or equivalent filer sand will be placed in the borehole to within 2 feet above the top of the screen. A 1-foot hydrated bentonite seal will be placed on top of the filter sand and the remainder of the borehole will be backfilled to grade. The monitoring wells will be finished with 5-inch manhole covers. Monitoring well construction and development logs will be provided in the Remedial Investigation Report (RIR) and Remedial Action Work Plan (RAWP).

All monitoring wells will be surveyed by a New York State Licensed Surveyor to determine relative casing elevation to the nearest 0.01 ftand horizontal position to the nearest 0.1ft. Survey data will be used to determine the direction and gradient of groundwater flow at the Site.

#### 2.5 Groundwater Sampling

Groundwater samples will be collected from the newly installed monitoring wells in accordance with USEPA low-flow sampling procedures using polyethylene tubing and a low flow pump with disposable pump tubing. Groundwater samples will be collected one week following the installation and development of all of the monitoring wells.

All groundwater sampling activities will be recorded in the project dedicated field book. This will include a description of:

- Date and time of sample collection;
- Sample location;
- Purging time, duration, and volume;
- Sample appearance

• Analytical methodology:

Groundwater samples will be collected using a low flow pump and dedicated polyethylene tubing in accordance with standard low-flow sampling procedures as follows:

- Record pump make & model on sampling form.
- Wear appropriate health and safety equipment as outlined in the Health and Safety Plan
- Inspect each well for any damage or evidence of tampering and note condition in field logbook.
- Remove the well cap
- Lay out plastic sheeting and place the monitoring, purging, and sampling equipment on the sheeting.
- To avoid cross-contamination, do not let any downhole equipment touch the ground.
- Measure well headspace with a PID or FID and record the reading in the field logbook.
- A synoptic water level measurement round should be performed (in the shortest possible time) before any purging and sampling activities begin. Measure and record the depth to water using a water level meter or interface probe to the nearest 0.01 ft. Record the measurement in the field logbook. Do not measure the depth to the bottom of the well at this time (to avoid disturbing any sediment that may have accumulated). Obtain depth to bottom information from installation information in the field logbook or soil boring logs.
- Collect samples in order from wells with lowest contaminant concentration to highest concentration Connect the polyethylene tubing to the Geosub 2 Pump and lower the tubing into the well to approximately the middle of the screen. Tubing should be a minimum of 2 feet above the bottom of the well as this may cause mobilization of any sediment present in the bottom of the well.
- Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet but remains stable, continue purging until indicator field parameters stabilize.
- There should be at least 1 foot of water over the end of the tubing so there is no risk of entrapment of air in the sample. Pumping rates should be reduced to the minimum capabilities of the pump, if needed, to avoid purging the well dry. However, if the recharge rate of the well is very low and the well is purged dry, then wait until the well has recharged to a sufficient level and collect the appropriate volume of sample.
- During well purging, monitor indicator field parameters (temperature, specific conductance, pH, and turbidity) every three to five minutes (or less frequently, if appropriate). Note: during the early phase of purging emphasis should be put on minimizing and stabilizing pumping stress and recording those adjustments. 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, taken at three to five (5) minute intervals, are within the following limits:
  - $\circ$  specific conductance (3%),
  - $\circ$  temperature (3%),
  - $\circ \quad pH \ (\pm \ 0.1 \ unit)$
  - turbidity (NTU)

- If stability is not reached within a reasonable time period purging may be stopped and the sample collected. This should be noted on the sampling log.
- VOC samples should be collected directly into pre-preserved sample containers. Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. Fill each container with sample to just overflowing so that no air bubbles are entrapped inside. Cap each bottle as it is filled.
- Label the samples and record them on the chain of custody form. Place immediately into a cooler for shipment and maintain at 4°C.
- Remove the tubing from the well. The polyethylene tubing must either be dedicated to each well or discarded. If dedicated the tubing should be placed in a large plastic garbage bag, sealed, and labeled with the appropriate well identification number.
- Close and lock the well.
- Decontaminate pump either by changing the surgical pump tubing between wells or as follows:
  - 1. Flush the equipment/pump with potable water.
  - 2. Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.
  - 3. 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.
  - 4. Flush with isopropyl alcohol (pesticide grade). If equipment blank data from the previous sampling event show that the level of contaminants is insignificant, then thisstep may be skipped.
  - 5. Flush with distilled/deionized water. The final water rinse must not be recycled.

Groundwater samples will be collected in pre-cleaned laboratory supplied glassware, stored in a cooler with ice and submitted to a New York State ELAP certified environmental laboratory. Groundwater samples from monitoring wells will be submitted for laboratory analysis as discussed in Section 2.8.1.

#### 2.6 Soil Vapor Sampling

A total of six soil vapor implants (23SV1 through 23SV6) will be installed in order to assess on-Site and off-Site soil vapor quality. Soil vapor implants 23SV1 through 23SV4 will be installed throughout the Site. Soil vapor implant 23SV1 will be installed in the northeastern portion of the Site, soil vapor implant 23SV2 will be installed in the western-central portion of the Site, soil vapor implant 23SV3 will be installed in the eastern-central portion of the Site, and soil vapor implant 23SV4 will be installed in the southwestern portion of the Site. Additionally, two soil vapor implants will be installed off-Site. One soil vapor implant (23SV6) will be installed to the west of the Site in the sidewalk along Exterior Street; and one soil vapor implant (23SV5) will be installed to the north of the Site in the sidewalk along East 149<sup>th</sup> Street. The proposed locations of the new soil vapor sampling locations are shown on **Figure 6**.

Soil vapor samples will be collected in accordance with the Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH 10/2006) to determine if the medium is contaminated with VOCs. The evaluation of current on-site exposure will be useful in determining if further off-site investigation of the exposure pathway is warranted. The evaluation of future on-site exposure will determine whether or not the use of control measures will be

necessary to prevent exposure by the commercial employees of the building. Methodologies used for the soil vapor assessment will conform to the <u>NYSDOH Final Guidance on Soil Vapor Intrusion</u>, October 2006 (as amended).

In order to determine the vapor quality in the soil beneath the Site, soil vapor samples will be collected from four soil vapor implants (23SV1 through 23SV4) that will be installed within the Site boundary. Additionally, off-Site soil vapor quality will be assessed via soil vapor samples collected from the sidewalks along East 149<sup>th</sup> Street (23SV5) and along Exterior Street (23SV6).

In accordance with the New York State Department of Health's (NYS DOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York, in order to evaluate the potential for future exposures, the soil vapor sampling points will be installed at multiple depths from the suspected subsurface source, or former source, to a depth comparable to the expected depth of foundation footings. Groundwater at the site occurs between 10-14 ft bgs and the foundation of the anticipated building is reportedly at 11 ft bgs with some areas to 14 ft bgs. In accordance with NYS DOH recommendation, soil vapor sampling points be installed at depths determined based upon field screening results. Where groundwater is encountered, the soil vapor sampling points will be installed approximately one foot above the groundwater interface.

The current sub-slab and soil vapor sampling locations will be abandoned in place and will not be used.

#### 2.6.1 Soil Vapor Sampling Procedure

The soil vapor implants will be installed with Geoprobe<sup>TM</sup> equipment and constructed in the same manner at all locations to minimize possible discrepancies. The implants will utilize premanufactured 6-inch stainless steel mesh tubes fitted with <sup>1</sup>/<sub>4</sub>-inch polyethylene tubing which extends to the surface. Coarse sand will be added to create a sampling zone of one foot in length and will be sealed above with hydrated bentonite powder for a minimum distance of three feet. The tubing at all locations will be sealed at the surface with hydrated granular bentonite and a 6" x 6" (approximate) plastic sheet.

After installation of all soil vapor probes, one to three volumes (i.e., the volume of the sample probe and tube) will be purged prior to collecting the samples to ensure samples collected are representative. Flow rates for both purging and collecting will not exceed 0.2 liters per minute to minimize outdoor air infiltration during sampling. Samples will be collected in Summa® canisters which have been certified clean by the laboratory and analyzed by using USEPA Method TO-15. All samples will be collected over an 8-hour period of time and submitted to a NYSDOH certified laboratory.

A sample log sheet will be maintained summarizing sample identification, date and time of sample collection, sampling depth, identity of samplers, sampling methods and devices, soil vapor purge volumes, volume of soil vapor extracted, vacuum of canisters before and after samples are collected, apparent moisture content of the sampling zone, and chain of custody protocols.

As part of the testing, a tracer gas will be used in accordance with NYSDOH protocols to serves as a quality assurance/quality control (QA/QC) device to verify the integrity of the soil vapor

probe seal. Helium will be used as the tracer gas and a box will serve to keep it in contact with the probe during the testing. A portable monitoring device will be used to analyze a sample of soil vapor for the tracer prior to sampling. If tracer sample results show a significant presence of the tracer, the probe seals will be adjusted to prevent infiltration.

After the collection of the analytical sample, a field reading will be recorded at each sampling points utilizing a photoionization detector (PID) capable of detecting organic compounds in the parts per billion range.

#### 2.7 Emerging Contaminant Sampling

Sampling and analysis for emerging contaminants (PFAS and 1,4-dioxane) in soil and groundwater samples shall be done in accordance with Sampling, Analysis and Assessment of Polyfluoroalkyl Substances (PFAS) November 2022 guidance (**Attachment C**).

#### 2.8 Laboratory Analysis

Samples will be submitted to the laboratory for a standard turnaround time, which is estimated to be one to two weeks. The proposed sampling program is summarized in **Table 1**.

#### 2.8.1 Analysis of Soil and Groundwater Samples

Collected soil and groundwater samples will be placed in pre-cleaned laboratory supplied glassware and placed in a cooler packed with ice for transport to the laboratory. Sample analysis will be provided by a New York State certified environmental laboratory; York Analytical Laboratories, Inc. of Stratford, Connecticut (NYSDOH Nos. 10854 and 12058).

#### Soil Sample Analysis

As discussed in Section 2.3 of this work plan, in order to ensure that the collection of soil samples is uniform throughout the Site, all borings will be sampled at the following five intervals:

- 0 to 2 feet below grade in At the highest PID reading At the groundwater interface unexcavated areas
- Just below the deepest observed contamination, staining, odors, PID reding (clean endpoint sample)

The soil samples collected for outside laboratory analysis will be analyzed for the following parameters:

- Organic Compounds: Full Target Compound List + 30 (10 volatile organic compounds and 20 semi-volatile organic compounds) (TCL + 30) and highest concentrations tentatively identified compounds (TICs). The full target compound list plus the 30 (TCL +30) as defined in paragraph 2.4(d)15 of DER-10
- Inorganic Compounds: The full target analyte list (TAL) as defined in paragraph 2.4 (d)13 of DER-10.
- Pesticides via EPA Method 8081
- PCBs via EPA Method 8082

- 21 PFAS Compounds via EPA Method 1633
- 1,4-dioxane via EPA Method 8270 SIM.

Groundwater Sample Analysis

The groundwater samples will be analyzed for the following parameters:

- Organic Compounds: Full Target Compound List + 30 (10 volatile organic compounds and 20 semi-volatile organic compounds) (TCL + 30) and highest concentrations tentatively identified compounds (TICs). The full target compound list plus the 30 (TCL +30) as defined in paragraph 2.4(d)15 of DER-10
- Inorganic Compounds: The full target analyte list (TAL) as defined in paragraph 2.4 (d) 13 of DER-10 filtered and unfiltered.
- Pesticides via EPA Method 8081
- PCBs via EPA Method 8082
- 21 PFAS Compounds via EPA Method 1633
- 1,4-dioxane via EPA Method 8270 SIM.

#### 2.8.2 Analysis of Soil Vapor Samples

Analytical procedures and corresponding reporting limits will be identified when reporting the sampling results. The reporting limits for the following five compounds shall be 0.2 micrograms per cubic meter or less: trichloroethene, cis-1,2-dichloroethene, 1,1-dichloroethene, carbon tetrachloride, and vinyl chloride. Samples will be analyzed for volatile organic compounds (VOCs) by USEPA Method TO-15 and compared to the NYSDOH Guidance Document. All samples will be analyzed by a New York State ELAP-certified environmental laboratory, York Analytical Laboratories, Inc. of Stratford, Connecticut (NYSDOH Nos. 10854 and 12058).

#### 2.9 Management of Investigation Derived Wastes

Investigation derived waste includes contaminated soil, groundwater, and disposable sampling equipment generated during the remedial investigation.

Soil from borings will be placed in U.S. Department of Transportation (DOT) – approved drums. Soil removed from soil borings, not containerized will be placed into 55-gallon drums for disposal. Excess soil from the installation of monitoring wells will be placed in U.S. Department of Transportation (DOT) – approved drums. This material will either be disposed of at an appropriate off-site disposal facility or will be disposed along with other soil during subsequent remedial activities to be implemented under the RAWP. Purge water generated during groundwater sampling will be containerized in drums and analyzed for VOCs. Final classification and disposal of purge water will be based on the results of this analysis and upon approval of the NYSDEC Project Manager.

Disposable sampling equipment (gloves, tubing, acetate liners, etc.) will be placed in heavy-duty plastic bags and disposed of properly.

#### **3.0 QUALITY ASSURANCE PROJECT PLAN (QAPP)**

The fundamental Quality Assurance (QA) objective with respect to accuracy, precision, and sensitivity of analysis for laboratory analytical data is to achieve the Quality Control (QC) acceptance of the analytical protocol. The accuracy, precision and completeness requirements will be addressed by the laboratory for all data generated.

Collected samples will be appropriately packaged, placed in coolers, and shipped via overnight courier or delivered directly to the analytical laboratory by field personnel. Samples will be containerized in appropriate laboratory provided glassware and shipped in plastic coolers. Samples will be preserved through the use of ice or cold-pak(s) to maintain a temperature of 4°C.

Dedicated disposable sampling materials will be used for both soil and groundwater samples (if collected), eliminating the need to prepare field equipment (rinsate) blanks. However, if nondisposable equipment is used, (stainless steel scoop, etc.) field rinsate blanks will be prepared at the rate of 1 for every eight samples collected.

Decontamination of non-dedicated sampling equipment will consist of the following:

- Gently tap or scrape to remove adhered soil;
- Rinse with tap water;
- Wash with alconox<sup>®</sup> detergent solution and scrub;
- Rinse with tap water;
- Rinse with distilled or deionized water.

Prepare field blanks by pouring distilled or deionized water over decontaminated equipment and collecting the water in laboratory provided containers. Trip blanks will accompany samples each time they are transported to the laboratory. Matrix spike and matrix spike duplicates (MS/MSD) will be collected at the rate of one per 20 samples submitted to the laboratory. Laboratory reports will include ASP category B deliverables for use in the preparation of a data usability report (DUSR). The DUSR will be applicable to all samples collected during the RI. Performance monitoring samples will be in a results-only format. The QAPP prepared for the Site is provided in **Attachment D**.

#### 3.1 Soil and Groundwater Samples

Dedicated disposable materials (polyethylene tubing, dedicated samplers, etc.) will be used for collecting groundwater samples, and for soil samples (disposable acetate liners) therefore, field equipment (rinsate) blanks will not be part of the QA/QC program. Trip blanks will accompany samples each time they are transported to the laboratory.

#### 3.2 Soil Vapor Samples

Extreme care will be taken during all aspects of sample collection to ensure that sampling error is minimized, and high-quality data are obtained. The sampling team members will avoid actions (e.g., using permanent marker pens and wearing freshly dry-cleaned clothes or personal fragrances) which can cause sample interference in the field. A tracer gas, helium, will be used in

accordance with NYSDOH sampling protocols to serve as a QA/QC device to verify the integrity of the soil vapor probe seals. QA/QC protocols will be followed for sample collection and laboratory analysis, such as use of certified clean sample devices, meeting sample holding times and temperatures, sample accession, and chain of custody.

Samples will be delivered to the analytical laboratory as soon as possible after collection. The laboratory analyzes QC samples with each analytical batch, including a Method Blank (MB), Laboratory Control Sample (LCS), and a Laboratory Control Sample Duplicate (LCSD). Internal standards are added to all calibration standards, samples, and blanks to verify that the analytical system is in control.

#### **3.3 Reporting of Results**

Sample analysis will be provided by a New York State certified environmental laboratory. Laboratory reports will include ASP category B deliverables for use in the preparation of a data usability summary report (DUSR). All results will be provided in accordance with the NYSDEC Environmental Information Management System (EIMS) electronic data deliverable (EDD) format (EQuIS).

#### 3.3.1 Daily Reports

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

- An update of progress made during the reporting day;
- Locations of work
- A summary of any and all complaints with relevant details (names, phone numbers, etc.);
- A summary of CAMP findings, including excursions;
- An explanation of notable Site conditions

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

Daily reports will include a description of daily activities keyed to a map for the Site that identifies work areas. These reports will include a summary of air sampling results, odor and dust problems and corrective actions, and any and all complaints received from the public. A Site Map that shows the BCP Site Boundary is attached in **Figure 3**. The NYSDEC assigned project number (C203159) will appear on all reports.

#### 3.3.2 Monthly Reports

Monthly reports will be provided to the NYSDEC and NYSDOH Project Managers by the 10<sup>th</sup> of each month covering the previous calendar month reporting period and will include:

• Activities relative to the Site during the previous reporting period and those anticipated

for the next reporting period, including a quantitative presentation of work performed (e.g., number of borings completed, etc.);

- Description of approved activity modifications, including changes of work scope and/or schedule;
- Sampling results received following internal data review and validation, as applicable; and,
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays.

All daily and monthly reports will be included in the Final Engineering Report.

#### **3.4 Data Usability Summary Report**

The Data Usability Summary Report (DUSR) provides a thorough evaluation of analytical data without third party data validation. Third party validation is a requirement and will be completed on analytical laboratory data per NYSDEC DER-10. The primary objective of a DUSR is to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and data use. Verification and/or performance monitoring samples collected under this RIWP will be reviewed and evaluated in accordancewith the Guidance for the Development of Data Usability Summary Reports as presented in Appendix 2B of NYSDEC DER-10.

A qualified Data Validator will review the laboratory reports and prepare a DUSR for the sampling event. The completed DUSR for verification/performance samples collected during implementation of this RIWP will be included in the Remedial Investigation Report prior to its formal approval. The DUSR will be performed by Rene Cohen of Premier Environmental Services, Inc. Her resume is provided in **Attachment B**.

#### 4.0 HEALTH AND SAFETY PLAN

The Health and Safety Plan (HASP) takes into account the specific hazards inherent in conducting the RI and presents the minimum requirements which are to be met by Touchstone Environmental Geology, P.C. (Touchstone), its subcontractors, and other personnel in order to avoid and, if necessary, protect against health and/or safety hazards. A HASP has been prepared and is provided in **Attachment E** of this work plan.

Sub-contractors will have the option of adopting this HASP or developing their own site-specific document. If a subcontractor chooses to prepare their own HASP, it must meet the minimum requirements as detailed in the RI HASP prepared by Touchstone and must be made available to Touchstone and the NYSDEC.

Activities performed under the HASP will comply with applicable parts of OSHA Regulations, primarily 29 CFR Parts 1910 and 1926. Modifications to the HASP may be made with the approval of the Touchstone Site Safety Manager (SSM) and/or Project Manager (PM). Resumes for key personnel are provided in **Attachment B**.

#### 5.0 COMMUNITY AIR MONITORING PLAN

The Community Air Monitoring Plan (CAMP) provides measures for protection for on-site workers and the downwind community (i.e., off-site receptors including residences, businesses, and on-site commercial workers) from potential airborne contaminant releases resulting from investigation activities. CAMP monitoring and reporting is required for all "ground intrusive" activities. The NYSDEC and NYCDOH will be notified separately for any and all CAMP exceedances within 24 hours.

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

The primary concerns during the investigation are odors from VOCs. The CAMP for this investigation is provided as **Attachment F**.

#### 6.0 REMEDIAL INVESTIGATION REPORT

Following completion of the investigation and receipt of the analytical data, Touchstone will prepare a Remedial Investigation Report (RIR) in accordance with NYSDEC DER-10 Section 3.14. The RIR will include the following:

- 1. A description of the work and all the relevant information which was performed under the RI including a technical overview and findings.
- 2. Any modification from this work scope and the reason for the modifications;
- 3. The nature and extent of contaminants in all media (soil, groundwater, vapor) and the potential for off-site migration using the state standards, criteria, and guidance identified in Section 2.1 of this report.
- 4. Soil, and groundwater conditions that were observed;
- 5. Analytical data in tabular form comparing results to part 375-6 SCOs;
- 6. Cross sections and data figures;
- 7. Laboratory analytical data, sampling logs and well completion logs for all samples and areas covered by the investigation;
- 8. Scaled drawings showing the locations of temporary sampling points, monitoring wellsand surface water sampling locations;
- 9. A Qualitative Human Health Exposure Assessment;
- 10. The results of the DUSR;
- 11. Stratigraphic logs which include soil/rock physical descriptions, well installation details, well development data including volumes purged, and field instrument readings detected during drilling for each soil boring, test pit and monitoring well.
- 12. Groundwater elevation contour maps with flow direction specified for each set of static water level measurements for each aquifer where monitoring wells/piezometers were installed for flow direction.

#### 7.0 SCHEDULE

The estimated duration of the full RI activity is two weeks total field time. The anticipated schedule for completing the RI activities is as follows:

Schedule Task	Estimated Date
Execution of Brownfield Cleanup Agreement	February 2023
NYSDEC Approval of RIWP	May 2023
Mobilize equipment to the Site (begin)	Within 3 weeks of approval of RIWP
Complete Field Work	Within 2 weeks of mobilization date
Receive all Laboratory Reports	Within 2 weeks of completion of field work
Receive all Laboratory Deliverables	Within 4 weeks of completion of field work
Receive DUSR	Within 8 weeks of completion of field work
Submit Demodial Investigation Depart	Within 3 weeks of Receipt of DUSR (October
Sublint Remedial Investigation Report	2022)
Distribute Fact Sheet on RI Results and Comment	Within 16 weeks of completion of field work -
period on RAWP (if submitted with RIR)	Subject to DEC / DOH Approval













#### TABLE 1

#### SUMMARY OF SAMPLING PROGRAM RATIONALE AND ANALYSIS

Matrix	Location	Approximate Number of Samples	Rationale for Sampling	Laboratory Analysis
Subsurface Soil (0-2 feet below grade in unexcavated areas)	Subsurface Soil 10   (0-2 feet below grade in unexcavated areas) 7 borings throughout the Site (23SP1 through 23SP7) 10   Subsurface Soil 3 borings off-Site: 2 borings to the west in the sidewalk along Exterior Street (23SP8 and 23SP9), 1 boring to the north in the sidewalk along East 149 <sup>th</sup> Street 10   Subsurface Soil 10 10   Subsurface Soil 10 10   Subsurface Soil 10 10   Subsurface Soil 10 10   below the deepest observed tamination (clean endpoint sample)) 10 10	10		TCL + 10 VOCs and TICs EPA Method 8260C,
Subsurface Soil (at highest PID reading)		7) 10		TCL + 20 SVOCs and TICs EPA Method 8270, Pesticides EPA Method 8081,
Subsurface Soil (at groundwater table)		10	quality at the Site.	PCBs EPA Method 8082, 21 PFAS Compounds by EPA Method 1633,
Subsurface Soil (just below the deepest observed contamination (clean endpoint sample))		10		1,4-dioxane EPA 8270 SIM, Full Target List inorganic compounds as defined in paragraph 2.4 (d) of DER-10
Total (Soils)		40		
	7 monitoring wells throughout the Site (23MW1 through 23MW7)	7		TCL + 10 VOCs and TICs EPA Method 8260C, TCL + 20 SVOCs and TICs EPA Method 8270,
Groundwater (water table)	2 monitoring wells to the west in the sidewalk along Exterior Street (23MW8 and 23MW9), 1 monitoring well to the north in the sidewalk along East 149 <sup>th</sup> Street (23MW10)	3	To assess groundwater 3 quality at the Site.	Pesticides EPA Method 8081, PCBs EPA Method 8082, 21 PFAS Compounds by EPA Method 1633, 1,4-dioxane EPA 8270 SIM, Full Target List inorganic compounds as defined in paragraph 2.4 (d) of DER-10 (filtere and unfiltered metals)
Total (Groundwater)		10		
Soil Coc	4 soil gas implants to be installed across the Site (23SV1 through 23SV4)	4	Evaluato coil gas	
Soil Gas (depth to be determined)	2 soil gas implants to be installed off-Site: 1 to the west in the sidewalk along Exterior Street (23SV5), 1 to the north in the sidewalk along East 149 <sup>th</sup> Street (23SV6)	2	across the Site. VOCs via EPA Metho	VOCs via EPA Method TO-15.
Total (Soil Gas)		6		
Soil Duplicate	One duplicate soil sample per 20 samples	2	To meet requirements of QA / QC program	TCL + 10 VOCs and TICs EPA Method 8260C, TCL + 20 SVOCs and TICs EPA Method 8270, Pesticides EPA Method 8081, PCBs EPA Method 8082, 21 PFAS Compounds by EPA Method 1633, 1,4-dioxane EPA 8270 SIM, Full Target List inorganic compounds as defined in paragraph 2.4 (d) of DER-10
Groundwater Duplicate	One duplicate groundwater sample per 20 samples	1	To meet requirements of QA / QC program	TCL + 10 VOCs and TICs EPA Method 8260C, TCL + 20 SVOCs and TICs EPA Method 8270, Pesticides EPA Method 8081, PCBs EPA Method 8082, 21 PFAS Compounds by EPA Method 1633, 1,4-dioxane EPA 8270 SIM, Full Target List inorganic compounds as defined in paragraph 2.4 (d) of DER-10
Field Blank for PFAS	One field blank groundwater sample per day	5	To meet requirements of QA / QC program	21 PFAS Compounds by EPA Method 1633
Soil MS/MSD	Matrix spike and Matrix spike duplicates at therate 5%	2	To meet requirements of QA / QC program	TCL + 10 VOCs and TICs EPA Method 8260C, TCL + 20 SVOCs and TICs EPA Method 8270, Pesticides EPA Method 8081, PCBs EPA Method 8082, 21 PFAS Compounds by EPA Method 1633, 1,4-dioxane EPA 8270 SIM, Full Target List inorganic compounds as defined in paragraph 2.4 (d) of DER-10
Groundwater MS/MSD	Matrix spike and Matrix spike duplicates at therate 5%	1	To meet requirements of QA / QC program	TCL + 10 VOCs and TICs EPA Method 8260C, TCL + 20 SVOCs and TICs EPA Method 8270, Pesticides EPA Method 8081, PCBs EPA Method 8082, 21 PFAS Compounds by EPA Method 1633, 1,4-dioxane EPA 8270 SIM, Full Target List inorganic compounds as defined in paragraph 2.4 (d) of DER-10
Trip Blanks	One laboratory prepared trip blank to accompany samples each time they are delivered to the laboratory.	5	To meet requirements of QA / QC program	TCL + 10 VOCs and TICs EPA Method 8260C
Total (QA/QC Samples)		16		
#### TABLE 2 SAMPLE COLLECTION AND ANALYSIS PROTOCOLS

Sample Type	Matrix	Sampling Device	Parameter	Sample Container	Sample Preservation	Analytical Method#	CRQL / MDLH	HoldingTime
Grab	Soil	Terra Core Sampler dispensed into 40mL vials	VOCs	(4) 40 mL vials (Soil VOAs)	Cool to 4° C (2) 40 mL vials w/5mL water, (1) 40 mL vial w/10 mL methanol	EPA Method 8260C (test Method 5035A)	Compound Specific (1-5 ug/kg)	48 hours / 14 days if frozen or extruded to methanol
Grab	Soil	Scoop Directly into Jar	SVOCs	(1) 8 oz jar	Cool to 4° C	EPA Method 8270D	Compound Specific (1-5 ug/kg)	14 days 40 days after extraction
Grab	Soil	Scoop Directly into Jar	Pest/PCBs	From 8 oz jar above	Cool to 4° C	EPA Method 8081/8082A	Compound Specific (1-5 ug/kg)	14 days 40 days after extraction
Grab	Soil	Scoop Directly into Jar	Metals	From 8 oz jar above	Cool to 4° C	TAL Metals 6010	Compound Specific (0.1-1 mg/kg)	6 months
Grab	Soil	Scoop Directly into Jar	1,4-dioxane	(1) 8 oz jar	Cool to 4° C Water Ice Only	Method 8270 SIM	[0.1 mg/kg (ppm)]	14 days 40 days after extraction
Grab	Soil	Scoop Directly into Jar	PFAS Target Analyte List	(1) 8 oz jar	Cool to 4° C Water Ice Only	EPA Method 1633	Compound Specific [but less than 1 ug/kg (ppb)]	14 days 40 days after extraction
Grab	Water	Pump Tubing	VOCs	(2) 40 mL vials	Cool to 4° C 1:1 HCL	EPA Method 8260C	Compound Specific (1-5 ug/kg)	14 days
Grab	Water	Pump Tubing	SVOCs	(1) 1 Liter Amber Bottle	Cool to 4° C	EPA Method 8270D	Compound Specific (1-5 ug/kg)	7 days 40 days after extraction
Grab	Water	Pump Tubing	Pest/PCBs	(2) 1 Liter Amber Bottles	Cool to 4° C	EPA Method 8081B/8082A	Compound Specific (1-5 ug/kg)	7 days 40 days after extraction
Grab	Water	Pump Tubing	Total Metals	(1) 100 ml	HNO3	TAL Metals 6010	Compound Specific (1-5 ug/kg)	6 months
Grab	Water	Pump Tubing	Dissolved Metals	(1) 100 ml	Cool to 4° C	TAL Metals 6010	Compound Specific (1-5 ug/kg)	6 months
Grab	Water	Pump Tubing	1,4-dioxane	(1) 1 Liter Amber Bottle	Cool to 4° C Water Ice Only	Method 8270 SIM	[0.35 ug/L (ppb)]	7 days 40 days after extraction
Grab	Water	Pump Tubing	PFAS	(2) 275 mL HDPE bottle, no Teflon Liner	Cool to 4° C Water Ice Only	EPA Method 1633	Compound Specific [but less than 2 ng/L (ppt)]	14 days 28 days after extraction
8 hr Avg	Soil Vapor	6-Liter Summa Canister	VOCs	6-Liter Summa Canister	None	EPA Method TO-15	< 0.5 ppbv	30 days if pressure Difference between sampling and analysis if <5psi
8 hr Avg	Ambient Air	6-Liter Summa Canister	VOCs	6-Liter Summa Canister	None	EPA Method TO-15	< 0.5 ppbv	30 days if pressure Difference between sampling and analysis if <5psi

Notes:

All holding times listed are from Verified Time of Sample Receipt (VTSR) unless noted otherwise. \* Holding time listed is from time of sample collection. The number in parentheses in the "Sample Container" column denotes the number of containers needed. Triple volume required when collected MS/MSD samples

The number of trip blanks are estimated.

CRQL / MDL = Contract Required Quantitation Limit / Method Detection Limit

QA / QC Frequencies: One soil duplicate sample and one groundwater duplicate sample will be collected per 20 samples. One field blank groundwater sample will be collected per day. Groundwater and soil MS/MSD samples will be collected at the rate of 5%. One laboratory prepared trip blank will accompany samples each time they are delivered to thelaboratory.

## ATTACHMENT A PREVIOUS REPORTS

### **100 EAST 149<sup>TH</sup> STREET**

**BRONX, NEW YORK** 

## **Remedial Investigation Report**

NYC VCP Site Number: 19TMP1170X

**Prepared for:** 

OER

100 Gold St., 2nd Floor, New York, NY 10038

(Ph) 212-788-2676 (Email) scatalanotto@dep.nyc.gove

**Prepared by:** 

**Eastern Environmental Solutions** 

258 Line Road, Manorville, New York 11949

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July, 2019





Sample ID	SB-1 (10-15')	SB-5 (10'-15')	SB-8 (10'-15')	SB-11 (10'-15')	NYSDEC Part 375	NYSDEC Part 375
York ID Sampling Date	1/4/2019	1/4/2019	1/4/2019	1/4/2019	Restricted Use Soil	Restricted Use Soil
Client Matrix	Soil	Soil	Soil	Soil	Cleanup Objectives-	Cleanup Objectives -
Compound	Result	Result	Result	Result	Protection of GW	Restricted Residential
Volatile Organics, CP-51	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor	1	1	100	100		
1,2,4-Trimethylbenzene	0.0400	0.0450	1.500	5.100	3.6	52
Benzene	0.00290	0.0470	1.200	0.300	0.06	4.8
Ethyl Benzene	0.00290	0.0470	1.900	6.800	1	41
n-Propylbenzene	0.00450	0.110	1.600	9.700	3.9	100
Toluene	0.00290	0.0230	1.400	0.300	0.7	100
Xylenes, Total	0.00860	0.0550	3.900	4.100	1.6	100
Semi-Volatiles, CP-51	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor	2	5	2	2		
Benzo(a)anthracene	0.210	2.300	0.410	0.130	1	1
Benzo(a)pyrene	0.280	4.500	0.470	0.0850	22	1
Benzo(b)fluoranthene	0.220	3.300	0.310	0.0940	1.7	1
Benzo(k)fluoranthene	0.200	2.900	0.210	0.0970	1.7	3.9
Chrysene	0.260	2.500	0.510	0.130	1	3.9
Dibenzo(a,h)anthracene	0.0520	1.200	0.0490	0.0500	1000	0.33
Indeno(1,2,3-cd)pyrene	0.210	4.400	0.300	0.0500	8.2	0.5
Metals, RCRA	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor	1	1	1	1		
Mercury by 7473	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor	1	1	1	1		
Mercury	0.783	0.304	0.306	0.193	0.73	0.81
Total Solids	%	%	%	%		
Dilution Factor	1	1	1	1		

Sample ID York ID Sampling Date Client Matrix	SB-1 (10-15') 1/4/2019 Soil	SB-5 (10'-15') 1/4/2019 Soil	SB-8 (10'-15') 1/4/2019 Soil	SB-11 (10'-15') 1/4/2019 Soil	NYSDEC Part 375 Restricted Use Soil Cleanup Objectives-	NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -
Compound	Result	Result	Result	Result	Protection of GW	Restricted Residential
Metals, RCRA	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor	1	1	1	1		
Mercury by 7473	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor	1	1	1	1		
Mercury	0.783	0.304	0.306	0.193	0.73	0.81
Total Solids	%	%	%	%		
Dilution Factor	1	1	1	1		

#### NOTES:

Any Regulatory Exceedences are color coded by Regulation

#### Q is the Qualifier Column with definitions as follows:

D=result is from an analysis that required a dilution

J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated

U=analyte not detected at or above the level indicated

B=analyte found in the analysis batch blank

E=result is estimated and cannot be accurately reported due to levels encountered or interferences

P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between

the two GC columns used for analysis

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

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

Sample ID		SB1 0-	-2'	SB1 1	0'	SB2 0-2'	SB2	10'	SB3 0-2	2'	SB3 10	)'	SB4 0-2	2'	SB4 10	1						
York ID		19C0312	2-01	19C0312	2-02	19C0312-03	<b>19C03</b>	2-04	19C0312	-05	19C0312-	-06	19C0312	-07	19C0312-	-08	NYSDEC Part 375 Postricted Use Soil	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375
Sampling Date		3/7/20	19	3/7/201	19	3/7/2019	3/7/2	019	3/7/201	9	3/7/201	9	3/7/201	.9	3/7/201	9	Cleanup Objectives	Restricted Use Soil	Restricted Use Soil	Restricted Use Soil	Restricted Use Soil	Unrestricted Use
Client Matrix		Soil	I	Soil		Soil	Soi	1	Soil		Soil		Soil		Soil		-Restricted	Commercial	Industrial	Protection of GW	Residential	Objectives
Compound	CAS Number	Result	Q	Result	Q	Result Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Residential					
Volatile Organics, 8260 - Comprehensive		mg/Kg		mg/Kg		mg/Kg	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor		1		1		1	100		1		1		1		1							
1,1,1,2-Tetrachloroethane	630-20-6	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
1,1,1-Trichloroethane	71-55-6	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	100	500	1000	0.68	100	0.68
1,1,2,2-Tetrachloroethane	79-34-5	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	76-13-1	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
1,1,2-Trichloroethane	79-00-5	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
1,1-Dichloroethane	75-34-3	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	26	240	480	0.27	19	0.27
1,1-Dichloroethylene	75-35-4	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	100	500	1000	0.33	100	0.33
1,2,3-Trichlorobenzene	87-61-6	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
1,2,3-Trichloropropane	96-18-4	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
1,2,4-Trichlorobenzene	120-82-1	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
1,2,4-Trimethylbenzene	95-63-6	0.00410	J	0.00260	U	0.00330 U	8.200	D	0.00330	U	0.00460	J	0.00260	U	0.00210	U	52	190	380	3.6	47	3.6
1,2-Dibromo-3-chloropropane	96-12-8	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
1,2-Dibromoethane	106-93-4	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
1,2-Dichlorobenzene	95-50-1	0.00320	U	0.00260	U	0.00330 U	1.200	JD	0.00330	U	0.00250	U	0.00260	U	0.00210	U	100	500	1000	1.1	100	1.1
1,2-Dichloroethane	107-06-2	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	3.1	30	60	0.02	2.3	0.02
1,2-Dichloropropane	78-87-5	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
1,3,5-Trimethylbenzene	108-67-8	0.00320	U	0.00260	U	0.00330 U	2.400	D	0.00330	U	0.00250	U	0.00260	U	0.00210	U	52	190	380	8.4	47	8.4
1,3-Dichlorobenzene	541-73-1	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	49	280	560	2.4	17	2.4
1,4-Dichlorobenzene	106-46-7	0.00320	U	0.00260	U	0.00330 U	2.500	D	0.00330	U	0.00250	U	0.00260	U	0.00210	U	13	130	250	1.8	9.8	1.8
1,4-Dioxane	123-91-1	0.0630	U	0.0520	U	0.0650 U	15	U	0.0660	U	0.0500	U	0.0530	U	0.0410	U	13	130	250	0.1	9.8	0.1
2-Butanone	78-93-3	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	100	500	1000	0.12	100	0.12
2-Hexanone	591-78-6	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
4-Methyl-2-pentanone	108-10-1	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Acetone	67-64-1	0.0150		0.00560	J	0.0150	1.500	U	0.00850	J	0.00500	U	0.00880	J	0.00770	J	100	500	1000	0.05	100	0.05
Acrolein	107-02-8	0.00630	U	0.00520	U	0.00650 U	1.500	U	0.00660	U	0.00500	U	0.00530	U	0.00410	U	~	~	~	~	~	~
Acrylonitrile	107-13-1	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Benzene	71-43-2	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	4.8	44	89	0.06	2.9	0.06
Bromochloromethane	74-97-5	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Bromodichloromethane	75-27-4	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Bromoform	75-25-2	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Bromomethane	74-83-9	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Carbon disulfide	75-15-0	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Carbon tetrachloride	56-23-5	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	2.4	22	44	0.76	1.4	0.76
Chlorobenzene	108-90-7	0.00320	U	0.00260	U	0.00330 U	5.500	D	0.00330	U	0.00250	U	0.00260	U	0.00210	U	100	500	1000	1.1	100	1.1
Chloroethane	75-00-3	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Chloroform	67-66-3	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	49	350	700	0.37	10	0.37
Chloromethane	74-87-3	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
cis-1,2-Dichloroethylene	156-59-2	0.00320	U	0.00260	U	0.00330 U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	100	500	1000	0.25	59	0.25

Sample ID		SB1 0-	-2'	SB1 1	10'	SB2 0-	-2'	SB2 1	l <b>0'</b>	SB3 0-2	2'	SB3 10	•	SB4 0-	2'	SB4 10	1						
York ID		19C0312	2-01	19C031	2-02	19C0312	2-03	19C031	2-04	19C0312	-05	19C0312-	·06	19C0312	-07	19C0312-	-08	NYSDEC Part 375 Restricted Use Soil	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375
Sampling Date		3/7/20	19	3/7/20	)19	3/7/20	19	3/7/20	19	3/7/201	9	3/7/201	9	3/7/201	.9	3/7/201	9	Cleanup Objectives	Restricted Use Soil	Restricted Use Soil	Restricted Use Soil	Restricted Use Soil	Unrestricted Use
Client Matrix		Soil	l	Soi	1	Soil		Soil	1	Soil		Soil		Soil		Soil		-Restricted	Commercial	Industrial	Protection of GW	Residential	Objectives
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Residential					
cis-1,3-Dichloropropylene	10061-01-5	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Cyclohexane	110-82-7	0.00320	U	0.00260	U	0.00330	U	3.600	D	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Dibromochloromethane	124-48-1	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Dibromomethane	74-95-3	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Dichlorodifluoromethane	75-71-8	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Ethyl Benzene	100-41-4	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	41	390	780	1	30	1
Hexachlorobutadiene	87-68-3	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Isopropylbenzene	98-82-8	0.00320	U	0.00260	U	0.00330	U	2.700	D	0.00330	U	0.00370	J	0.00260	U	0.00210	U	~	~	~	~	~	~
Methyl acetate	79-20-9	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Methyl tert-butyl ether (MTBE)	1634-04-4	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	100	500	1000	0.93	62	0.93
Methylcyclohexane	108-87-2	0.00390	J	0.00260	U	0.00330	U	11	D	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Methylene chloride	75-09-2	0.00860	J	0.00520	U	0.00650	U	1.500	U	0.00660	U	0.00500	U	0.00530	U	0.00410	U	100	500	1000	0.05	51	0.05
n-Butylbenzene	104-51-8	0.00320	U	0.00260	U	0.00330	U	2.800	D	0.00330	U	0.00250	U	0.00260	U	0.00210	U	100	500	1000	12	100	12
n-Propylbenzene	103-65-1	0.00320	U	0.00260	U	0.00330	U	6.500	D	0.00330	U	0.0120		0.00260	U	0.00210	U	100	500	1000	3.9	100	3.9
o-Xylene	95-47-6	0.00320	U	0.00260	U	0.00330	U	1	JD	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
p- & m- Xylenes	179601-23-1	0.00630	U	0.00520	U	0.00650	U	3.900	D	0.00660	U	0.00500	U	0.00530	U	0.00410	U	~	~	~	~	~	~
p-Isopropyltoluene	99-87-6	0.00320	U	0.00260	U	0.00330	U	1.500	D	0.00330	U	0.00390	J	0.00260	U	0.00210	U	~	~	~	~	~	~
sec-Butylbenzene	135-98-8	0.00320	U	0.00260	U	0.00330	U	2.200	D	0.00330	U	0.00410	J	0.00260	U	0.00210	U	100	500	1000	11	100	11
Styrene	100-42-5	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
tert-Butyl alcohol (TBA)	75-65-0	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
tert-Butylbenzene	98-06-6	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	100	500	1000	5.9	100	5.9
Tetrachloroethylene	127-18-4	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	19	150	300	1.3	5.5	1.3
Toluene	108-88-3	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	100	500	1000	0.7	100	0.7
trans-1,2-Dichloroethylene	156-60-5	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	100	500	1000	0.19	100	0.19
trans-1,3-Dichloropropylene	10061-02-6	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	2	~	~	~
trans-1,4-dichloro-2-butene	110-57-6	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	~	~	~	~
Trichloroethylene	79-01-6	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	21	200	400	0.47	10	0.47
Trichlorofluoromethane	75-69-4	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	~	~	2	~	~	~
Vinyl Chloride	75-01-4	0.00320	U	0.00260	U	0.00330	U	0.730	U	0.00330	U	0.00250	U	0.00260	U	0.00210	U	0.9	13	27	0.02	0.21	0.02
Xylenes, Total	1330-20-7	0.00950	U	0.00790	U	0.00980	U	<b>4.900</b>	D	0.0100	U	0.00740	U	0.00790	U	0.00620	U	100	500	1000	1.6	100	0.26
Semi-Volatiles, 8270 - Comprehensive		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor		2		2		2		10		10		10		2		2							
1,1-Biphenyl	92-52-4	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0502	JD	0.0432	U	0.0432	U	~	~	~	~	~	~
1,2,4,5-Tetrachlorobenzene	95-94-3	0.0989	U	0.100	U	0.0939	U	10.200	U	0.101	U	0.0981	U	0.0861	U	0.0861	U	~	~	~	~	~	~
1,2,4-Trichlorobenzene	120-82-1	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
1,2-Dichlorobenzene	95-50-1	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	100	500	1000	1.1	100	1.1
1,2-Diphenylhydrazine (as Azobenzene)	122-66-7	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
1,3-Dichlorobenzene	541-73-1	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	49	280	560	2.4	17	2.4
1,4-Dichlorobenzene	106-46-7	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	13	130	250	1.8	9.8	1.8
2,3,4,6-Tetrachlorophenol	58-90-2	0.0989	U	0.100	U	0.0939	U	10.200	U	0.101	U	0.0981	U	0.0861	U	0.0861	U	~	~	~	~	~	~

Sample ID		SB1 0	-2'	SB1 1	l <b>0'</b>	SB2 0-	-2'	SB2 1	)'	SB3 0-2	2'	SB3 10	)'	SB4 0-2	2'	SB4 10	)'						
York ID		19C031	2-01	19C031	2-02	19C0312	2-03	19C0312	2-04	19C0312	-05	19C0312-	-06	19C0312	-07	19C0312	-08	NYSDEC Part 375 Restricted Use Soil	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375
Sampling Date		3/7/20	19	3/7/20	19	3/7/20	19	3/7/202	19	3/7/201	9	3/7/201	9	3/7/201	.9	3/7/201	9	Cleanup Objectives	Restricted Use Soil	Restricted Use Soil	Restricted Use Soil	Restricted Use Soil	Unrestricted Use
Client Matrix		Soil	I I	Soil	L I	Soil		Soil		Soil		Soil		Soil		Soil		-Restricted	Cleanup Objectives Commercial	Industrial	Protection of GW	Residential	Objectives
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Residential					-
2,4,5-Trichlorophenol	95-95-4	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
2,4,6-Trichlorophenol	88-06-2	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
2,4-Dichlorophenol	120-83-2	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
2,4-Dimethylphenol	105-67-9	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
2,4-Dinitrophenol	51-28-5	0.0989	U	0.100	U	0.0939	U	10.200	U	0.101	U	0.0981	U	0.0861	U	0.0861	U	~	~	~	~	~	~
2,4-Dinitrotoluene	121-14-2	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
2,6-Dinitrotoluene	606-20-2	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
2-Chloronaphthalene	91-58-7	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
2-Chlorophenol	95-57-8	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
2-Methylnaphthalene	91-57-6	0.0495	U	0.0727	JD	0.0471	U	50.800	D	0.0508	U	0.169	D	0.0432	U	0.310	D	~	~	~	~	~	~
2-Methylphenol	95-48-7	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	100	500	1000	0.33	100	0.33
2-Nitroaniline	88-74-4	0.0989	U	0.100	U	0.0939	U	10.200	U	0.101	U	0.0981	U	0.0861	U	0.0861	U	~	~	~	~	~	~
2-Nitrophenol	88-75-5	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
3- & 4-Methylphenols	65794-96-9	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
3,3-Dichlorobenzidine	91-94-1	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
3-Nitroaniline	99-09-2	0.0989	U	0.100	U	0.0939	U	10.200	U	0.101	U	0.0981	U	0.0861	U	0.0861	U	~	2	~	~	~	~
4,6-Dinitro-2-methylphenol	534-52-1	0.0989	U	0.100	U	0.0939	U	10.200	U	0.101	U	0.0981	U	0.0861	U	0.0861	U	~	~	~	~	~	~
4-Bromophenyl phenyl ether	101-55-3	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
4-Chloro-3-methylphenol	59-50-7	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
4-Chloroaniline	106-47-8	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	2	~	~	~	~
4-Chlorophenyl phenyl ether	7005-72-3	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
4-Nitroaniline	100-01-6	0.0989	U	0.100	U	0.0939	U	10.200	U	0.101	U	0.0981	U	0.0861	U	0.0861	U	~	~	~	~	~	~
4-Nitrophenol	100-02-7	0.0989	U	0.100	U	0.0939	U	10.200	U	0.101	U	0.0981	U	0.0861	U	0.0861	U	~	~	~	~	~	~
Acenaphthene	83-32-9	0.0609	JD	0.0501	U	0.0773	JD	5.100	U	0.543	D	0.169	D	0.0432	U	0.0432	U	100	500	1000	98	100	20
Acenaphthylene	208-96-8	0.0711	JD	0.0501	U	0.0471	U	5.100	U	0.117	D	0.143	D	0.0432	U	0.0432	U	100	500	1000	107	100	100
Acetophenone	98-86-2	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Aniline	62-53-3	0.198	U	0.200	U	0.188	U	20.400	U	0.203	U	0.196	U	0.172	U	0.172	U	~	~	~	~	~	~
Anthracene	120-12-7	0.281	D	0.0501	U	0.217	D	5.100	U	1.520	D	0.540	D	0.0432	U	0.0432	U	100	500	1000	1000	100	100
Atrazine	1912-24-9	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Benzaldehyde	100-52-7	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Benzidine	92-87-5	0.198	U	0.200	U	0.188	U	20.400	U	0.203	U	0.196	U	0.172	U	0.172	U	~	~	~	~	~	~
Benzo(a)anthracene	56-55-3	1.500	D	0.201	D	0.756	D	5.100	U	4.590	D	3.020	D	0.142	D	0.0432	U	1	5.6	11	1	1	1
Benzo(a)pyrene	50-32-8	1.480	D	0.421	D	0.702	D	5.100	U	4.570	D	8.570	D	0.147	D	0.0432	U	1	1	1.1	22	1	1
Benzo(b)fluoranthene	205-99-2	1.300	D	0.344	D	0.609	D	5.100	U	3.180	D	5.230	D	0.128	D	0.0432	U	1	5.6	11	1.7	1	1
Benzo(g,h,i)perylene	191-24-2	0.819	D	0.349	D	0.408	D	5.100	U	2.170	D	7.370	D	0.0943	D	0.0432	U	100	500	1000	1000	100	100
Benzo(k)fluoranthene	207-08-9	1.020	D	0.247	D	0.512	D	5.100	U	3.010	D	4.270	D	0.0957	D	0.0432	U	3.9	56	110	1.7	1	0.8
Benzoic acid	65-85-0	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Benzyl alcohol	100-51-6	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Benzyl butyl phthalate	85-68-7	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Bis(2-chloroethoxy)methane	111-91-1	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~

Sample ID		SB1 0-	-2'	SB1 1	10'	SB2 0-	-2'	SB2 1	0'	SB3 0-2	2'	SB3 10	'	SB4 0-2	2'	SB4 10	0'						
York ID		19C0312	2-01	19C031	2-02	19C0312	2-03	19C0312	2-04	19C0312	-05	19C0312-	-06	19C0312	-07	19C0312	2-08	NYSDEC Part 375 Restricted Use Soil	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375
Sampling Date		3/7/20	19	3/7/20	19	3/7/20	19	3/7/202	19	3/7/201	9	3/7/201	9	3/7/201	9	3/7/201	19	Cleanup Objectives	Restricted Use Soil	Restricted Use Soil	Restricted Use Soil	Restricted Use Soil	Unrestricted Use
Client Matrix		Soil	l	Soil	1	Soil		Soil		Soil		Soil		Soil		Soil		-Restricted	Commercial	Industrial	Protection of GW	Residential	Objectives
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Residential					
Bis(2-chloroethyl)ether	111-44-4	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Bis(2-chloroisopropyl)ether	108-60-1	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Bis(2-ethylhexyl)phthalate	117-81-7	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Caprolactam	105-60-2	0.0989	U	0.100	U	0.0939	U	10.200	U	0.101	U	0.0981	U	0.0861	U	0.0861	U	~	~	~	~	~	~
Carbazole	86-74-8	0.0672	JD	0.0501	U	0.0555	JD	5.100	U	0.327	D	0.212	D	0.0432	U	0.0432	U	~	~	~	~	~	~
Chrysene	218-01-9	1.280	D	0.225	D	0.671	D	5.100	U	4.040	D	2.670	D	0.120	D	0.0432	U	3.9	56	110	1	1	1
Dibenzo(a,h)anthracene	53-70-3	0.251	D	0.105	D	0.132	D	5.100	U	0.736	D	1.500	D	0.0432	U	0.0432	U	0.33	0.56	1.1	1000	0.33	0.33
Dibenzofuran	132-64-9	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.148	D	0.172	D	0.0432	U	0.0432	U	59	350	1000	210	14	7
Diethyl phthalate	84-66-2	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Dimethyl phthalate	131-11-3	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Di-n-butyl phthalate	84-74-2	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Di-n-octyl phthalate	117-84-0	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Fluoranthene	206-44-0	2.850	D	0.242	D	1.500	D	5.610	JD	8.850	D	3.880	D	0.192	D	0.0432	U	100	500	1000	1000	100	100
Fluorene	86-73-7	0.0545	JD	0.0501	U	0.0713	JD	5.100	U	0.501	D	0.173	D	0.0432	U	0.0432	U	100	500	1000	386	100	30
Hexachlorobenzene	118-74-1	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	1.2	6	12	3.2	0.33	0.33
Hexachlorobutadiene	87-68-3	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Hexachlorocyclopentadiene	77-47-4	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Hexachloroethane	67-72-1	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Indeno(1,2,3-cd)pyrene	193-39-5	0.974	D	0.390	D	0.449	D	5.100	U	2.600	D	7.570	D	0.103	D	0.0432	U	0.5	5.6	11	8.2	0.5	0.5
Isophorone	78-59-1	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Naphthalene	91-20-3	0.0495	U	0.0501	U	0.0471	U	26.300	D	0.0508	U	1.010	D	0.0432	U	0.393	D	100	500	1000	12	100	12
Nitrobenzene	98-95-3	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
N-Nitrosodimethylamine	62-75-9	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
N-nitroso-di-n-propylamine	621-64-7	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	2	~	~	~
N-Nitrosodiphenylamine	86-30-6	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	~	~	~	~	~	~
Pentachlorophenol	87-86-5	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	6.7	6.7	55	0.8	2.4	0.8
Phenanthrene	85-01-8	1.100	D	0.109	D	0.898	D	6.920	JD	5.920	D	1.800	D	0.0599	JD	0.0432	U	100	500	1000	1000	100	100
Phenol	108-95-2	0.0495	U	0.0501	U	0.0471	U	5.100	U	0.0508	U	0.0492	U	0.0432	U	0.0432	U	100	500	1000	0.33	100	0.33
Pyrene	129-00-0	2.520	D	0.245	D	1.290	D	8.790	JD	9.010	D	4.040	D	0.183	D	0.0432	U	100	500	1000	1000	100	100
Pesticides, EPA TCL List		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor		2		2		2		2		2		2		2		2							
4,4'-DDD	72-54-8	0.00078	U	0.00079	U	0.00891	D	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	13	92	180	14	2.6	0.0033
4,4'-DDE	72-55-9	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	8.9	62	120	17	1.8	0.0033
4,4'-DDT	50-29-3	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00185	D	0.00069	U	7.9	47	94	136	1.7	0.0033
Aldrin	309-00-2	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	0.097	0.68	1.4	0.19	0.019	0.005
alpha-BHC	319-84-6	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	0.48	3.4	6.8	0.02	0.097	0.02
beta-BHC	319-85-7	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	0.36	3	14	0.09	0.072	0.036
Chlordane, total	57-74-9	0.00156	U	0.00158	U	0.00149	U	0.00321	U	0.00158	U	0.00157	U	0.00137	U	0.00137	U	~	~	~	~	~	~
delta-BHC	319-86-8	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	100	500	1000	0.25	100	0.04
Dieldrin	60-57-1	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	0.2	1.4	2.8	0.1	0.039	0.005

Sample ID		SB1 0-	-2'	SB1 1	<b>.0'</b>	SB2 0-	-2'	SB2 1	l <b>0'</b>	SB3 0-2	2'	SB3 10	)'	SB4 0-2	2'	SB4 10	'						
York ID		19C0312	2-01	19C031	2-02	19C0312	2-03	19C031	2-04	19C0312	-05	19C0312	-06	19C0312	-07	19C0312-	-08	NYSDEC Part 375 Restricted Use Soil	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375
Sampling Date		3/7/20	19	3/7/20	19	3/7/20	19	3/7/20	19	3/7/201	9	3/7/201	9	3/7/201	9	3/7/201	9	Cleanup Objectives	Restricted Use Soil	Restricted Use Soil	Restricted Use Soil	Restricted Use Soil	Unrestricted Use
Client Matrix		Soil		Soil	l	Soil		Soi	L	Soil		Soil		Soil		Soil		-Restricted	Commercial	Industrial	Protection of GW	Residential	Objectives
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Kesidentiai					
Endosulfan I	959-98-8	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	24	200	920	102	4.8	2.4
Endosulfan II	33213-65-9	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	24	200	920	102	4.8	2.4
Endosulfan sulfate	1031-07-8	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	24	200	920	1000	4.8	2.4
Endrin	72-20-8	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	11	89	410	0.06	2.2	0.014
Endrin aldehyde	7421-93-4	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	~	~	~	~	~	~
Endrin ketone	53494-70-5	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	~	~	~	~	~	~
gamma-BHC (Lindane)	58-89-9	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	1.3	9.2	23	0.1	0.28	0.1
Heptachlor	76-44-8	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	2.1	15	29	0.38	0.42	0.042
Heptachlor epoxide	1024-57-3	0.00078	U	0.00079	U	0.00074	U	0.00160	U	0.00079	U	0.00078	U	0.00069	U	0.00069	U	~	~	~	~	~	~
Methoxychlor	72-43-5	0.00391	U	0.00396	U	0.00371	U	0.00802	U	0.00396	U	0.00392	U	0.00343	U	0.00343	U	~	~	~	~	~	~
Toxaphene	8001-35-2	0.0396	U	0.0400	U	0.0376	U	0.0811	U	0.0401	U	0.0397	U	0.0347	U	0.0347	U	~	~	~	~	~	~
Metals, Target Analyte		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor		1		1		1		1		1		1		1		1							
Aluminum	7429-90-5	8,550		9,270		4,670		8,690		8,820		7,930		8,070		4,380		~	~	~	~	~	~
Antimony	7440-36-0	2.980	U	3.020	U	2.840	U	5.420		3.050	U	2.980	U	2.610	U	2.620	U	~	~	~	~	~	~
Arsenic	7440-38-2	6.190		10		5.300		35.800		2.610		4.770		6.150		10.200		16	16	16	16	16	13
Barium	7440-39-3	196		141		68.300		1,110		86.200		87.200		104		66.500		400	400	10000	820	350	350
Beryllium	7440-41-7	0.0600	U	0.0600	U	0.0570	U	0.0820	U	0.0610	U	0.0600	U	0.0520	U	0.227		72	590	2700	47	14	7.2
Cadmium	7440-43-9	1.980		0.628		0.777		16.500		0.366	U	0.914		0.399		0.314	U	4.3	9.3	60	7.5	2.5	2.5
Calcium	7440-70-2	9,120		8,790		50,000		17,900		6,480		7,780		103,000		158,000		~	~	~	~	~	~
Chromium	7440-47-3	25.200		17.100		9.400		54.200		13.600		19.800		19.500		7.270		~	~	~	~	~	~
Cobalt	7440-48-4	9.880		10.800		4.880		8.900		6.830		9.460		8.680		5.210		~	~	~	~	~	~
Copper	7440-50-8	81.400		77.600		31.500		267		35		209		29.300		15.100		270	270	10000	1720	270	50
Iron	7439-89-6	19,300		24,000		11,000		30,400		14,000		16,700		16,600		11,600		~	~	~	~	~	~
Lead	7439-92-1	410		566		112		10,700		238		173		18.200		11.200		400	1000	3900	450	400	63
Magnesium	7439-95-4	3,930		5,330		13,000		2,470		3,660		3,310		8,770		11,500		~	~	~	~	~	~
Manganese	7439-96-5	268		265		166		223		117		348		200		179		2000	10000	10000	2000	2000	1600
Nickel	7440-02-0	25.100		19.700		11.900		62.500		14		28.300		18.700		12.900		310	310	10000	130	140	30
Potassium	7440-09-7	2,030		2,810		803		1,460		1,000		2,500		3,560		1,250		~	~	~	~	~	~
Selenium	7782-49-2	2.980	U	3.020	U	5.240		4.110	U	3.050	U	2.980	U	2.610	U	2.620	U	180	1500	6800	4	36	3.9
Silver	7440-22-4	0.597	U	0.603	U	0.568	U	0.822	U	0.610	U	0.596	U	0.521	U	0.523	U	180	1500	6800	8.3	36	2
Sodium	7440-23-5	524		274		202		1,690		214		179		512		387		~	~	~	~	~	~
Thallium	7440-28-0	2.980	U	3.020	U	2.840	U	4.110	U	3.050	U	2.980	U	2.610	U	2.620	U	~	~	~	~	~	~
Vanadium	7440-62-2	40.300		34.100		24.400		45.700		18.800		25.400		28.100		11.100		~	~	~	~	~	~
Zinc	7440-66-6	654		204		103		2,090		107		283		51.500		122		10000	10000	10000	2480	2200	109
Mercury by 7473		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor		1		1		1		1		1		1		1		1							
Mercury	7439-97-6	1.070		1.950		0.0898		0.716		1.540		2.250		0.0313	U	0.0314	U	0.81	2.8	5.7	0.73	0.81	0.18
Total Solids		%		%		%		%		%		%		%		%							
Dilution Factor		1		1		1		1		1		1		1		1							

Sample ID		SB1 0	-2'	SB1 1	10'	SB2 0	-2'	SB2 1	.0'	SB3 0-	2'	SB3 1	D'	SB4 0-	2'	SB4 10	)'						
York ID		19C031	2-01	19C031	2-02	19C031	2-03	<b>19C031</b>	2-04	19C0312	-05	19C0312	2-06	19C0312	2-07	19C0312	-08	NYSDEC Part 375 Restricted Use Soil	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375	NYSDEC Part 375
Sampling Date		3/7/20	)19	3/7/20	19	3/7/20	19	3/7/20	19	3/7/201	9	3/7/202	19	3/7/202	19	3/7/201	19	Cleanup Objectives	Restricted Use Soil	Restricted Use Soil Cleanup Objectives	Restricted Use Soil Cleanup Objectives	Restricted Use Soil Cleanup Objectives	Unrestricted Use Soil Cleanup
Client Matrix		Soil	1	Soi	l	Soil		Soil		Soil		Soil		Soil		Soil		-Restricted Residential	Commercial	Industrial	Protection of GW	Residential	Objectives
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Residential					
% Solids	solids	83.800		82.900		88		60.800		82		83.900		95.900		95.600		~	~	~	~	~	~
Polychlorinated Biphenyls (PCB)		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor		1		1		1		1		1		1		1		1							
Aroclor 1016	12674-11-2	0.0197	U	0.0200	U	0.0188	U	0.0405	U	0.0200	U	0.0198	U	0.0173	U	0.0173	U	~	~	~	~	~	~
Aroclor 1221	11104-28-2	0.0197	U	0.0200	U	0.0188	U	0.0405	U	0.0200	U	0.0198	U	0.0173	U	0.0173	U	~	~	~	~	~	~
Aroclor 1232	11141-16-5	0.0197	U	0.0200	U	0.0188	U	0.0405	U	0.0200	U	0.0198	U	0.0173	U	0.0173	U	~	~	~	~	~	~
Aroclor 1242	53469-21-9	0.0197	U	0.0200	U	0.0188	U	3.100		0.0200	U	0.0198	U	0.0173	U	0.0173	U	~	~	~	~	~	~
Aroclor 1248	12672-29-6	0.0197	U	0.0200	U	0.0188	U	2.920		0.0200	U	0.0198	U	0.0173	U	0.0173	U	~	~	~	~	~	~
Aroclor 1254	11097-69-1	0.0197	U	0.0200	U	0.0188	U	1.510		0.0200	U	0.0198	U	0.0173	U	0.0173	U	~	~	~	~	~	~
Aroclor 1260	11096-82-5	0.0197	U	0.0200	U	0.0342		0.934		0.0200	U	0.0198	U	0.0173	U	0.0173	U	~	~	~	~	~	~
Total PCBs	1336-36-3	0.0197	U	0.0200	U	0.0342		<b>8.460</b>		0.0200	U	0.0198	U	0.0173	U	0.0173	U	1	1	25	3.2	1	0.1

NOTES:

Any Regulatory Exceedences are color coded by Regulation

#### Q is the Qualifier Column with definitions as follows:

D=result is from an analysis that required a dilution

J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated

U=analyte not detected at or above the level indicated

B=analyte found in the analysis batch blank

E=result is estimated and cannot be accurately reported due to levels encountered or interferences

P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis

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

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

Sample ID		MW1		MW2		MW3		MW4		
York ID		19C0297	-01	19C0297-	-02	19C0296-	·01	19C0296-	·02	NYSDEC TOGS
Sampling Date		3/7/201	9	3/7/201	9	3/7/201	9	3/7/201	9	Standards and
Client Matrix		Water		Water		Water		Water		Guidance values
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	
Volatile Organics, 8260 - Comprehensive		ug/L		ug/L		ug/L		ug/L		ug/L
Dilution Factor		5		5		5		5		
1,1,1,2-Tetrachloroethane	630-20-6	0.400	U	0.400	U	0.200	U	0.200	U	5
1,1,1-Trichloroethane	71-55-6	0.400	U	0.400	U	0.200	U	0.200	U	5
1,1,2,2-Tetrachloroethane	79-34-5	0.400	U	0.400	U	0.200	U	0.200	U	5
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	76-13-1	0.400	U	0.400	U	0.200	U	0.200	U	5
1,1,2-Trichloroethane	79-00-5	0.400	U	0.400	U	0.200	U	0.200	U	1
1,1-Dichloroethane	75-34-3	0.400	U	0.400	U	0.200	U	0.200	U	5
1,1-Dichloroethylene	75-35-4	0.400	U	0.400	U	0.200	U	0.200	U	5
1,2,3-Trichlorobenzene	87-61-6	0.400	U	0.400	U	0.200	U	0.200	U	5
1,2,3-Trichloropropane	96-18-4	0.400	U	0.400	U	0.200	U	0.200	U	0.04
1,2,4-Trichlorobenzene	120-82-1	0.400	U	0.400	U	0.200	U	0.200	U	5
1,2,4-Trimethylbenzene	95-63-6	110	D	21	D	7		150		5
1,2-Dibromo-3-chloropropane	96-12-8	0.400	U	0.400	U	0.200	U	0.200	U	0.04
1,2-Dibromoethane	106-93-4	0.400	U	0.400	U	0.200	U	0.200	U	0.0006
1,2-Dichlorobenzene	95-50-1	0.400	U	0.400	U	0.200	U	0.200	U	3
1,2-Dichloroethane	107-06-2	0.400	U	0.400	U	0.200	U	0.200	U	0.6
1,2-Dichloropropane	78-87-5	0.400	U	0.400	U	0.200	U	0.200	U	1
1,3,5-Trimethylbenzene	108-67-8	54	D	9.900	D	45		41		5
1,3-Dichlorobenzene	541-73-1	0.400	U	0.400	U	0.200	U	0.200	U	3
1,4-Dichlorobenzene	106-46-7	0.400	U	0.400	U	0.200	U	0.200	U	3
1,4-Dioxane	123-91-1	80	U	80	U	40	U	40	U	~
2-Butanone	78-93-3	10	D	43	D	11		0.200	U	50
2-Hexanone	591-78-6	0.400	U	0.400	U	0.200	U	0.200	U	50
4-Methyl-2-pentanone	108-10-1	0.400	U	0.400	U	0.200	U	0.200	U	~
Acetone	67-64-1	14	D	55	D	15		2	J	50
Acrolein	107-02-8	0.400	U	0.400	U	0.200	U	0.200	U	~
Acrylonitrile	107-13-1	0.400	U	0.400	U	0.200	U	0.200	U	~
Benzene	71-43-2	54	D	86	D	0.200	U	3		1
Bromochloromethane	74-97-5	0.400	U	0.400	U	0.200	U	0.200	U	5
Bromodichloromethane	75-27-4	0.400	U	0.400	U	0.200	U	0.200	U	50
Bromoform	75-25-2	0.400	U	0.400	U	0.200	U	0.200	U	50
Bromomethane	74-83-9	0.400	U	0.400	U	0.200	U	0.200	U	5
Carbon disulfide	75-15-0	0.700	JD	1.500	D	0.640		0.200	U	~
Carbon tetrachloride	56-23-5	0.400	U	0.400	U	0.200	U	0.200	U	5
Chlorobenzene	108-90-7	0.400	U	0.740	JD	0.200	U	0.200	U	5
Chloroethane	75-00-3	0.400	U	0.400	U	0.200	U	0.200	U	5
Chloroform	67-66-3	0.400	U	0.400	U	0.200	U	14		7
Chloromethane	74-87-3	0.400	U	0.400	U	0.200	U	0.200	U	5
cis-1,2-Dichloroethylene	156-59-2	0.400	U	0.400	U	0.200	U	0.200	U	5

Sample ID		MW1		MW2		MW3		MW4		
York ID		19C0297-	-01	19C0297-	-02	19C0296-	·01	19C0296-	·02	NYSDEC TOGS
Sampling Date		3/7/201	9	3/7/201	9	3/7/201	9	3/7/201	9	Standards and
Client Matrix		Water		Water		Water		Water		Guidance values
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	
cis-1,3-Dichloropropylene	10061-01-5	0.400	U	0.400	U	0.200	U	0.200	U	0.4
Cyclohexane	110-82-7	200	DE	280	DE	180	D	0.200	U	~
Dibromochloromethane	124-48-1	0.400	U	0.400	U	0.200	U	0.200	U	50
Dibromomethane	74-95-3	0.400	U	0.400	U	0.200	U	0.200	U	~
Dichlorodifluoromethane	75-71-8	0.400	U	0.400	U	0.200	U	0.200	U	5
Ethyl Benzene	100-41-4	61	D	50	D	51		60		5
Hexachlorobutadiene	87-68-3	0.400	U	0.400	U	0.200	U	0.200	U	0.5
Isopropylbenzene	98-82-8	37	D	53	D	19		92		5
Methyl acetate	79-20-9	0.400	U	0.400	U	0.200	U	0.200	U	~
Methyl tert-butyl ether (MTBE)	1634-04-4	0.400	U	0.400	U	0.200	U	0.200	U	10
Methylcyclohexane	108-87-2	400	D	460	D	240	D	120		~
Methylene chloride	75-09-2	2	U	2	U	1	U	1.900	J	5
n-Butylbenzene	104-51-8	17	D	30	D	11		43		5
n-Propylbenzene	103-65-1	81	D	120	D	50		290	D	5
o-Xylene	95-47-6	12	D	9	D	5.900		4.600		5
p- & m- Xylenes	179601-23-1	54	D	35	D	20		84		5
p-Isopropyltoluene	99-87-6	8.800	D	8.300	D	5.800		3.400		5
sec-Butylbenzene	135-98-8	8.600	D	12	D	5.700		38		5
Styrene	100-42-5	0.400	U	0.400	U	0.200	U	0.200	U	5
tert-Butyl alcohol (TBA)	75-65-0	1	U	1	U	0.500	U	0.500	U	~
tert-Butylbenzene	98-06-6	1.200	D	1.400	D	0.520		0.200	U	5
Tetrachloroethylene	127-18-4	0.400	U	0.400	U	0.200	U	0.200	U	5
Toluene	108-88-3	14	D	18	D	6.300		3.900		5
trans-1,2-Dichloroethylene	156-60-5	0.400	U	0.400	U	0.200	U	0.200	U	5
trans-1,3-Dichloropropylene	10061-02-6	0.400	U	0.400	U	0.200	U	0.200	U	0.4
trans-1,4-dichloro-2-butene	110-57-6	0.400	U	0.400	U	0.200	U	0.200	U	~
Trichloroethylene	79-01-6	0.400	U	0.400	U	0.200	U	0.200	U	5
Trichlorofluoromethane	75-69-4	0.400	U	0.400	U	0.200	U	0.200	U	5
Vinyl Chloride	75-01-4	0.400	U	0.400	U	0.200	U	0.200	U	2
Xylenes, Total	1330-20-7	66	D	44	D	26		89		5
Semi-Volatiles, 8270 - Comprehensive		ug/L		ug/L		ug/L		ug/L		ug/L
Dilution Factor		2		5		1		2		
1,1-Biphenyl	92-52-4	2.500	U	2.500	U	2.560	U	2.630	U	~
1,2,4,5-Tetrachlorobenzene	95-94-3	2.500	U	2.500	U	2.560	U	2.630	U	~
1,2,4-Trichlorobenzene	120-82-1	2.500	U	2.500	U	2.560	U	2.630	U	5
1,2-Dichlorobenzene	95-50-1	2.500	U	2.500	U	2.560	U	2.630	U	3
1,2-Diphenylhydrazine (as Azobenzene)	122-66-7	2.500	U	2.500	U	2.560	U	2.630	U	~
1,3-Dichlorobenzene	541-73-1	2.500	U	2.500	U	2.560	U	2.630	U	3
1,4-Dichlorobenzene	106-46-7	2.500	U	2.500	U	2.560	U	2.630	U	3
2,3,4,6-Tetrachlorophenol	58-90-2	2.500	U	2.500	U	2.560	U	2.630	U	~

Sample ID		MW1		MW2		MW3		MW4		
York ID		19C0297	-01	19C0297-	-02	19C0296	-01	19C0296-	·02	NYSDEC TOGS
Sampling Date		3/7/201	9	3/7/201	9	3/7/201	9	3/7/201	9	Standards and
Client Matrix		Water		Water		Water		Water		Guidance Values
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	
2,4,5-Trichlorophenol	95-95-4	2.500	U	2.500	U	2.560	U	2.630	U	1
2,4,6-Trichlorophenol	88-06-2	2.500	U	2.500	U	2.560	U	2.630	U	1
2,4-Dichlorophenol	120-83-2	2.500	U	2.500	U	2.560	U	2.630	U	5
2,4-Dimethylphenol	105-67-9	2.500	U	2.500	U	2.560	U	2.630	U	50
2,4-Dinitrophenol	51-28-5	2.500	U	2.500	U	2.560	U	2.630	U	10
2,4-Dinitrotoluene	121-14-2	2.500	U	2.500	U	2.560	U	2.630	U	5
2,6-Dinitrotoluene	606-20-2	2.500	U	2.500	U	2.560	U	2.630	U	5
2-Chloronaphthalene	91-58-7	2.500	U	2.500	U	2.560	U	2.630	U	10
2-Chlorophenol	95-57-8	2.500	U	2.500	U	2.560	U	2.630	U	1
2-Methylnaphthalene	91-57-6	23		52.800	D	16.600		10.800		~
2-Methylphenol	95-48-7	2.500	U	2.500	U	2.560	U	2.630	U	1
2-Nitroaniline	88-74-4	2.500	U	2.500	U	2.560	U	2.630	U	5
2-Nitrophenol	88-75-5	2.500	U	2.500	U	2.560	U	2.630	U	1
3- & 4-Methylphenols	65794-96-9	2.500	U	2.500	U	2.560	U	2.630	U	~
3,3-Dichlorobenzidine	91-94-1	2.500	U	2.500	U	2.560	U	2.630	U	5
3-Nitroaniline	99-09-2	2.500	U	2.500	U	2.560	U	2.630	U	5
4,6-Dinitro-2-methylphenol	534-52-1	2.500	U	2.500	U	2.560	U	2.630	U	~
4-Bromophenyl phenyl ether	101-55-3	2.500	U	2.500	U	2.560	U	2.630	U	~
4-Chloro-3-methylphenol	59-50-7	2.500	U	2.500	U	2.560	U	2.630	U	1
4-Chloroaniline	106-47-8	2.500	U	2.500	U	2.560	U	2.630	U	5
4-Chlorophenyl phenyl ether	7005-72-3	2.500	U	2.500	U	2.560	U	2.630	U	~
4-Nitroaniline	100-01-6	2.500	U	2.500	U	2.560	U	2.630	U	5
4-Nitrophenol	100-02-7	2.500	U	2.500	U	2.560	U	2.630	U	1
Acenaphthene	83-32-9	2.500	U	2.500	U	2.780	J	2.630	U	20
Acenaphthylene	208-96-8	2.500	U	2.500	U	0.513	J	2.630	U	~
Acetophenone	98-86-2	2.500	U	2.500	U	2.560	U	2.630	U	~
Aniline	62-53-3	2.500	U	2.500	U	2.560	U	2.630	U	5
Anthracene	120-12-7	2.500	U	2.500	U	1.710	J	2.630	U	50
Atrazine	1912-24-9	2.500	U	2.500	U	0.513	U	2.630	U	~
Benzaldehyde	100-52-7	2.500	U	2.500	U	2.560	U	2.630	U	~
Benzidine	92-87-5	10	U	10	U	10.300	U	10.500	U	~
Benzo(a)anthracene	56-55-3	2.500	U	2.500	U	3.250	J	2.630	U	0.002
Benzo(a)pyrene	50-32-8	2.500	U	2.500	U	4.390	J	2.630	U	0.002
Benzo(b)fluoranthene	205-99-2	2.500	U	2.500	U	4.230	J	2.630	U	0.002
Benzo(g,h,i)perylene	191-24-2	2.500	U	2.500	U	3.460	J	2.630	U	~
Benzo(k)fluoranthene	207-08-9	2.500	U	2.500	U	3.330	J	2.630	U	0.002
Benzoic acid	65-85-0	25	U	25	U	25.600	U	26.300	U	~
Benzyl alcohol	100-51-6	2.500	U	2.500	U	2.560	U	2.630	U	~
Benzyl butyl phthalate	85-68-7	2.500	U	2.500	U	2.560	U	2.630	U	50
Bis(2-chloroethoxy)methane	111-91-1	2.500	U	2.500	U	2.560	U	2.630	U	5

Sample ID		MW1		MW2		MW3		MW4		
York ID		19C0297	-01	19C0297-	-02	19C0296-	·01	19C0296-	·02	NYSDEC TOGS
Sampling Date		3/7/201	9	3/7/201	9	3/7/201	9	3/7/201	9	Standards and
Client Matrix		Water		Water		Water		Water		Guidance values
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	
Bis(2-chloroethyl)ether	111-44-4	2.500	U	2.500	U	2.560	U	2.630	U	1
Bis(2-chloroisopropyl)ether	108-60-1	2.500	U	2.500	U	2.560	U	2.630	U	5
Bis(2-ethylhexyl)phthalate	117-81-7	2.500	U	2.500	U	0.513	J	2.630	U	5
Caprolactam	105-60-2	2.500	U	2.500	U	2.560	U	2.630	U	~
Carbazole	86-74-8	2.500	U	2.500	U	2.560	U	2.630	U	~
Chrysene	218-01-9	2.500	U	2.500	U	3.200	J	2.630	U	0.002
Dibenzo(a,h)anthracene	53-70-3	2.500	U	2.500	U	0.349	J	2.630	U	~
Dibenzofuran	132-64-9	2.500	U	2.500	U	2.560	U	2.630	U	~
Diethyl phthalate	84-66-2	2.500	U	2.500	U	2.560	U	2.630	U	50
Dimethyl phthalate	131-11-3	2.500	U	2.500	U	2.560	U	2.630	U	50
Di-n-butyl phthalate	84-74-2	2.500	U	2.500	U	2.560	U	2.630	U	50
Di-n-octyl phthalate	117-84-0	2.500	U	2.500	U	2.560	U	2.630	U	50
Fluoranthene	206-44-0	2.660	J	3.750	J	7.900		2.630	U	50
Fluorene	86-73-7	2.500	U	2.500	U	2.880	J	2.630	U	50
Hexachlorobenzene	118-74-1	2.500	U	2.500	U	0.0205	U	2.630	U	0.04
Hexachlorobutadiene	87-68-3	2.500	U	2.500	U	0.513	U	2.630	U	0.5
Hexachlorocyclopentadiene	77-47-4	2.500	U	2.500	U	2.560	U	2.630	U	5
Hexachloroethane	67-72-1	2.500	U	2.500	U	0.513	U	2.630	U	5
Indeno(1,2,3-cd)pyrene	193-39-5	2.500	U	2.500	U	3.440	J	2.630	U	0.002
Isophorone	78-59-1	2.500	U	2.500	U	2.560	U	2.630	U	50
Naphthalene	91-20-3	51.100	D	114	D	22.600		65.700	D	10
Nitrobenzene	98-95-3	2.500	U	2.500	U	0.256	U	2.630	U	0.4
N-Nitrosodimethylamine	62-75-9	2.500	U	2.500	U	0.513	U	2.630	U	~
N-nitroso-di-n-propylamine	621-64-7	2.500	U	2.500	U	2.560	U	2.630	U	~
N-Nitrosodiphenylamine	86-30-6	2.500	U	2.500	U	2.560	U	2.630	U	50
Pentachlorophenol	87-86-5	2.500	U	2.500	U	0.256	U	2.630	U	1
Phenanthrene	85-01-8	4.060	J	3.320	J	9.860		2.630	U	50
Phenol	108-95-2	2.500	U	2.500	U	2.560	U	2.630	U	1
Pyrene	129-00-0	3.060	J	3.730	J	7.200		2.630	U	50
Pesticides, 8081 target list		ug/L		ug/L		ug/L		ug/L		ug/L
Dilution Factor		1		1		1		1		
4,4'-DDD	72-54-8	0.00410	U	0.00410	U	0.00410	U	0.00410	U	0.3
4,4'-DDE	72-55-9	0.00410	U	0.00410	U	0.00410	U	0.00410	U	0.2
4,4'-DDT	50-29-3	0.00410	U	0.00410	U	0.00410	U	0.00410	U	0.2
Aldrin	309-00-2	0.00410	U	0.00410	U	0.00410	U	0.00410	U	~
alpha-BHC	319-84-6	0.00410	U	0.00410	U	0.00410	U	0.00410	U	0.01
alpha-Chlordane	5103-71-9	0.00410	U	0.00410	U	0.00410	U	0.00410	U	~
beta-BHC	319-85-7	0.00410	U	0.00410	U	0.00410	U	0.00410	U	0.04
Chlordane, total	57-74-9	0.0205	U	0.0205	U	0.0205	U	0.0205	U	0.05
delta-BHC	319-86-8	0.00410	U	0.00410	U	0.00410	U	0.00410	U	0.04

Sample ID		MW1		MW2		MW3		MW4		
York ID		19C0297-	-01	19C0297-	-02	19C0296-	·01	19C0296-	·02	NYSDEC TOGS
Sampling Date		3/7/201	9	3/7/201	9	3/7/201	9	3/7/2019	9	Standards and
Client Matrix		Water		Water		Water		Water		Guidance values
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	
Dieldrin	60-57-1	0.00205	U	0.00205	U	0.00205	U	0.00205	U	0.004
Endosulfan I	959-98-8	0.00410	U	0.00410	U	0.00410	U	0.00410	U	~
Endosulfan II	33213-65-9	0.00410	U	0.00410	U	0.00410	U	0.00410	U	~
Endosulfan sulfate	1031-07-8	0.00410	U	0.00410	U	0.00410	U	0.00410	U	~
Endrin	72-20-8	0.00410	U	0.00410	U	0.00410	U	0.00410	U	~
Endrin aldehyde	7421-93-4	0.0103	U	0.0103	U	0.0103	U	0.0103	U	5
Endrin ketone	53494-70-5	0.0103	U	0.0103	U	0.0103	U	0.0103	U	5
gamma-BHC (Lindane)	58-89-9	0.00410	U	0.00410	U	0.00410	U	0.00410	U	0.05
gamma-Chlordane	5566-34-7	0.0103	U	0.0103	U	0.0103	U	0.0103	U	~
Heptachlor	76-44-8	0.00410	U	0.00410	U	0.00410	U	0.00410	U	0.04
Heptachlor epoxide	1024-57-3	0.00410	U	0.00410	U	0.00410	U	0.00410	U	0.03
Methoxychlor	72-43-5	0.00410	U	0.00410	U	0.00410	U	0.00410	U	35
Toxaphene	8001-35-2	0.103	U	0.103	U	0.103	U	0.103	U	0.06
Metals, Target Analyte		ug/L		ug/L		ug/L		ug/L		ug/L
Dilution Factor		10		10		1		1		
Aluminum	7429-90-5	33,600		54,100		7,610		2,600		~
Antimony	7440-36-0	28	U	28	U	28	U	28	U	3
Arsenic	7440-38-2	17	U	64		17	U	17	U	25
Barium	7440-39-3	934		1,260		274		59		1000
Beryllium	7440-41-7	3		3		0.600	U	0.600	U	3
Cadmium	7440-43-9	3	U	3	U	18		3	U	5
Calcium	7440-70-2	247,000		618,000		135,000		44,800		~
Chromium	7440-47-3	100		352		23		7		50
Cobalt	7440-48-4	36		56		7		4	U	~
Copper	7440-50-8	58		191		860		22	U	200
Iron	7439-89-6	117,000	D	173,000	D	19,000		4,130		~
Lead	7439-92-1	912		2,190		541		55		25
Magnesium	7439-95-4	34,400		59,600		15,800		9,040		35000
Manganese	7439-96-5	3,430		4,440		905		187		300
Nickel	7440-02-0	73		148		23		11	U	100
Potassium	7440-09-7	13,400		15,900		14,400		4,970		~
Selenium	7782-49-2	28	U	28	U	28	U	28	U	10
Silver	7440-22-4	6	U	6	U	6	U	6	U	50
Sodium	7440-23-5	49,700		37,400		53,300		47,500		20000
Thallium	7440-28-0	28	U	28	U	28	U	28	U	~
Vanadium	7440-62-2	188		233		27		11	U	~
Zinc	7440-66-6	1,840		4,120		4,510		38		2000
Mercury by 7473		ug/L		ug/L		ug/L		ug/L		ug/L
Dilution Factor		1		1		1		1		
Mercury	7439-97-6	0.200	U	0.200	U	0.200	U	0.200	U	0.7

Sample ID		MW1		MW2		MW3		MW4		
York ID		19C0297	-01	19C0297-	-02	19C0296	-01	19C0296-	-02	NYSDEC TOGS
Sampling Date		3/7/201	9	3/7/201	9	3/7/201	9	3/7/201	9	Standards and Guidance Values .
Client Matrix		Water	•	Water		Water		Water		GA GA
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	
Polychlorinated Biphenyls (PCB)		ug/L		ug/L		ug/L		ug/L		ug/L
Dilution Factor		1		1		1		1		
Aroclor 1016	12674-11-2	0.0513	U	0.0513	U	0.0513	U	0.0513	U	~
Aroclor 1221	11104-28-2	0.0513	U	0.0513	U	0.0513	U	0.0513	U	~
Aroclor 1232	11141-16-5	0.0513	U	0.0513	U	0.0513	U	0.0513	U	~
Aroclor 1242	53469-21-9	0.0513	U	0.0513	U	0.0513	U	0.0513	U	~
Aroclor 1248	12672-29-6	0.0513	U	0.0513	U	0.0513	U	0.0513	U	~
Aroclor 1254	11097-69-1	0.0513	U	0.0513	U	0.0513	U	0.0513	U	~
Aroclor 1260	11096-82-5	0.0513	U	0.0513	U	0.0513	U	0.0513	U	~
Total PCBs	1336-36-3	0.0513	U	0.0513	U	0.0513	U	0.0513	U	0.09

NOTES:

Any Regulatory Exceedences are color coded by Regulation

#### Q is the Qualifier Column with definitions as follows:

D=result is from an analysis that required a dilution

J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated

U=analyte not detected at or above the level indicated

B=analyte found in the analysis batch blank

E=result is estimated and cannot be accurately reported due to levels encountered or interferences

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

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

#### Table 4 Soil Vapor Sampling Results 100 E. 149th Street Bronx, New York

Sample ID	VP-1		VP-2	VP-3		VP-4			
York ID		19C0284-01		19C0284-02		19C0284-03		19C0284-04	
Sampling Date		3/7/2019		3/7/2019		3/7/2019		3/7/2019	
Client Matrix		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor	
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q
Volatile Organics, EPA TO15 F	ull List	ug/m3		ug/m3		ug/m3		ug/m3	
Dilution Factor		13.4		13.4		13.58		13.67	
1,1,1,2-Tetrachloroethane	630-20-6	9.200	U	9.200	U	9.300	U	9.400	U
1,1,1-Trichloroethane	71-55-6	7.300	U	7.300	U	7.400	U	7.500	U
1,1,2,2-Tetrachloroethane	79-34-5	9.200	U	9.200	U	9.300	U	9.400	U
1,1,2-Trichloro-1,2,2- trifluoroethane (Freon 113)	76-13-1	10	U	10	U	10	U	10	U
1,1,2-Trichloroethane	79-00-5	7.300	U	7.300	U	7.400	U	7.500	U
1,1-Dichloroethane	75-34-3	5.400	U	5.400	U	5.500	U	5.500	U
1,1-Dichloroethylene	75-35-4	1.300	U	1.300	U	1.300	U	1.400	U
1,2,4-Trichlorobenzene	120-82-1	9.900	U	9.900	U	10	U	10	U
1,2,4-Trimethylbenzene	95-63-6	6.600	U	6.600	U	6.700	U	6.700	U
1,2-Dibromoethane	106-93-4	10	U	10	U	10	U	11	U
1,2-Dichlorobenzene	95-50-1	8.100	U	8.100	U	8.200	U	8.200	U
1,2-Dichloroethane	107-06-2	5.400	U	5.400	U	5.500	U	5.500	U
1,2-Dichloropropane	78-87-5	6.200	U	6.200	U	6.300	U	6.300	U
1,2-Dichlorotetrafluoroethane	76-14-2	9.400	U	9.400	U	9.500	U	9.600	U
1,3,5-Trimethylbenzene	108-67-8	6.600	U	6.600	U	6.700	U	6.700	U
1,3-Butadiene	106-99-0	8.900	U	8.900	U	9	U	12	U
1,3-Dichlorobenzene	541-73-1	8.100	U	8.100	U	8.200	U	8.200	D
1,3-Dichloropropane	142-28-9	6.200	U	6.200	U	6.300	U	6.300	U
1,4-Dichlorobenzene	106-46-7	8.100	U	8.100	U	8.200	U	8.200	U
1,4-Dioxane	123-91-1	9.700	U	9.700	U	9.800	U	9.900	U
2-Butanone	78-93-3	28	D	11	D	19	D	31	U
2-Hexanone	591-78-6	11	U	11	U	11	U	11	D
3-Chloropropene	107-05-1	21	U	21	U	21	U	21	U
4-Methyl-2-pentanone	108-10-1	5.500	U	5.500	U	5.600	U	5.600	U
Acetone	67-64-1	150	BD	98	BD	120	BD	130	U
Acrolein	107-02-8	3.100	U	3.100	U	3.100	U	3.100	BD
Acrylonitrile	107-13-1	2.900	U	2.900	U	2.900	U	3	U
Benzene	71-43-2	4.300	U	4.300	U	4.300	U	24	U
Benzyl chloride	100-44-7	6.900	U	6.900	U	7	U	7.100	D
Bromodichloromethane	75-27-4	14	D	60	D	9.100	U	9.200	U

Sample ID		VP-1 19C0284-01		VP-2		VP-3		VP-4 1900284-04		
Sampling Date		3/7/2019		3/7/2019		3/7/2019		3/7/2019		
Client Matrix		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	
Volatile Organics, EPA TO15 Fu	ull List	ug/m3		ug/m3		ug/m3		ug/m3		
Dilution Factor		13.4		13.4		13.58		13.67		
Bromoform	75-25-2	14	U	14	U	14	U	14	U	
Bromomethane	74-83-9	5.200	U	5.200	U	5.300	U	5.300	U	
Carbon disulfide	75-15-0	4.200	U	4.200	U	6.300	D	4.300	U	
Carbon tetrachloride	56-23-5	2.100	U	2.100	U	2.100	U	2.200	U	
Chlorobenzene	108-90-7	6.200	U	6.200	U	6.300	U	6.300	U	
Chloroethane	75-00-3	3.500	U	3.500	U	3.600	U	3.600	U	
Chloroform	67-66-3	130	D	370	D	17	D	13	U	
Chloromethane	74-87-3	2.800	U	2.800	U	2.800	U	5.600	D	
cis-1,2-Dichloroethylene	156-59-2	1.300	U	1.300	U	1.300	U	1.400	D	
cis-1,3-Dichloropropylene	10061-01-5	6.100	U	6.100	U	6.200	U	6.200	U	
Cyclohexane	110-82-7	4.600	U	150	D	4.700	U	32	U	
Dibromochloromethane	124-48-1	11	U	11	U	12	U	12	D	
Dichlorodifluoromethane	75-71-8	6.600	U	6.600	U	6.700	U	6.800	U	
Ethanol	64-17-5	2.500	U	2.500	U	2.600	U	2.600	U	
Ethyl acetate	141-78-6	9.700	U	9.700	U	9.800	U	9.900	U	
Ethyl Benzene	100-41-4	5.800	U	12	D	5.900	U	7.700	D	
Hexachlorobutadiene	87-68-3	14	U	14	U	14	U	15	U	
Isopropanol	67-63-0	6.600	U	6.600	U	6.700	U	6.700	U	
lsopropylbenzene	98-82-8	6.600	U	12	D	6.700	U	6.700	U	
Methyl Methacrylate	80-62-6	5.500	U	5.500	U	5.600	U	5.600	U	
Methyl tert-butyl ether (MTBE)	1634-04-4	4.800	U	4.800	U	4.900	U	4.900	U	
Methylene chloride	75-09-2	9.300	U	9.300	U	9.400	U	9.500	U	
Naphthalene	91-20-3	14	U	14	U	14	U	14	U	
n-Butylbenzene	104-51-8	7.400	U	7.400	U	7.500	U	7.500	U	
n-Heptane	142-82-5	6	D	5.500	U	5.600	U	170	D	
n-Hexane	110-54-3	4.700	U	66	D	7.200	D	130	D	
n-Propylbenzene	103-65-1	6.600	U	7.200	D	6.700	U	6.700	U	
o-Xylene	95-47-6	5.800	U	5.800	U	5.900	U	14	D	
p- & m- Xylenes	179601-23-1	12	U	12	U	12	U	31	D	
p-Ethyltoluene	622-96-8	6.600	U	6.600	U	6.700	U	6.700	U	
p-Isopropyltoluene	99-87-6	7.400	U	7.400	U	7.500	U	7.500	U	
Propylene	115-07-1	2.300	U	2.300	U	2.300	U	2.400	U	

Sample ID		VP-1		VP-2		VP-3		VP-4		
York ID		19C0284-01		19C0284-02		19C0284-03		19C0284-04		
Sampling Date		3/7/2019		3/7/2019		3/7/2019		3/7/2019		
Client Matrix		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		
Compound	CAS Number	Result	Q	Result	Q	Result	Q	Result	Q	
Volatile Organics, EPA TO15 Fu	ıll List	ug/m3		ug/m3		ug/m3		ug/m3		
Dilution Factor		13.4		13.4		13.58		13.67		
sec-Butylbenzene	135-98-8	7.400	U	7.400	U	7.500	U	7.500	U	
Styrene	100-42-5	5.700	U	5.700	U	5.800	U	5.800	U	
Tentatively Identified Compounds		0	U	0	U	0	U	0	U	
tert-Butylbenzene	98-06-6	7.400	U	7.400	U	7.500	U	7.500	U	
Tetrachloroethylene	127-18-4	2.300	U	2.300	U	2.300	U	2.300	U	
Tetrahydrofuran	109-99-9	7.900	U	7.900	U	8	U	8.100	U	
Toluene	108-88-3	11	BD	5	U	7.200	BD	29	BD	
trans-1,2-Dichloroethylene	156-60-5	5.300	U	5.300	U	5.400	U	5.400	U	
trans-1,3-Dichloropropylene	10061-02-6	6.100	U	6.100	U	6.200	U	6.200	U	
Trichloroethylene	79-01-6	1.800	U	1.800	U	1.800	U	1.800	U	
Trichlorofluoromethane (Freon 11	75-69-4	7.500	U	7.500	U	7.600	U	7.700	U	
Vinyl acetate	108-05-4	4.700	U	4.700	U	4.800	U	4.800	U	
Vinyl bromide	593-60-2	5.900	U	5.900	U	5.900	U	6	U	
Vinyl Chloride	75-01-4	0.860	U	0.860	U	0.870	U	0.870	U	

NOTES:

#### Q is the Qualifier Column with definitions as follows:

D=result is from an analysis that required a dilution

J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated

U=analyte not detected at or above the level indicated

B=analyte found in the analysis batch blank

E=result is estimated and cannot be accurately reported due to levels encountered or interferences

P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis

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



### **Phase II Environmental Site Assessment**

100 East 149<sup>th</sup> Street Bronx, New York

NYSDEC Spill Number 18-10498



Prepared for: Tony Boemi 5 East 22<sup>nd</sup> Street New York, New York

Touchstone Project Number 200101







#### Table 1 Groundwater Monitoring Data - October 2020 100 East 149th Street, Bronx, NY

Well ID	Benchmark	Shot	DTW	Water Table Elevation (ft)
MW-1	30	5.20	11.40	13.40
MW-2	30	5.24	14.70	10.06
MW-3	30	5.58	14.15	10.27
MW-4	30	5.98	14.20	9.82

All values reported in feet. DTW...Depth to Water DTP...Depth to Product ND...None Detected

Table 2A
Soil Volatile Organic Compounds Analytical Results
100 East 149th Street, Bronx, New York

Sample ID	SP1 2.5-	5	SP1 7.5-1	0	SP2 2.5-	5	SP2 12.5-1	.5	SP3 7.5-1	10	SP3 10-12	.5	SP4 5-7.5		SP4 10-12	.5	
Sampling Date	9/15/202	20	9/15/202	0	9/15/202	0	9/15/2020	0	9/15/202	20	9/15/202	0	9/15/202	0	9/15/202	20	NYSDEC Part 375
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Unrestricted Use Soil
Unit	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		Cleanup Objectives
Compound	Result	0	Result	0	Result	0	Result	0	Result	0	Result	0	Result	0	Result	0	
1.1.1.2-Tetrachloroethane	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	~
1.1.1-Trichloroethane	0.00240	U	0.00230	U.	0.420	U	0.250	Ű	0.00330	U.	0.350	U	0.220	Ŭ	0.310	Ú.	0.68
1.1.2.2-Tetrachloroethane	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	Ű	0.310	Ű	~
1.1.2-Trichloro-1.2.2-trifluoroethane (Freon 113)	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U.	~
1.1.2-Trichloroethane	0.00240	U.	0.00230	U.	0.420	U.	0.250	Ű	0.00330	Ű	0.350	U.	0.220	Ű	0.310	Ű	~
1.1-Dichloroethane	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	Ű	0.310	Ű	0.27
1.1-Dichloroethylene	0.00240	U	0.00230	U.	0.420	U	0.250	Ű	0.00330	U.	0.350	U	0.220	Ŭ	0.310	Ú.	0.33
1.2.3-Trichlorobenzene	0.00240	U	0.00230	U	0.420	U	0.250	Ŭ	0.00330	U	0.350	U	0.220	Ű	0.310	Ű	~
1.2.3-Trichloropropage	0.00240	Ū.	0.00230	U	0.420	U	0.250	U	0.00330	U U	0.350	U	0.220	U.	0.310	Ű	~
1.2.4-Trichlorobenzene	0.00240	U.	0.00230	U.	0.420	U.	0.250	Ű	0.00330	U U	0.350	U	0.220	Ű	0.310	Ű	~
1.2.4-Trimethylbenzene	0.00240	U.	0.00230	U.	1.600	D	36	DF	0.00330	U U	61	D	0.420	ID	0.310	Ű	3.6
1.2-Dibromo-3-chloropropane	0.00240	U	0.00230	U.	0.420	U	0.250	U	0.00330	U.	0.350	U	0.220	U	0.310	Ú.	~
1.2-Dibromoethane	0.00240	U	0.00230	U	0.420	U	0.250	Ŭ	0.00330	U	0.350	U	0.220	Ű	0.310	Ű	~
1.2-Dichlorobenzene	0.00240	Ū.	0.00230	U	0.420	U.	0.250	U	0.00330	U U	0.350	U	0.220	U.	0.310	Ű	1.1
1.2-Dichloroethane	0.00240	U.	0.00230	U.	0.420	U.	0.250	Ű	0.00330	U U	0.350	U	0.220	Ű	0.310	Ű	0.02
1.2-Dichloropropane	0.00240	U	0.00230	U	0.420	U	0.250	Ŭ	0.00330	U	0.350	U	0.220	Ű	0.310	Ű	~
1.3.5-Trimethylbenzene	0.00240	U U	0.00230	Ű	0.420	Ű	15	D	0.00330	Ŭ	12	D	0.220	Ű	0.310	Ű	8.4
1 3-Dichlorobenzene	0.00240	U.	0.00230	U.	0.420	U.	0.250	U U	0.00330	U U	0.350	- U	0.220	Ű	0.310	Ű	2.4
1 4-Dichlorobenzene	0.00240		0.00230		0.420		0.250		0.00330		0.350		0.220		0.310	U U	1.8
1.4-Dioxane	0.0480	U	0.0450	U	8.300	U	5	U U	0.0660	Ű	7	U	4.500	U	6.100	U	0.1
2-Butanone	0.0160	-	0.00230	U.	0.420	U.	0.250	Ű	0.00330	U U	0.350	U.	0.220	Ű	0.310	Ű	0.12
2-Hexanone	0.00240	U	0.00230	Ű	0.420	Ű	0.250	Ű	0.00330	Ŭ	0.350	U	0.220	Ű	0.310	Ű	~
4-Methyl-2-pentanone	0.00240	Ű	0.00230	Ű	0.420	Ű	0.250	Ű	0.00330	Ű	0.350	Ű	0.220	Ŭ	0.310	Ŭ	~
Acetone	0.0650		0.00450		0.830		0.500		0.0260		0.700		0.450		0.610	U U	0.05
Acrolein	0.00480	U	0.00450	U	0.830	U	0.500	U U	0.00660	U	0.700	U	0.450	U	0.610	U	~
Acrylonitrile	0.00240	U.	0.00230	U.	0.420	U.	0.250	Ű	0.00330	Ű	0.350	U.	0.220	Ű	0.310	Ű	~
Benzene	0.00240	Ű.	0.00230		0.420	U U	0.960	D	0.00330	Ű.	0.350		0.470	D	0.950	D	0.06
Bromochloromethane	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	Ű	0.350	U	0.220	U	0.310	Ű	~
Bromodichloromethane	0.00240	ů.	0.00230		0.420		0.250		0.00330	U.	0.350		0.220		0.310	U U	~
Bromoform	0.00240	U U	0.00230	U.	0.420	U.	0.250	Ű	0.00330	U U	0.350	U	0.220	Ű	0.310	Ű	~
Bromomethane	0.00240	ů.	0.00230	U.	0.420	U.	0.250	Ű	0.00330	U U	0.350	U	0.220	Ű	0.310	Ű	~
Carbon disulfide	0.00240	Ū.	0.00230	U	0.420	U U	0.250	U	0.00330	U U	0.350	U	0.220	U.	0.310	Ű	~
Carbon tetrachloride	0.00240	U	0.00230	U	0.420	U	0.250	U U	0.00330	Ű	0.350	U	0.220	U	0.310	U	0.76
Chlorobenzene	0.00240	U.	0.00230		0.420		0.250		0.00330	U.	0.350		0.220		0.310	U U	11
Chloroethane	0.00240	U	0.00230	U	0.420	U	0.250	U U	0.00330	Ű	0.350	U	0.220	U	0.310	U	~
Chloroform	0.00240	U.	0.00230	U.	0.420	U.	0.250	Ű	0.00330	U U	0.350	U	0.220	Ű	0.310	Ű	0.37
Chloromethane	0.00240	U.	0.00230		0.420		0.250		0.00330	U.	0.350		0.220		0.310	U U	~
cis-1.2-Dichloroethylene	0.00240	U	0.00230	U	0.420	U	0.250	U U	0.00330	U	0.350	U	0.220	U	0.310	U	0.25
cis-1 3-Dichloropropylene	0.00240	U.	0.00230		0.420		0.250		0.00330	U.	0.350		0.220		0.310	U U	~
Cvclobexane	0.00240	U.	0.00230	U.	0.420	U.	8.900	D	0.00330	U U	0.350	U	0.220	Ű	16	D	~
Dibromochloromethane	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	Ű	0.310	U	~
Dibromomethane	0.00240	Ū.	0.00230	U	0.420	U U	0.250	U	0.00330	U U	0.350	U	0.220	U.	0.310	Ű	~
Dichlorodifluoromethane	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	Ű	0.310	Ű	~
Ethyl Benzene	0.00240	U	0.00230	U	7.500	D	17	D	0.00330	U	4,400	D	0.250	JD	0.310	U	1
Hexachlorobutadiene	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	~
Isopropylbenzene	0.00240	U	0.00230	U	4	D	2	D	0.00330	U	3,400	D	0,300	JD	1,600	D	~
Methyl acetate	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	~
Methyl tert-butyl ether (MTBE)	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	0.93
Methylcyclohexane	0.00240	U	0.00230	U	120	D	36	DE	0.00330	U	8.100	D	0.720	D	38	D	~
Methylene chloride	0.00480	U	0.00450	U	0.830	U	0.500	U	0.00660	U	0.700	U	0.450	U	0.610	U	0.05
n-Butylbenzene	0.00240	U	0.00230	U	6.400	D	1.500	D	0.00330	U	5	D	0.220	U	0.950	D	12
n-Propylbenzene	0.00240	U	0.00230	U	15	D	6.900	D	0.00330	U	17	D	0.780	D	3.100	D	3.9
o-Xylene	0.00240	U	0.00230	U	0.560	JD	7.300	D	0.00330	U	0.350	U	0.220	U	0.310	U	~
p- & m- Xylenes	0.00480	U	0.00450	U	2.800	D	29	D	0.00660	U	3	D	0.690	JD	0.610	U	~
p-isopropyltoluene	0.00240	U	0.00230	U	0.520	JD	1	D	0.00330	U	1.800	D	0.220	U	0.310	U	~
sec-Butylbenzene	0.00240	U	0.00230	U	3.500	D	0.700	D	0.00330	U	2.900	D	0.400	JD	0.510	JD	11
Styrene	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	~
tert-Butyl alcohol (TBA)	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	~
tert-Butylbenzene	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	5.9
Tetrachloroethylene	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	1.3
Toluene	0.00240	U	0.00230	U	1.100	D	2.400	D	0.00330	U	0.350	U	0.510	D	0.310	U	0.7
trans-1,2-Dichloroethylene	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	0.19
trans-1,3-Dichloropropylene	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	~
trans-1.4-dichloro-2-butene	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	~
Trichloroethylene	0.00240	Ű	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	0.47
Trichlorofluoromethane	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	~
Vinyl Chloride	0.00240	U	0.00230	U	0.420	U	0.250	U	0.00330	U	0.350	U	0.220	U	0.310	U	0.02
Xylenes, Total	0.00720	U	0.00680	U	3.400	D	36	D	0.00990	U	3	D	0.690	JD	0.920	U	0.26
Total BTEX	-		-		12.000		56.360		-		7.400		1.920		0.950	•	-
Total VOCs	0.065				166 380		200 660		0.026		116.600		5 230		61 110		
	0.005				100.300		200.000		0.020		110.000		5.230		01.110		

NOTES: Any Regulatory Exceedences are color coded by Regulation

Q is the Qualifier Column with definitions as follow: Deresult is from an analysis that required a dilution Janalyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated

Janalyte detected a or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated Uvanalyte not detected at or above the well indicated Branalyte found in the analysis bath blank Eresult is estimated and cannot be accurately reported due to levels encountered or interferences Preths flag is used for pesticide and PCB (Arcoto) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis NT=this indicates that no regulatory limit has been established for this analyte

#### Table 2B Soil Semi-Volatile Organic Compounds Analytical Results 100 East 149th Street, Bronx, New York

								.,,									
Sample ID	SP1 2.5-	5	SP1 7.5-1	0	SP2 2.5-	5	SP2 12.5	-15	SP3 7.5-1	10	SP3 10-12	5	SP4 5-7.	5	SP4 10-12	.5	
Sampling Date	9/15/202	20	9/15/202	20	9/15/202	0	9/15/20	20	9/15/202	20	9/15/202	:0	9/15/202	0	9/15/202	0	NYSDEC Part 375
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Unrestricted Use Soil
Unit	mg/Kg	1	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		Cleanup Objectives
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
1,2,4-Trichlorobenzene	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	U	0.0862	U	~
1,2-Dichlorobenzene	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	U	0.0862	U	1.1
1,3-Dichlorobenzene	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	U	0.0862	U	2.4
1,4-Dichlorobenzene	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	U	0.0862	U	1.8
2,4-Dinitrotoluene	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	U	0.0862	U	~
2,6-Dinitrotoluene	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	U	0.0862	U	~
2-Chloronaphthalene	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	U	0.0862	U	~
2-Methylnaphthalene	0.0998	D	0.618	D	0.231	D	44	D	0.154	D	0.325	D	2.790	D	0.120	JD	~
3,3-Dichlorobenzidine	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	U	0.0862	U	~
3-Nitroaniline	0.0946	U	0.0916	U	0.0969	U	0.486	U	0.0942	U	0.0896	U	0.0894	U	0.172	U	~
4-Bromophenyl phenyl ether	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	U	0.0862	U	~
4-Chloroaniline	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	U	0.0862	U	~
4-Chlorophenyl phenyl ether	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	U	0.0862	U	2
4-Nitroaniline	0.0946	U	0.0916	U	0.0969	U	0.486	U	0.0942	U	0.0896	U	0.0894	U	0.172	U	~
Acenaphthene	0.365	D	2	D	0.0485	U	0.365	JD	0.270	D	0.0523	JD	3.070	D	0.604	D	20
Acenaphthylene	0.128	D	0.0637	JD	0.0485	U	0.244	U	0.511	D	0.0767	JD	0.264	D	0.0862	U	100
Aniline	0.189	U	0.183	U	0.194	U	0.973	U	0.189	U	0.179	U	0.179	U	0.345	U	~
Anthracene	1.170	D	5.210	D	0.0485	U	0.637	D	0.913	D	0.160	D	10.600	D	0.679	D	100
Benzo(a)anthracene	3.640	D	6.950	D	0.0588	JD	1.800	D	2.720	D	0.464	D	19.700	D	2.670	D	1
Benzo(a)pyrene	4.080	D	6.610	D	0.0875	JD	2.170	D	3.080	D	0.431	D	21	D	3.250	D	1
Benzo(b)fluoranthene	2.650	D	4.970	D	0.0790	JD	1.690	D	2.400	D	0.373	D	15.900	D	2.520	D	1
Benzo(g,n,i)perviene	2.480	D	4.240	D	0.0759	JU	1.550	D	2.010	D	0.265	D	13.900	D	2.130	D	100
Benzo(k)fluorantnene	2.120		4.700	D	0.0596	JU	1.550	U U	2.220	U	0.324		14.800		2.110	U	0.8
Benzyl butyl phthalate	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	0	0.0448	U	0.0862	U	~
Bis(2-chloroethoxy)methane	0.0474	0	0.0459	0	0.0485	U	0.244	0	0.0472	0	0.0449	0	0.0448	0	0.0862	0	-
Bis(2-chloroethyl)ether	0.0474	U	0.0459	0	0.0485	0	0.244	0	0.0472	U	0.0449	0	0.0448	U	0.0862	0	-
Bis(2-chiolosopropyljetter	0.0474	0	0.0459	0	0.0465	0	0.244	0	0.0472	0	0.0449	0	0.0448	0	0.0862	0	~
Sis(2-ethylnexyl)phthalate	0.0474	0	0.0459	0	0.0485		0.244	0	0.0472	0	0.0449	0	0.0446	0	0.0862	0	~
Chrysono	3.950	D	5.940	D	0.0485	ID	2 020	0	2,020	D	0.0400	0	18 300	D	2 020	0	1
Disease (	2.960	0	5.940	0	0.0705	10	2.020	10	2.960		0.491	0	18.200	10	5.050	0	1
Dibenzo(a,n)antinacene	0.756	0	1.050	D	0.0465	0	0.478		0.091	0	0.0896		1.150		0.0002		0.35
Disthyl obthalate	0.0474		0.0459		0.0485		0.244		0.0472		0.0449		0.0449		0.0862		~
Directly: philalate	0.0474		0.0459		0.0485		0.244		0.0472		0.0449		0.0448		0.0862	0	~
Di-n-butyl phthalate	0.0474	U	0.0459	U U	0.0485		0.244		0.0472		0.0449		0.0448		0.0862		~
Di-n-octyl obthalate	0.0474		0.0459	U U	0.0485		0.244		0.0472		0.0449		0.0448		0.0862		~
Eluoranthene	7.040	D	18,700	D	0.123	D	3.480	D	5.090	D	0.939	D	46.600	D	4.200	D	100
Fluorene	0.409	D	2.150	D	0.0485	U	0.474	ID	0.267	D	0.0559	ID	3.860	D	0.378	D	30
Hexachlorobenzene	0.0474	-	0.0459		0.0485		0.244		0.0472		0.0449		0.0448		0.0862		0.33
Hexachlorobutadiene	0.0474	U	0.0459	Ŭ	0.0485	U	0.244	U	0.0472	U U	0.0449	U	0.0448	U	0.0862	U	~
Hexachlorocyclopentadiene	0.0474	U U	0.0459		0.0485		0.244		0.0472		0.0449		0.0448	U.	0.0862	U.	~
Hexachloroethane	0.0474	U	0.0459	Ŭ	0.0485	U	0.244	U	0.0472	U U	0.0449	U	0.0448	U	0.0862	U	~
indeno(1.2.3-cd)ovrene	2.540	D	4.540	D	0.0736	ID	1.550	D	2.120	D	0.279	D	14,700	D	2.220	D	0.5
sonhorone	0.0474	- U	0.0459	U	0.0485	U	0.244	U	0.0472	U.	0.0449	U U	0.0448	- U	0.0862	-	~
Naphthalene	0.0968	D	0.564	D	0.316	D	50,800	D	0.224	D	0.590	D	1.590	D	0.0862	Ű	12
Nitrobenzene	0.0474	U	0.0459	Ū	0.0485	- U	0.244	U	0.0472	Ū	0.0449	Ū	0.0448	U	0.0862	U	~
N-Nitrosodimethylamine	0.0474	Ű	0.0459	U	0.0485	Ű	0.244	Ŭ	0.0472	U	0.0449	Ŭ	0.0448	U	0.0862	U	~
N-nitroso-di-n-propylamine	0.0474	Ű	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	Ű	0.0862	U	~
N-Nitrosodiphenvlamine	0.0474	U	0.0459	U	0.0485	U	0.244	U	0.0472	U	0.0449	U	0.0448	U	0.0862	U	~
Phenanthrene	3.960	D	21.300	D	0.110	D	2.640	D	3.670	D	0.774	D	32.700	D	2.700	D	100
Pyrene	6.840	D	16.600	D	0.132	D	3.690	D	5.870	D	0.956	D	40,900	D	5.360	D	100
Pyridine	0.189		0.183		0 194		0.973	-	0.189	- ii	0.179		0.179	-	0.345		~

NOTES:

Any Regulatory Exceedences are color coded by Regulation

Q is the Qualifier Column with definitions as follows: Deresult is from an analysis that required a dilution JanaNyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated

Janahyte detected a tor above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated Uvanahyte not detected at or above the level indicated Banahyte found in the analysis batch blank Exresult is estimated and cannot be accurately reported due to levels encountered or interferences Pathis flag is used for pesticide and PCR (Arocoln Target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis NT-sthis indicates the analyte was not a target for this sample calific indicates the analyte in the normalization limits have the origination.

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

Table 3A
Groundwater Volatile Organic Compounds Analytical Results
100 East 149th Street, Bronx, New York

Sample ID	MW1		MW2		MW3		MW4		MW5		
Sampling Date	9/15/202	20	9/15/20	20	9/15/20	20	9/15/20	20	9/15/20	20	NYSDEC TOGS
Client Matrix	Water		Water		Water	•	Water		Water	·	Standards and
Unit	ug/L		ug/L		ug/L		ug/L		ug/L		Guidance Values - GA
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
1,1,1,2-Tetrachloroethane	2	U	40	U	5	U	20	U	2	U	5
1,1,1-Trichloroethane	2	U	40	U	5	U	20	U	2	U	5
1,1,2,2-Tetrachloroethane	2	U	40	U	5	U	20	U	2	U	5
1.1.2-Trichloro-1.2.2-trifluoroethane (Freon 113)	2	U	40	U	5	U	20	U	2	U	5
1.1.2-Trichloroethane	2	U	40	U	5	U	20	U	2	U	1
1.1-Dichloroethane	2	Ű	40	Ŭ	5	Ŭ	20	Ŭ	2	ŭ	5
1.1-Dichloroethylene	2	Ű	40	Ŭ	5	Ŭ	20	Ŭ	2	ŭ	5
1 2 3-Trichlorobenzene	2	U U	40	Ű	5	Ű.	20	Ű	2	- U	5
1 2 3-Trichloropropage	2	U U	40	Ű	5	U U	20	U	2	U U	0.04
1.2.4-Trichlorobenzene	2	0	40	U	5	0	20	0	2	U	5
1.2.4-Trimethylbenzene	4 900	0 ID	120	D	26	D	42	UD.	210	D	5
1.2.94 milliona 2 chloropropano	4.500		40	U	20			91	210		0.04
1,2-Dibromosthese	2	0	40	0	5	0	20	0	2	0	0.04
1,2-Dibromoethane	2	0	40	0	5	0	20	0	2	0	0.0006
1,2-Dichloropenzene	2	0	40	0	5	0	20	0	2	0	3
1,2-Dichloroethalle	2	0	40	0	5	0	20	0	2	0	0.0
1,2-Dichloropropane	2	0	40	0	5	0	20	0	2	0	1
1,5,5-IIIIIeuiyibenzene	84	U	210	U U	5	U	38	ענ	100	U	5
	2	U	40	U	5	U	20	U	2	0	3
1,4-Dichlorobenzene	2	U	40	U	5	U	20	U	2	0	3
1,4-DIOXane	400	U	8,000	U	1,000	U	4,000	U	400	U	~
2-Butanone	2	U	40	U	5	U	20	U	2	U	50
2-Hexanone	2	U	40	U	5	U	20	U	2	U	50
4-Methyl-2-pentanone	2	U	40	U	5	U	20	U	2	U	~
Acetone	10	U	200	U	25	U	100	U	10	U	50
Acrolein	2	U	40	U	5	U	20	U	2	U	~
Acrylonitrile	2	U	40	U	5	U	20	U	2	U	~
Benzene	5.300	D	520	D	9	JD	820	D	88	D	1
Bromochloromethane	2	U	40	U	5	U	20	U	2	U	5
Bromodichloromethane	2	U	40	U	5	U	20	U	2	U	50
Bromoform	2	U	40	U	5	U	20	U	2	U	50
Bromomethane	2	U	40	U	5	U	20	U	2	U	5
Carbon disulfide	2	U	40	U	5	U	20	U	2	U	~
Carbon tetrachloride	2	U	40	U	5	U	20	U	2	U	5
Chlorobenzene	2	U	40	U	5	U	20	U	2	U	5
Chloroethane	2	U	40	U	5	U	20	U	2	U	5
Chloroform	2	U	40	U	5	U	20	U	2	U	7
Chloromethane	2	U	40	U	5	U	20	U	2	U	5
cis-1,2-Dichloroethylene	2	U	40	U	5	U	20	U	2	U	5
cis-1,3-Dichloropropylene	2	U	40	U	5	U	20	U	2	U	0.4
Cyclohexane	320	D	530	D	42	D	530	D	260	D	~
Dibromochloromethane	2	U	40	U	5	U	20	U	2	U	50
Dibromomethane	2	U	40	U	5	U	20	U	2	U	~
Dichlorodifluoromethane	2	U	40	U	5	U	20	U	2	U	5
Ethyl Benzene	120	D	400	D	20	D	130	D	180	D	5
Hexachlorobutadiene	2	Ū.	40	U	5	Ū	20	U	2	- u	0.5
Isopropylbenzene	33	P	84	a	16	P	88	P	78	p	5
Methyl acetate	2	U	40	10	5	1	20	U	2		~
Methyl tert-butyl ether (MTRF)	2	U U	40	U U	5	U U	20	11	2	1	10
Methylcyclohexane	560	D	570	D	20	D	520	D	400	D	~
Methylene chloride	10	U U	200		20		100	U	10		c
n Putulbonzono	10	D	200	UD ID	20 7 900	0	200	U ID	10	0	5
n Bronylbonzono	20		42	- 01	7.800	ענ	3/	10	29		5
	6/	0	210		45		200	U U	220	0	5
	9	U F	40	0	5	U	28	U	88		5
p- & m- Aylenes	31	U	260	0	12	U	120	U	490	0	5
p-isopropyitoluene	8.200	D	40	U	5	U	20	U	3.200	U	5
sec-Butylbenzene	8.700	D	40	U	14	D	20	U	13	D	5
Styrene	2	U	40	U	5	U	20	U	2	U	5
tert-Butyl alcohol (TBA)	5	U	100	U	12	U	50	U	5	U	~
tert-Butylbenzene	2	U	40	U	5	U	20	U	2	U	5
Tetrachloroethylene	2	U	40	U	5	U	20	U	2	U	5
Toluene	11	D	100	D	5	U	73	D	70	D	5
trans-1,2-Dichloroethylene	2	U	40	U	5	U	20	U	2	U	5
trans-1,3-Dichloropropylene	2	U	40	U	5	U	20	U	2	U	0.4
trans-1,4-dichloro-2-butene	2	U	40	U	5	U	20	U	2	U	~
Trichloroethylene	2	U	40	U	5	U	20	U	2	U	5
Trichlorofluoromethane	2	U	40	U	5	U	20	U	2	U	5
Vinyl Chloride	2	U	40	U	5	U	20	U	2	U	2
Xylenes, Total	40	D	260	JD	15	U	140	JD	580	D	5
BTEX	176		1,280		29		1,163		918		-
Total VOCs	1.342		3.306		200		2.766		2.809		
NOTES:									,,,,,,		

Any Regulatory Exceedences are color coded by Regulation

Q is the Qualifier Column with definitions as follows: D=result is from an analysis that required a dilution J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated

Use analyte to detected at or above the level indicated B=analyte found in the analysis batch blank E-result is estimated and cannot be accurately reported due to levels encountered or interferences P-this flag is used for pesticide and PCB (Arodor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis N=this indicates the analyte was not a target for this sample ~=this indicates that no regulatory limit has been established for this analyte

Table 3B									
Groundwater Semi-Volatile Organic Compounds Analytical Results									
100 East 140th Street Brony New York									

Consulta 10																	
Sample ID	0/15/2020		0/15/2020		NIN 3		0 (45 (2020		1/1///5								
Sampling Date	9/15/2020		9/15/2020		9/15/2020		9/15/2020		9/15/2020		NYSDEC TOGS						
Client Matrix	Water		Water		Water		Water		Water		Standards and						
Unit	ug/L		ug/L		ug/L		ug/L		ug/L		Guidance Values - GA						
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q							
1,2,4-Trichlorobenzene	2.740	U	2.910	U	2.470	U	2.740	U	2.470	U	5						
1,2-Dichlorobenzene	2.770	U	2.930	U	2.490	U	2.770	U	2.490	U	3						
1,3-Dichlorobenzene	2.900	U	3.070	U	2.610	U	2.900	U	2.610	U	3						
1,4-Dichlorobenzene	2.460	U	2.600	U	2.210	U	2.460	U	2.210	U	3						
2,4-Dinitrotoluene	1.790	U	1.890	U	1.610	U	1.790	U	1.610	U	5						
2,6-Dinitrotoluene	1.790	U	1.890	U	1.610	U	1.790	U	1.610	U	5						
2-Chloronaphthalene	2.440	U	2.590	U	2.200	U	2.440	U	2.200	U	10						
2-Methylnaphthalene	12.600		40.100		2.760	U	24.900		48.700	D	~						
2-Nitroaniline	1.870	U	1.980	U	1.680	U	1.870	U	1.680	U	5						
3,3-Dichlorobenzidine	1.410	U	1.490	U	1.270	U	1.410	U	1.270	U	5						
3-Nitroaniline	1.870	U	1.980	U	1.680	U	1.870	U	1.680	U	5						
4-Bromophenyl phenyl ether	1.480	U	1.560	U	1.330	U	1.480	U	1.330	U	~						
4-Chloroaniline	3.310	U	3.510	U	2.980	U	3.310	U	2.980	U	5						
4-Chlorophenyl phenyl ether	2.720	U	2.880	U	2.450	U	2.720	U	2.450	U	~						
4-Nitroaniline	2.980	U	3.150	U	2.680	U	2.980	U	2.680	U	5						
Acenaphthene	0.789		0.671		0.120		0.367		0.310		20						
Acenaphthylene	0.0778		0.0588	J	0.0500	U	0.0556	U	0.0500	U	~						
Aniline	1.670	U	1.760	U	1.500	U	1.670	U	1.500	U	5						
Anthracene	0.344		0.247		0.0600		0.100		0.0700		50						
Benzo(a)anthracene	0.267		0.188		0.0500	J	0.100		0.0500	1	0.002						
Benzo(a)pyrene	0.178		0.188		0.0600		0.0889		0.0500	U	0.002						
Benzo(b)fluoranthene	0.156		0.141		0.0800		0.0667		0.0500	U	0.002						
Benzo(g,h,i)perylene	0.0889		0.129		0.0600		0.0556	J	0.0500	U	~						
Benzo(k)fluoranthene	0.167		0.141		0.0500	U	0.0667		0.0500	U	0.002						
Benzyl butyl phthalate	0.947	U	1	U	0.852	U	0.947	U	0.852	U	50						
Bis(2-chloroethoxy)methane	1.970	U	2.080	U	1.770	U	1.970	U	1.770	U	5						
Bis(2-chloroethyl)ether	1.670	U	1.760	U	1.500	U	1.670	U	1.500	U	1						
Bis(2-chloroisopropyl)ether	3.320	U	3.520	U	2.990	U	3.320	U	2.990	U	5						
Bis(2-ethylhexyl)phthalate	0.556	U	0.588	U	0.500	U	0.556	U	0.500	U	5						
Carbazole	1.460	U	1.540	U	1.310	U	1.460	U	1.310	U	~						
Chrysene	0.222		0.176		0.0600		0.0889		0.0500	U	0.002						
Dibenzo(a,h)anthracene	0.0556	U	0.0588	U	0.0500	U	0.0556	U	0.0500	U	~						
Dibenzofuran	2.680	U	2.840	U	2.410	U	2.680	U	2.410	U	~						
Diethyl phthalate	2.840	U	3.010	U	2.560	U	2.840	U	2.560	U	50						
Dimethyl phthalate	2.120	U	2.250	U	1.910	U	2.120	U	1.910	U	50						
Di-n-butyl phthalate	2.280	U	2.410	U	2.050	U	2.280	U	2.050	U	50						
Di-n-octyl phthalate	1.240	U	1.320	U	1.120	U	1.240	U	1.120	U	50						
Fluoranthene	1.010		0.647		0.240		0.311		0.210		50						
Fluorene	0.711		0.471		0.120		0.211		0.200		50						
Hexachlorobenzene	0.0222	U	0.0235	U	0.0200	U	0.0222	U	0.0200	U	0.04						
Hexachlorobutadiene	0.556	U	0.588	U	0.500	U	0.556	U	0.500	U	0.5						
Hexachlorocyclopentadiene	2.810	U	2.980	U	2.530	U	2.810	U	2.530	U	5						
Hexachloroethane	0.556	U	0.588	U	0.500	U	0.556	U	0.500	U	5						
Indeno(1,2,3-cd)pyrene	0.0778		0.129		0.0500	U	0.0556	J	0.0500	U	0.002						
Isophorone	2.980	U	3.150	U	2.680	U	2.980	U	2.680	U	50						
Naphthalene	46.600	D	203	D	2.850		85.800	D	175	D	10						
Nitrobenzene	0.278	U	0.294	U	0.250	U	0.278	U	0.250	U	0.4						
N-Nitrosodimethylamine	0.556	U	0.588	U	0.500	U	0.556	U	0.500	U	~						
N-nitroso-di-n-propylamine	2.840	U	3.010	U	2.560	U	2.840	U	2.560	U	~						
N-Nitrosodiphenylamine	5.560	U	5.880	U	5	U	5.560	U	5	U	50						
Phenanthrene	1.930		1		0.140		0.456		0.400		50						
Pyrene	0.811		0.541		0.230		0.311		0.180		50						
Pyridine	4.340	U	4.600	U	3.910	U	4.340	U	3.910	U	50						
NOTES:				-		prome 4.340 0 4.000 0 5.50 0 5.50 0 30 NOTE:											

Any Regulatory Exceedences are color coded by Regulation

#### Q is the Qualifier Column with definitions as follows:

Us the Qualine State Qualine State Qualine State Quality of a dilution J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated

Jeanalyte to detected at or above the IWDL (method detection init) but below the KL [keporting Limit] - data is estimated U=analyte not detected at or above the Ievel indicated B=analyte found in the analysis batch blank E=result is estimated and cannot be accurately reported due to levels encountered or interferences P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis NT=this indicates the analyte was not a target for this sample ~=this indicates that no regulatory limit has been established for this analyte



### **Phase I Environmental Site Assessment**

100 East 149<sup>th</sup> Street Bronx, New York 10451



RGDC 149 LLC 214 W. 39<sup>th</sup> St., Suite 1200 New York, NY 10018

April 21, 2022

Touchstone Project Number: 220243

Address: 1919 Middle Country Road, Suite 205, Centereach, New York Office Phone: 631-315-2733 Website: Touchstone-Environmental.com





Figure 2: Site Plan 100 East 149<sup>th</sup> Street Bronx, New York



# ATTACHMENT B RESUMES



#### RACHEL ATAMAN, PG PRESIDENT

#### **SUMMARY OF EXPERIENCE**

Having worked in the environmental field since 2003, I have a vast understating of the Environmental world in New York State. I have worked on multiple projects ranging from Phase I ESAs, Phase II ESAs, Mold Investigations to New York State Brownfield Cleanup Projects. Additionally, I have worked closely with clients to meet their specific project needs such as deadlines, project grants and program requirements. Using my vast experience I also assisted clients in cost estimates for future investigations or remediations.

#### **RELEVANT PROJECT EXPERIENCE**

- Recently completed the investigation and Remedial Design for a 3-story building on Moffat Street in Brooklyn. The investigation included the installation and sampling of a series of soil probes, monitoring wells and soil vapor probes. The remedial design included the excavation and property disposal of soils within the foundation and the installation of a vapor barrier beneath the foundation. The Investigation and Remedial Design were approved by the New York City Office of Environmental Projection since the site is going through a zoning variance.
- Was instrumental in entering the first site (Pelham Parkway) into New York City Brownfield Cleanup program (BCP) and bringing Mayor Bloomberg to the Site to announce the start of the City's BCP. I then managed the environmental requirements of the site including City Environmental Quality Review, Phase I ESAs, Site Investigations, Remedial Action Work Plans and the Site Remedation during development.
- Managed a large variety of New York City Brownfield Cleanup Projects including the preparation of the Site Investigation Work Plans, implementation of the fieldwork, the preparation of Site Investigation Report and Remediation Action Plans. Also successfully managed the implementation of Remedial Action Plans during fieldwork. On a site location on North 8th Street in Brooklyn, New York, supervised the removal of 10,000 tons of contaminated soil and the installation of a vapor barrier and sub-slab depressurization system.
- Knowledgeable in the characterization of soil for disposal. On a NYC BCP site located on Third Avenue in the Bronx I successfully investigated and managed the disposal of over 2,000 tons of hazardous soil.
- Sucessfully investigated and managed the closure of hundreds of NYSDEC Spill Sites. For example she recently completely the closusre of a Spill on Anthony Avenue by investigating soils and determining a subsurface impact was not identified. Additionally, successfully remediated a site on Burnside Avenue in Inwood through the removal of three underground storage tanks (USTs), over 100 tons of petroleum contaminated soil, the injection of Oxygen Releasing Compounds (ORC) and the performance of monthly monitoring and quarterly sampling of
groundwater over a 2 year period. The remediation was successful in reducing the levels of contamination in groundwater and the NYSDEC Spill number was closed.

- Supervised the removal of four underground storage tanks for the Rockland County Sewer District and continue to work with the RCSD on the update of the Sewer Plants from underground storage tanks to above ground storage tanks.
- Performed hundreds of Phase I ESA site inspections and has reviewed and written hundreds of Phase I ESAs as well. Based upon the results of the Phase I ESA, determined the proper scope of work for the Phase II ESAs, prepared Phase II ESA scopes of work and proposals and then properly implemented the Phase II ESA.

#### **Technical Responsibilities:**

Coordinates work with regulatory agencies and organizes project schedules with clients, project geologists, and field managers. Phase I and Phase II Environmental Site Assessments Design and Management of Site Investigations "E"-Designations Site Supervision and Remediation Environmental Assessment Statements Mold testing Air Quality/control Technical review of assessment reports, remedial action plans, mold investigations Remedial Action: Implemented numerous Remedial Action Plans. Supervised the construction and managed the operation of numerous hydrocarbon and chlorinated solvent remediation systems for soil and groundwater.

#### **EDUCATION**

BS Geology, SUNY Stony Brook, 2001

#### Affiliations/Certifications:

New York State Professional Geologist License #000900

Certified GPR Operator (Subsurface Interface Radar in Engineering)

10-Hour OSHA Hazard Recognition Training for The Construction Industry Course on 2/13/2018 Certified by ASTM for the E-1527 Phase I ESA

#### PUBLICATIONS

"Sick Building Syndrome: How it is affecting you and what you can do about it" New York Real Estate Journal.

"Managing Lead-Based Pain in Houses/Apartments" New York Real Estate Journal

"Without Profit Brownfield Development will Not be Sustaniable" New York Real Estate Journal "What are the options for Soil Disposal During the Construction of the Next Property" New York Real Estate Journal



#### Gabrielle Castro

Senior Project Manager for Touchstone Environmental Geology, P.G.

#### SUMMARY OF EXPERIENCE

Working in various sections of environmental sciences throughout the course of my career has provided me with an understanding of the local environment in New York State. I have worked on projects including Phase I and Phase II Environmental Site Assessments as well as New York Brownfield Cleanup Projects and investigations for the New York City Office of Environmental Remediation. Throughout my career, I have worked effectively to meet deadlines and program requirements and to ensure accuracy in the data I have collected and analyzed.

#### **RELEVANT PROJECT EXPERIENCE**

- Recently completed waste characterization testing as part of a Phase II Investigation on Fulton Street in Brooklyn, New York. The investigation included the installation, sampling, and collection of a series of soil probes. The investigation and Remedial Design were approved by the New York City Office of Environmental Remediation.
- Written a number of for Phase I Environmental Site Assessments (ESAs). Recommendations for Phase II ESAs were then based upon the results of the Phase I ESAs and Phase II ESAs were then properly implemented.
- Knowledgeable in soil disposal characterization. Supervised the excavation and disposal of soil at a site on Jericho Turnpike in Queens, New York.
- Performed a Phase I ESA site inspection at 88 North 1<sup>st</sup> Street in Brooklyn, New York. Based upon the results of the Phase I ESA, the proper scope of work for a Phase II ESA was determined and a Phase II ESA scope of work and proposal was prepared.
- Managed a variety of New York City Brownfield Cleanup Projects including the preparation of the Remedial Investigation Work Plans, Remedial Action Work Plans, and implementation of the fieldwork.
- Successfully managed the implementation of Remedial Action Plans during fieldwork.

#### **TECHNICAL RESPONSIBILITIES**

- Compile information on properties for Phase I and Phase II Environmental Site Assessments.
- Conduct Phase I and Phase II Environmental Site Assessments.
- Management of site investigations and site supervision.
- Conduct air quality/dust monitoring control.
- File Freedom of Information Act (FOIA) Requests with various agencies to collect further information about the properties in order to assess the environmental quality.
- Create reports to evaluate the potential environmental impacts associated with the Subject Properties.

- Supervise disposal of excavated soil.
- Collect indoor and outdoor air samples, soil vapor samples, and soil probe samples for laboratory analyses.
- Air Quality/Control

#### **EDUCATION**

Master of Science Integrated Biology, *Hofstra University*, Hempstead, NY, December 2019 Bachelor of Science Biology, *SUNY University at Albany*, Albany, NY, May 2014

#### CERTIFICATIONS

OSHA Outreach Certification ASTM Training and E-Learning: Phase I & II ESA Workshop September 14, 2020 October 1, 2020



Project Manager for Touchstone Environmental Geology, P.G.

#### **RELEVANT PROJECT EXPERIENCE**

- Performance of Phase I Environmental Site Assessment (ESA) inspections.
- Performance of Phase II ESA and site investigation fieldwork including the collection of soil, groundwater, vapor samples, indoor/outdoor ambient air samples.
- Installation of monitoring wells and soil vapor/subslab probes.
- Performance of waste characterization studies. Knowledgeable in soil disposal characterization.

#### **TECHNICAL RESPONSIBILITIES**

- Compile information on properties for Phase I and Phase II Environmental Site Assessments.
- Conduct Phase I and Phase II Environmental Site Assessments.
- Management of site investigations and site supervision.
- Conduct air quality/dust monitoring control.
- Create reports to evaluate the potential environmental impacts associated with the Subject Properties.
- Supervise disposal of excavated soil.
- Supervise underground storage tank removals.
- Collect indoor and outdoor air samples, soil vapor samples, and soil probe samples for laboratory analyses.
- Air Quality/Control

#### **EDUCATION**

Bachelor of Science Computer Science, SUNY Farmingdale NY, May 2005

#### **CERTIFICATIONS**

OSHA Outreach Certification 08/31/2019 UST A/B Operator

#### RENEE G. COHEN 2815 Covered Bridge Road Merrick, NY 11566 516-223-9761 FAX 516-223-0983 rgcs70@aol.com

#### EXPERIENCE PREMIER ENVIRONMENTAL SERVICES, Merrick, New York

Perform organic and inorganic data validation according to the various protocols from the USEPA EPA CLP, NYS ASP and USEPA Test Methods for the Evaluation of Solid Waste, Methods for the Chemical Analysis of Water and Waste and the Federal Register. Use the USEPA National Functional Guidelines for Organic and Inorganic Data Validation (where applicable) as well as State (NYS DEC ASP/DUSR) and EPA Region requirements to report on laboratory data quality and data usability. Review and write Quality Assurance Project Plans using Regional and State guidelines for Remedial Investigations, Ground Water Monitoring programs and Superfund Programs. Review data and work plans as they relate to project data quality objectives. Conducts seminars on client specific topics. Perform on-site laboratory QA/QC audits as required by the client and site-specific work plans. Has performed ASTM Phase 1 Assessments for engineering firms when requested.

#### ENVIRONMENTAL QUALITY SERVICES, INC., Farmingdale, New York

#### 1/2011-11/11 QA Manager

(30 hrs/wk)

Perform the data review and report compilation of organic and inorganic data for report preparation. Review data for compliance with method as well as data quality objectives for specific client work plans. Perform departmental audits in compliance with NELAC and internal lab mandates. Revise laboratory logbooks for bench chemists. Revised/updated laboratory SOP's for method compliance. Participate in on-site audits by both state representatives and commercial clients. Coordinate PT studies for analyte certification for laboratory certifications. Insure analyte certification for client project requirements. Responsible for the review of new and/or updated method and implementation of these methods within the laboratory.

#### ENVIRONMENTAL TESTING LABORATORIES, Farmingdale, New York

#### 8/2010-1/2011 QA Manager

(25-30 hrs/wk) Perform the data review and report compilation of organic and inorganic data for report preparation. Perform departmental audits in compliance with NELAC and internal lab mandates. Revise laboratory logbooks for bench chemists. Revised/updated laboratory SOP's for method compliance. Participate in on-site audits by both state representatives and commercial clients. Coordinate PT studies for analyte certification for laboratory certifications. Insure analyte certification for client project requirements.

#### **Renee Cohen – Page 2**

#### SOUTH MALL ANALYTICAL LABORATORIES, Plainview, New York

#### 10/2004-12/2009 QA Manager (Part Time)

(10 hrs/wk) Responsible for the overall QA program at the laboratory. Revised, updated and prepared SOP's for method compliance. Wrote and prepared the annual updates to laboratory Quality Assurance Manual. Perform audits of laboratory systems and methods. Prepare corrective action reports and follow-up to audit deficiencies. Oversee client and agency on-site audits. Contact with clients to discuss sampling plans, regulations, and required analyses. Perform the data review and report compilation of organic and inorganic data for reporting. Revised all laboratory logbooks and methods to comply with EPA and method guidelines. Handled document control of logbooks, SOP's, QAPP's. Performed annual data integrity and ethics seminars for all employees. Report directly to senior management.

#### ENVIRONMENTAL TESTING LABORATORIES, Farmingdale, New York

- 5/2002-10/2003 QA Specialist
- (20-24 hrs/wk) Performed the data review and report compilation of organic and inorganic data for report preparation. Performed departmental audits in compliance with NELAC and internal lab mandates. Helped to revise laboratory logbooks for bench chemists. Revised/updated laboratory SOP's for method compliance. Participated in on-site audits by both state representatives and commercial clients.

#### KEYSPAN LABORATORY SERVICES, Brooklyn, New York

2/1999-5/2002 Consultant

Developed laboratory QAPP (in accordance with NELAC) and Chemical Hygiene Plan. Modified and updated laboratory SOP's. Perform audits in the different work areas. Maintained the NYS DOH proficiency program for analytes of interest. Review data for completeness and QC criteria. Implemented client inquiry system. Performed QC training and method training for bench and field chemists. Developed protocols and documentation for field PCB wipe sampling. Responsible for update/maintenance of laboratory state certifications and approvals.

#### NYTEST ENVIRONMENTAL INC., Port Washington, New York

#### 1994-1998 Quality Assurance Officer

Responsible for the overall quality program at the laboratory. This included the auditing test methods, systems and data reporting. Performed the review of 10% of all data reports prior to submission to client. Oversaw the training program of new employees. Maintain the documentation of the training records. Review and maintain state certification paperwork and SOP files. Update and file annual MDL datum. Worked with sales and customer service to ensure that client needs are met. Respond to client data inquires. Work with state and federal auditors for review of laboratory to receive certification. Successfully lead the laboratory to an Army Corp of Engineer validation.

#### **Renee Cohen – Page 3**

#### 1989-1993 ENSECO EAST, Somerset, New Jersey

QA/QC Scientist - Performed organic and inorganic audits of the laboratory. Performed and coordinated corrections and revisions to data reports. Wrote and reviewed laboratory Quality Assurance Project plans (QAPjP's) for client specific projects. Developed and led seminars for both client and employees on a number of topics including; data quality objectives, data review vs. data validation and laboratory QC. Interacted with clients, project managers and state personnel for regulatory concerns and data/lab issues. Performed lab audits for method compliance and project specific requirements. Acted as the Technical Representative for Ensecos EPA 3/90 Organic CLP Contract.

#### 1988-1989 INTECH BIOLABS, East Brunswick, New Jersey

QA/QC Manager - Responsible for the review of all organic and inorganic data. Performed general laboratory and safety audits. Recorded and charted all QA/QC data. Reviewed and assembled all CLP organic data reports.

#### 1986-1988 INTERNATIONAL TECHNOLOGIES CORPORATION, Edison, New Jersey

Central Laboratory Chemist - REAC and EERU Contract for the Emergency Response Branch (ERB) of the USEPA. Responsible for the organic and inorganic extraction of environmental samples according to EPA Methods. This included both metals digestion as well as organic extraction's for semivolatiles, pesticides and PCB's. Performed Volatile Organic analyses using Gas Chromatography, Total Petroleum Hydrocarbon Analysis by IR, Metal Analyses by both Graphite Furnace AA and ICP. Field experience included s on site analyses for both metals and GC volatiles.

#### 1985-1986 U.S. TESTING COMPANY, Hoboken, New Jersey

Chemist - Responsible for the digestion and analysis of both soil and aqueous samples for metals according to USEPA CLP and SW 846 protocols. Responsible for the analysis of sample digestates using the Varian Graphite Furnace Atomic Absorption Spectrophotometer and a Jerall Ash ICP-61.

#### **Education**

B.S. Environmental Science, December 1984B.S. Biology, May 1984Old Dominion University, Norfolk, Virginia

20 hours of Chemistry coursework Graduate Coursework - Rutgers University, New Brunswick, New Jersey Long Island University at C.W. Post, Glen Cove, New York

#### **Continuing Education**

Good Laboratory Practice (GLP) - June 1992, Center for Professional Development, East Brunswick, New Jersey

40 Hour Course, Region II-Edison, NJ (1987) 24 Hour Refresher Course (1988, 1989, 1991)

#### **References**

Available upon request.

# ATTACHMENT C

# SAMPLING FOR EMERGING CONTAMINANTS

## Division of Environmental Remediation - PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number	
	Perfluorobutanesulfonic acid	PFBS	375-73-5	
	Perfluoropentanesulfonic acid	PFPeS	2706-91-4	
	Perfluorohexanesulfonic acid	PFHxS	355-46-4	
Derfluereelled culterie eeide	Perfluoroheptanesulfonic acid	PFHpS	375-92-8	
Perhuoroaikyi sullonic acius	Perfluorooctanesulfonic acid	PFOS	1763-23-1	
	Perfluorononanesulfonic acid	PFNS	68259-12-1	
	Perfluorodecanesulfonic acid	PFDS	335-77-3	
	Perfluorododecanesulfonic acid	PFDoS	79780-39-5	
	Perfluorobutanoic acid	PFBA	375-22-4	
	Perfluoropentanoic acid	PFPeA	2706-90-3	
	Perfluorohexanoic acid	PFHxA	307-24-4	
	Perfluoroheptanoic acid	PFHpA	375-85-9	
Dorfluoroollad oorboxydio	Perfluorooctanoic acid	PFOA	335-67-1	
acids	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	
	Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6	
Der and Dolyfluoreether	4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4	
carboxylic acids	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	
	4:2 Fluorotelomer sulfonic acid	4:2-FTS	757124-72-4	
Fluorotelomer sulfonic acids	6:2 Fluorotelomer sulfonic acid	6:2-FTS	27619-97-2	
	8:2 Fluorotelomer sulfonic acid	8:2-FTS	39108-34-4	
Ebuara talang ang angkang dia	3:3 Fluorotelomer carboxylic acid	3:3 FTCA	356-02-5	
Fluorotelomer carboxylic acids	5:3 Fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3	
0000	7:3 Fluorotelomer carboxylic acid	7:3 FTCA	812-70-4	
	Perfluorooctane sulfonamide	PFOSA	754-91-6	
Perfluorooctane	N-methylperfluorooctane sulfonamide	NMeFOSA	31506-32-8	
Sullohannues	N-ethylperfluorooctane sulfonamide	NEtFOSA	4151-50-2	
Perfluorooctane	N-methylperfluorooctane sulfonamidoacetic acid	N-MeFOSAA	2355-31-9	
sulfonamidoacetic acids	N-ethylperfluorooctane sulfonamidoacetic acid	N-EtFOSAA	2991-50-6	
Perfluorooctane sulfonamide	N-methylperfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7	
ethanols	N-ethylperfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2	
	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic		750400 50 4	
	acid (F-53B Major)	9CI-PF3ONS	756426-58-1	
Ether sulfonic acids	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic		763051-92-9	
	aciu (F-535 Millior) Perfluoro(2-ethoxyethane) sulfonic acid	PEESA	113507-82-7	
		TILLOA	110007-02-7	



Department of Environmental Conservation

# SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

# **Under NYSDEC's Part 375 Remedial Programs**

November 2022





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#### 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
Routine Analysis, page 9	"However, laboratories analyzing environmental samplesPFOA and PFOS in drinking water by EPA Method 537, 537.1 or ISO 25101."	"However, laboratories analyzing environmental samplesPFOA 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
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



Citation and Page Number	Current Text	Corrected Text	Date
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
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."	<ul> <li>"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. "</li> <li>[Interim SCO Table]</li> <li>"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.</li> <li>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. "</li> </ul>	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	<ul> <li><sup>1</sup> 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.</li> <li><sup>2</sup> 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).</li> </ul>	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 textEPA 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 <sup>2</sup> 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	



# Sampling, Analysis, and Assessment of Perand Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

## 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: <a href="https://www.dec.ny.gov/chemical/62440.html">https://www.dec.ny.gov/chemical/62440.html</a>.

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  $\mu$ g/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.<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> 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.

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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 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.

## Water Sample Results

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.

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

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:

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 <sup>2</sup>	1.1	3.7

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

<sup>&</sup>lt;sup>2</sup> 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).

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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: <u>https://www.nj.gov/dep/srp/guidance/rs/daf.pdf</u>.

## 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 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.



## 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:
  - o Matrix type
  - Number or frequency of samples to be collected per matrix
  - o 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
  - o Number and type of matrix spike and matrix spike duplicate samples to be collected
  - o Number and type of duplicate samples to be collected
  - o 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  $-0.5 \mu g/kg (ppb)$
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
- ٠
- Include detailed sampling procedures
  - Precautions to be taken
  - Pump and equipment types
  - Decontamination procedures
  - o 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 (<u>http://www.dec.ny.gov/docs/remediation\_hudson\_pdf/sgpsect5.pdf)</u>, 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<sup>TM</sup>) 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  $4 \pm 2^{\circ}$  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 (<u>http://www.dec.ny.gov/docs/remediation\_hudson\_pdf/sgpsect5.pdf</u>), 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<sup>TM</sup>) 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  $4 \pm 2^{\circ}$  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 (<u>http://www.dec.ny.gov/docs/remediation\_hudson\_pdf/sgpsect5.pdf</u>), 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<sup>™</sup>) 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  $4 \pm 2^{\circ}$  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 (<u>http://www.dec.ny.gov/docs/remediation\_hudson\_pdf/sgpsect5.pdf)</u>, 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). Precleaned 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<sup>™</sup>) 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  $4 \pm 2^{\circ}$  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 latest guidelines developed by the Division of Fish and Wildlife (DFW) entitled "General Fish Handling Procedures for Contaminant Analysis" (Ver. 8).

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. <u>All necessary forms will be supplied by the Bureau of Ecosystem Health.</u> 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<u>and signed</u> 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 <u>and signed</u> 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 <u>each</u> 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 <u>each</u> 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. The Bureau of Ecosystem Health will supply the bags. 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</u><u>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  $<45^{\circ}$  F ( $<8^{\circ}$  C) immediately following data processing. As soon as possible, freeze at  $-20^{\circ}$  C  $\pm 5^{\circ}$  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.

richter (revised): sop\_fish\_handling.docx (MS Word: H:\documents\procedures\_and\_policies); 1 April 2011, revised 10/5/11, 12/27/13, 10/05/16, 3/20/17, 3/23/17, 9/5/17, 3/22/18, 4/26/19

page \_\_\_\_\_ of \_\_\_\_\_

#### NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION DIVISION OF FISH AND WILDLIFE FISH COLLECTION RECORD

Project and S	Project and Site Name DEC Region						DEC Region		
Collections	made by (include all	crew)							
Sampling M	ethod:  □Electrofishi	ng	ng □Trap	netting Trawling	∃Seining	g □Anglin	g □Other		
Preservation	Method: □Freezing	□Other		Notes	(SWFD	B survey nu	mber):		
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, V	'illage, Road, etc.)	
Town of			, in	County.
Item(s) Said sample(s) were in my posse	ession and ha	andled acc	cording to standard procedures provi	ded to me prior to
collection. The sample(s) were p	placed in the	custody c	of a representative of the New York S	State Department of
Environmental Conservation on			, 20 .	
Si	gnature		D	ate
I,	, r	eceived th	ne above mentioned sample(s) on the	date specified
and assigned identification numb	er(s)		to	the sample(s). I
have recorded pertinent data for	the sample(s)	) on the at	tached collection records. The samp	le(s) remained in

my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

Signatur	e	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
	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluoropentanesulfonic acid	PFPeS	2706-91-4
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroalkyl	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
sulfonic acids	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorononanesulfonic acid	PFNS	68259-12-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
	Perfluorododecanesulfonic acid	PFDoS	79780-39-5
	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluoroalkyl	Perfluorooctanoic acid	PFOA	335-67-1
carboxylic acids	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
	Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
Per- and	4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
Polyfluoroether	Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
carboxylic acids	Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
	Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Fluorotolomor	4:2 Fluorotelomer sulfonic acid	4:2-FTS	757124-72-4
sulfonic acids	6:2 Fluorotelomer sulfonic acid	6:2-FTS	27619-97-2
	8:2 Fluorotelomer sulfonic acid	8:2-FTS	39108-34-4
<b>F</b> huenetelensen	3:3 Fluorotelomer carboxylic acid	3:3 FTCA	356-02-5
Fluorotelomer	5:3 Fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3
carboxylic acids	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	N-methylperfluorooctane sulfonamidoacetic acid	N-MeFOSAA	2355-31-9
sulfonamidoacetic acids	N-ethylperfluorooctane sulfonamidoacetic acid	N-EtFOSAA	2991-50-6
Perfluorooctane	N-methylperfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7
sulfonamide ethanols	N-ethylperfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2



Group	Chemical Name	Abbreviation	CAS Number
	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (F-53B Major)	9CI-PF3ONS	756426-58-1
Ether sulfonic acids	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor)	11CI-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 6°C 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
---------------------------	----------------

#### November 2022

# 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<="" td=""><td>Qualify as ND at reporting limit</td></reporting>	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	Apply J qualifier to detects and UJ qualifier to
criteria can also be used)	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 D QUALITY ASSURANCE PROJECT PLAN

## QUALITY ASSURANCE PROJECT PLAN 100 EAST 149<sup>TH</sup> STREET SITE 100 East 149<sup>th</sup> Street, Bronx, New York Block 2351, Lot 35

APRIL 2023

#### Prepared on behalf of:

RGDC 149 LLC 214 West 39<sup>th</sup> Street, Suite 1200 New York, New York

# Prepared by:

Touchstone Environmental Geology, P.C. 1919 Middle Country Road, Suite 205 Centereach, New York 11720 rachelataman@touchstoneenvironmental.com (631) 315-2733

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FIGURES	

Figure 1 Proposed Sample Location Map

#### ATTACHMENTS

Attachment 1	York Analytical Laboratories Inc EPA 1633 (PFAS) Field Sampling Guidelines and PFAS Sampling
	Instructions
Attachment 2	York Analytical Laboratories Inc MDLs for 21 PFAS Compounds
Attachment 3	NYSDEC PFAS Analyte List
Attachment 4	Laboratory SOPs for PFAS Analysis
Attachment 5	Third-Party Data Validator Credentials
Attachment 6	Field Staff Resumes

# **1.0 INTRODUCTION**

This Quality Assurance Project Plan (QAPP) has been prepared in accordance with DER-10 to detail procedures to be followed during the course of the sampling and analytical portion of the project, as required by the approved work plan.

To ensure the successful completion of the project each individual responsible for a given component of the project must be aware of the quality assurance objectives of his / her particular work and of the overall project. The Touchstone Project Manager, Rachel Ataman will be directly responsible to the client for the overall project conduct and quality assurance/quality control (QA/QC) for the project. The Project Manager will be responsible for overseeing all technical and administrative aspects of the project and for directing QA/QC activities. Ms. Gabrielle Castro will serve as the Quality Assurance Officer (QAO) and in this role may conduct:

- conduct periodic field and sampling audits;
- interface with the analytical laboratory to resolve problems; and
- interface with the data validator and/or the preparer of the DUSR to resolve problems.

Rachel Ataman will serve as the Project Manager and will be responsible for implementation of the Remedial Investigation and coordination with field sampling crews and subcontractors. Reporting directly to the Project Manager will be the Field Operations Officer, Mehmet Firat Ataman; who will serve as the on-Site qualified environmental professional who will record observations, direct the drilling crew and be responsible for the collection and handling of all samples.

#### 1.1 Organization

The Project QA will be maintained under the direction of the Project Manager, in accordance with this QAPP. QC for specific tasks will be the responsibility of the individuals and organizations listed below, under the direction and coordination of the Project Manager.

GENERAL RESPONSIBILITY	SCOPE OF WORK	RESPONSIBILITY OF QUALITY CONTROL
Field Operations	Supervision of Field Crew, sample collection and handling.	Mehmet Firat Ataman
Project Manager	Implementation of the RI according to the RIWP.	Rachel Ataman
Quality Assurance Officer	Interface with laboratory, validator, and field crew to identify / resolve data quality issues.	Gabrielle Castro
Laboratory Analysis	Laboratory Analysis of soil / groundwater samples for PFAS and 1,4-dioxane by NYSDEC ASP methods.	York Analytical Laboratories, Inc.
Data review	Review for completeness and compliance.	Renee G. Cohen, Premier Environmental Services

# 2.0 QUALITY ASSURANCE PROJECT PLAN OBJECTIVES

#### 2.1 Overview

Overall project goals are defined through the development of Data Quality Objectives (DQOs), which are qualitative and quantitative Statements that specify the quality of the data required to support decisions; DQOs, as described in this section, are based on the end uses of the data as described in the work plan.

In this plan, Quality Assurance and Quality Control are defined as follows:

- Quality Assurance The overall integrated program for assuring reliability of monitoring and measurement data.
- Quality Control The routine application of procedures for obtaining prescribed standards ofperformance in the monitoring and measurement process.

#### 2.2 QA / QC Requirements for Analytical Laboratory

Samples will be analyzed by a New York State Department of Health (NYSDOH) certified laboratory that is certified in the appropriate categories. Data generated from the laboratory will be used to evaluate contaminants such as chlorinated and other volatile organic compounds (VOCs) in soil, soil gas and groundwater, and 1,4-dioxane and PFAS in soil and groundwater. The QA requirements for all subcontracted analytical laboratory work performed on this project are described below. QA elements to be evaluated include accuracy, precision, sensitivity, representativeness, and completeness. The data generated by the analytical laboratory for this project are required to be sensitive enough to achieve required quantification limits as specified in NYSDEC Analytical Services Protocol (NYSDEC ASP, 11/2022) and useful for comparison with clean-up objectives. The analytical results meeting the required quantification limits will provide data sensitive enough to meet the data quality objectives of this remedial program as described in the work plan. Reporting of the data must be clear, concise, and comprehensive. The QC elements that are important to this project are completeness of field data, sample custody, sample holding times, sample preservation, sample storage, instrument calibration andblank contamination.

#### 2.2.1 Instrument Calibration

Calibration curves will be developed for each of the compounds to be analyzed. Standard concentrations and a blank will be used to produce the initial curves. The development of calibration curves and initial calibration response factors must be consistent with method requirements presented in the most recent version of NYSDEC ASP 11/2022.

#### 2.2.2 Continuing Instrument Calibration

The initial calibration curve will be verified every 12 hrs by analyzing one calibration standard. The standard concentration will be the midpoint concentration of the initial calibration curve. The calibration check compound must come within 25% relative percent difference (RPD) of the average response factor obtained during initial calibration. If the RPD is greater than 25%, then corrective action must be taken as provided in the specific methodology.

#### 2.2.3 Method Blanks

Method blank or preparation blank is prepared from an analyte free matrix which includes the same reagents, internal standards, and surrogate standards as me related samples. II is carried through the entire sample preparation and analytical procedure. The method blank must contain less than or equal to the CRQL of any single target compound. For non-target peaks in the method blank, the

peak area must be less than 10 percent of the nearest internal standard. The method blank will be used to demonstrate the level of laboratory background and reagent contamination that might result from the analytical process itself.

#### 2.2.4 Equipment / Materials Rinsate Blanks

Equipment / materials rinsate blanks are samples which are obtained by running PFAS free water through or over decontaminated sampling equipment or materials including pump tubing, scoops, augers etc. (bailer, pump, auger, etc.). These samples are used to determine if decontamination procedures are adequate. Equipment / materials rinsate banks will be collected for 1,4-dioxane and PFAS soil and groundwater water samples at a minimum frequency of 1 per day per matrix.

#### 2.2.5 Surrogate Spike Analysis

For organic analyses, all samples and blanks will be spiked with surrogate compounds before purging or extraction in order to monitor preparation and analyses of samples. Surrogate spike recoveries shall fall within the advisory limits in accordance with the NYSDEC ASP protocols for samples falling within the quantification limits without dilution.

#### 2.2.6 Surrogate Spike Analysis

MS, MSD, and MSB analyses will be performed to evaluate the matrix effect of the sample upon the analytical methodology along with the precision of the instrument by measuring recoveries. The MS / MSD / MSB samples will be analyzed for each group of samples of a similar matrix at a rate of one forevery 20 field samples. The RPD will be calculated from the difference between the MS and MSD. Matrix spike blank analysis will be performed to indicate the appropriateness of the spiking solution(s) used for the MS/MSD.

#### 2.2.7 Sampling Procedures PFAS

Field Sampling Guidelines for PFAS are included in Attachment 1 and are described below:

The following sample container procedures will be followed:

- All PFAS samples will be collected first on site.
- Groundwater samples will be collected from the monitoring wells utilizing dedicated HDPE tubing which will be replaced with new tubing between each monitoring well.
- All sample containers made of HDPE or polypropylene.
- Caps are unlined and made of HDPE or polypropylene (no Teflon® -lined caps).

The following field clothing and PPE procedures will be followed:

- No clothing or boots containing Gore-Tex®.
- All safety boots made from polyurethane and PVC.
- No materials containing Tyvek®.
- Do not use fabric softener on clothing to be worn in field.
- Do not used cosmetics, moisturizers, hand cream, or other related products the morning of sampling.
- Do not use unauthorized sunscreen or insect repellant.
- Wet weather gear made of polyurethane and PVC only.
- Sampler must use powderless nitrile gloves.

The following field equipment procedures will be followed:

- Must not contain Teflon® (aka PTFE) or LDPE materials.
- All sampling materials must be made from stainless steel, HDPE, acetate, silicon,

or polypropylene.

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

PFAS Sampling instructions are provided in Attachment 1.

#### 2.2.8 Sampling Procedures Soil

A total of 10 soil borings (23SP1 through 23SP10) will be advanced using the Geoprobe<sup>™</sup> dualtube sampling system. The Geoprobe<sup>™</sup> uses a direct push hydraulic percussion system to drive and retrieve five-foot core samplers. A track mounted Geoprobe<sup>™</sup> model 6720DT or equivalent will be utilized. Soil samples from each of the soil borings will be retrieved using a 1.5-inch diameter, 5-foot-long core sampler with disposable acetate liners and the dual-tube method to preserve sample integrity. A sample location map is provided as **Figure 1**.

Soil samples will be collected in accordance with procedures described below:

- Open the dual tube acetate liner.
- Wear a new pair of powderless nitrile gloves when collecting each discrete soil sample.
- If any of the soil in the sampler appears to be caved or sloughed material from the open boring overlying the sampled interval, remove it from the sampler.
- Record the depth interval and recovery of each soil sample to the nearest one-tenth (0.1) foot.
- Perform soil field screening or logging activities (e.g., PID screening, soil type identification and description) using a representative portion of the soil sample that is not needed for fixed- base laboratory analysis.
- Screening and logging activities may be performed before or after laboratory containers have been filled.
- A grab soil sample for PFAS analysis should be collected using powderless nitrile gloves in two laboratory supplied 250mL plastic containers. PFAS samples are to be immediately placed in a plastic bag in a cooler with water/ice separate from other samples.
- Soil samples for 1,4-dioxane analysis should be collected immediately following PFAS sample collection. Collect the soil samples using powderless nitrile gloves in the laboratory supplied containers.
- Immediately place the labeled and filled laboratory containers in a cooler on ice.
- Complete the chain-of-custody form and applicable boring logs, field forms, logbook, or log sheets.
- Typically, the Geoprobe sampling equipment does not need to be decontaminated between sampling locations because soil cores are collected in disposable acetate liners. However, if gross contamination (e.g., non-aqueous phase liquids) is encountered, the Geoprobe sampling equipment should be decontaminated in accordance with Section 2.2.10 below. When samplingfor emerging contaminants the cutting shoe of the lead rod must be decontaminated.

#### 2.2.9 Sampling Procedures Groundwater

Groundwater samples will be collected from four newly installed monitoring wells through the use of a pump with new HDPE tubing placed down the monitoring wells and any tubing connections using new silicone tubing. All pump tubing is to be replaced with new tubing between each monitoring well. A sample location map is provided as **Figure 1**.

Groundwater samples will be collected in accordance with standard low-flow sampling procedures as follows:

- Record pump make & model on sampling form.
- Wear appropriate health and safety equipment as outlined in the Health and Safety Plan and PFAS sampling procedure documented above.
- Inspect each well for any damage or evidence of tampering and note condition in field logbook.
- Remove the well cap.
- Lay out plastic sheeting and place the monitoring, purging, and sampling equipment on thesheeting.
- To avoid cross-contamination, do not let any downhole equipment touch the ground.
- Measure well headspace with a PID or FID and record the reading in the field logbook.
- A synoptic water level measurement round should be performed (in the shortest possible time) before any purging and sampling activities begin. Measure and record the depth to water using a water level meter or interface probe to the nearest 0.01 ft. Record the measurement in the field logbook. Do not measure the depth to the bottom of the well at this time (to avoid disturbing any sediment that may have accumulated). Obtain depth to bottom information from installation information in the field logbook or soil boring logs.
- Collect samples in order from wells with lowest contaminant concentration to highest concentration.
- Connect the HDPE tubing to the pump and lower the pump into the well to approximately the middle of the screen. The pump should be a minimum of 2 feet above the bottom of the well as this may cause mobilization of any sediment present in the bottom of the well.
- Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet but remains stable, continue purging until indicator field parameters stabilize.
- There should be at least 1 foot of water over the end of the tubing / pump so there is no risk of entrapment of air in the sample. Pumping rates should be reduced to the minimum capabilities of the pump, if needed, to avoid purging the well dry. However, if the recharge rate of the well is very low and the well is purged dry, then wait until the well has recharged to a sufficientlevel and collect the appropriate volume of sample.
- During well purging, monitor indicator field parameters (temperature, specific conductance, and pH) every three to five minutes (or less frequently, if appropriate). Note: during the early phase of purging emphasis should be put on minimizing and stabilizing pumping stress and recording those adjustments. 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, taken at three (3) to five (5) minute intervals, are within the following limits:
  - $\circ$  specific conductance (3%),
  - temperature (3%),
  - $\circ$  pH (± 0.1 unit)

- If stability is not reached within a reasonable time period purging may be stopped and the sample collected. This should be noted on the sampling log.
- Collect PFAS samples first directly into laboratory supplied containers. PFAS samples are to beplaced in a plastic bag and in a cooler separate from all other samples.
- Label the samples and record them on the chain of custody form. Place immediately into acooler for shipment and maintain at 4°C.
- Remove the tubing from the well. The HDPE tubing must be discarded.

#### 2.2.10 Sampling Procedures Groundwater

Decontamination of non-dedicated sampling equipment will consist of the following:

- Gently tap or scrape to remove adhered soil.
- Rinse with PFAS free water.
- Wash with alconox® detergent solution and scrub (liquinox not suitable for 1,4-Dioxane sampling).
- Rinse with PFAS free water.
- Rinse with PFAS free water.

#### 2.3 Accuracy

Accuracy is defined as the nearness of a real or the mean (x) of a set of results to the true value. Accuracy is assessed by means of reference samples and percent recoveries. Accuracy includes both precision and recovery and is expressed as percent recovery (% REC). The MS sample is used to determine the percent recovery. The matrix spike percent recovery (% REC) is calculated by the following equation:

$$\% REC = \frac{SSR - SR}{x} \times 100SA$$

Where: SSR = spike sample results SR = sample results SA = spike added from spiking mix

#### 2.4 Precision

Precision is defined as the measurement of agreement of a set of replicate results among themselves without a Precision is defined as the measurement of agreement of a set of replicate results among themselves without assumption of any prior information as to the true result. Precision is assessed by means of duplicate/replicate sample analyses.

Analytical precision is expressed in terms of RPD. The RPD is calculated using the following formula:

$$RPD = \frac{D^1 - D^2}{(D^1 + D^2)/2} \times 100$$

Where: RPD = relative percent difference  $D^1$  = first sample value  $D^2$  = second sample value (duplicate)

# 2.5 Sensitivity

The sensitivity objectives for this plan require that data generated by the analytical laboratory achieve quantification levels low enough to meet the required detection limits specified by NYSDEC ASP and to meet all site-specific standards, criteria, and guidance values (SGCs) established for this project.

## 2.6 Representativeness

Representativeness is a measure of the relationship of an individual sample taken from a particular site to the remainder of that site and the relationship of a small aliquot of the sample (i.e., the one used in the actual analysis) to the sample remaining on site. The representativeness of samples is assured by adherence to sampling procedures described in the Remedial Investigation Work Plan (RIWP).

# 2.7 Completeness

Completeness is a measure of the quantity of data obtained from a measurement system as compared tothe amount of data expected from the measurement system. Completeness is defined as the percentage of all results that are not affected by failing QC qualifiers and should be between 70 and 100% of all analyses performed. The objective of completeness in laboratory reporting is to provide a thorough data support package. The laboratory data package provides documentation of sample analysis and results in the form of summaries, QC data, and raw analytical data. The laboratory will be required to submit data packages that follow NYSDEC ASP Category B reporting format which, at a minimum, will include the following components:

- 1. All sample chain-of-custody forms.
- 2. The case narrative(s) presenting a discussion of any problems and/or procedural changes required during analyses. Also presented in the case narrative are sample summary forms.
- 3. Documentation demonstrating the laboratory's ability to attain the contract specified detectionlimits for all target analytes in all required matrices.
- 4. Tabulated target compound results and tentatively identified compounds.
- 5. Surrogate spike analysis results (organics).
- 6. Matrix spike/matrix spike duplicate/matrix spike blank results.
- 7. QC check sample and standard recovery results
- 8. Blank results (field, trip, and method).
- 9. Internal standard area and RT summary.

#### 2.8 Laboratory Custody Procedures

The following elements are important for maintaining the field custody of samples:

- Sample identification
- Sample labels
- Custody records
- Shipping records
- Packaging procedures

Sample labels will be attached to all sampling bottles before field activities begin; each label will contain an identifying number. Each number will have a suffix that identifies the site and where the sample was taken. Approximate sampling locations will be marked on a map with a description of the sample location. The number, type of sample, and sample identification will be entered into the field logbook. A chain-of-custody form, initiated at the analytical laboratory will accompany the sample bottles from the laboratory into the field. Upon receipt of the bottles and cooler, the

sampler will sign and date the first received blank space. After each sample is collected and appropriately identified, entries will be made on the chain-of-custody form that will include:

- Site name and address
- Samplers' names and signatures

#### 2.9 Sample Handling and Decontamination Procedures

Collected samples will be appropriately packaged, placed in coolers, and shipped via overnight courier or delivered directly to the analytical laboratory by field personnel. Samples will be containerized in appropriate laboratory provided glassware and shipped in plastic coolers. Samples will be preserved through the use of water ice to maintain a temperature of 4°C.

Dedicated disposable sampling materials will be used for both soil and groundwater samples (if collected), eliminating the need to prepare field equipment / materials (rinsate) blanks. However, equipment / materials rinsate blanks will be prepared for the Geoprobe cutting shoe and for the polyethylene sample tubing at the rate of 1 sample per matrix per day. No field filtering will be conducted; any required filtration will be completed by the laboratory.

Decontamination of non-dedicated sampling equipment will consist of the following:

- Gently tap or scrape to remove adhered soil;
- Rinse with tap water;
- Wash with alconox<sup>®</sup> detergent solution and scrub ;
- Rinse with tap water;
- Rinse with distilled or deionized water.

Prepare equipment / material rinsate blanks by pouring distilled or deionized water over decontaminated equipment for soil or through sample tubing for groundwater and collecting the water in laboratory provided containers. Matrix spike and matrix spike duplicates (MS/MSD) will be collected at the rate of one per 20 samples submitted to the laboratory and duplicate samples will be collected at a rate of one per ten samples submitted to the laboratory.

# **3.0 ANALYTICAL PROCEDURES**

#### 3.1 Laboratory Analysis

Preventive Samples will be analyzed by the NYSDOH ELAP laboratory for one or more of the followingparameters: TCL VOCs +TICs in soil/groundwater by USEPA Method 8260C; 1,4-dioxane in soil/groundwater by USEPA Method 8270 SIM mode; LC-MS/MS for Per- and Polyfluoroalkyl Substances (PFAS) compounds in soil and groundwater by USEPA Method 1633; TCL SVOCs +TICs in soil/groundwater by USEPA Method 8270; Target Analyte List (TAL) and TCL Metals 6010 in soil/groundwater; Pesticides / PCBs by USEPA Method 8081/8082 in soil/groundwater and VOCs in airby USEPA Method TO-15 (**Table 2**). If any modifications or additions to the standard procedures are anticipated and if any nonstandard sample preparation or analytical protocol is to be used, the modifications and the nonstandard protocol will be explicitly defined and documented. Prior approval by Touchstone's PM will be necessary for any nonstandard analytical or sample preparation protocol used by the laboratory, i.e., dilution of samples or extracts by greater than a factor of five (5). A table depicting the NYSDEC DER PFAS Analyte List is provided in **Attachment 3**.

If any modifications or additions to the standard procedures are anticipated and if any nonstandard sample preparation or analytical protocol is to be used, the modifications and the nonstandard protocol will be explicitly defined and documented. Prior approval by Touchstone's PM will be necessary for any nonstandard analytical or sample preparation protocol used by the laboratory, i.e., dilution of samplesor extracts by greater than a factor of five (5). Laboratory SOPs for PFA analysis are included in **Attachment 4**.

#### 4.0 DATA REDUCATION, VALIDATION, REVIEW, AND REPORTING

#### 4.1 Overview

The process of data reduction, review, and reporting ensures the assessments, or a conclusion based on the final data accurately reflects actual site conditions. This plan presents the specific procedures, methods, and format that will be employed for data reduction, review and reporting of each measurement parameter determined in the laboratory and field. Also described in this section is the process by which all data, reports, and work plans are proofed and checked for technical and numerical errors prior to final submission.

#### 4.2 Data Reduction

Standard methods and references will be used as guidelines for data handling, reduction, validation, and reporting. All data for the project will be compiled and summarized with an independent verification at each step in the process to prevent transcription/typographical errors. Any computerized entry of data will also undergo verification review.

Sample analysis will be provided by a New York State certified environmental laboratory. The ELAP approved laboratory is required to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 1633 or ISO 25101 for PFAS analysis. Laboratory reports will include ASP category B deliverables for use in the preparation of a data usability summary report (DUSR). All results will be provided in accordance with the NYSDEC Environmental Information Management System (EIMS) electronic data deliverable (EDD) format. Analytical results shall be presented on standard NYSDEC ASP-B forms or equivalents and include the dates the samples were received and analyzed, and the actual methodology used. Note that if waste characterization samples are analyzed they will be in results only format and will not be evaluated in the DUSR.

Laboratory QA/QC information required by the method protocols will be compiled, including the application of data QA/QC qualifiers as appropriate. In addition, laboratory worksheets, laboratory notebooks, chains-of-custody, instrument logs, standards records, calibration records, and maintenance records, as applicable, will be provided in the laboratory data packages to determine the validity of data. Specifics on internal laboratory data reduction protocols are identified in the laboratory's SOPs.

Following receipt of the laboratory analytical results by Touchstone, the data results will be compiled and presented in an appropriate tabular form. Where appropriate, the impacts of QA/QC qualifiers resultingfrom laboratory or external validation reviews will be assessed in terms of data usability. A resume for the proposed data validator is included in **Attachment 5**.

#### 4.3 Laboratory Data Reporting

All sample data packages submitted by the analytical laboratory will be required to be reported in conformance to the NYSDEC ASP (11/2022), Category B data deliverable requirements as applicable to the method utilized. All results will be provided in accordance with the NYSDEC Environmental Information Management System (EIMS) electronic data deliverable (EDD) format. Note that waste characterization samples, if analyzed, will be in results only format and will not be evaluated in the DUSR. Phoenix Environmental Laboratories, Inc. has confirmed that reporting limits for 1,4-Dioxane in groundwater are at least 0.25 µg/L and 0.1 mg/Kg for soil. The reporting limit for PFAS's is 2 ng/L for aqueous samples (20 ng/L for HFPO-DA) and 1 ng/g (10 ng/g for HFPO-DA) for soil samples. Laboratory MDLs for PFAs in soil and groundwater are included in **Attachment 2**.

# **5.0 CORRECTIVE ACTION**

Review and implementation of systems and procedures may result in recommendations for corrective action. Any deviations from the specified procedures within approved project plans due to unexpected site-specific conditions shall warrant corrective action. All errors, deficiencies, or other problems shallbe brought to the immediate attention of the Touchstone PM, who in turn shall contact the Quality Assurance/Data Quality Manager or his designee (if applicable).

Procedures have been established to ensure that conditions adverse to data quality are promptly investigated, evaluated, and corrected. These procedures for review and implementation of a change areas follows:

- Define the problem.
- Investigate the cause of the problem.
- Develop a corrective action to eliminate the problem, in consultation with the personnelwho defined the problem and who will implement the change.
- Complete the required form describing the change and its rationale (see below for formrequirements).
- Obtain all required written approvals.
- Implement the corrective action.
- Verify that the change has eliminated the problem.

During the field investigation, all changes to the sampling program will be documented in field logs/sheets and the Touchstone PM advised.

If any problems occur with the laboratory or analyses, the laboratory must immediately notify the PM, who will consult with other project staff. All approved corrective actions shall be controlled and documented.

All corrective action documentation shall include an explanation of the problem and a proposed solution which will be maintained in the project file or associated logs. Each report must be approved by the necessary personnel (e.g., the PM) before implementation of the change occurs. The PM shall be responsible for controlling, tracking, implementing, and distributing identified changes.

# QAPP ATTACHMENT 1

Sampling/Preservation Considerations-Based upon EPA 1633 Draft Rev.3, Dec., 2022						
<u>Matrix</u>	Sampling Containers/Amounts	QC Containers	Preservation Required-Exclude light)	Holding Times		
Soil	$1 \times 250 \text{ mL HDPE-filled} \ge 1/2 \text{ way}$	Field Blank-PFAS Free water Field Dup if in Work Plan	Maintain 0-6 deg.C during transport to lab Must arrive at lab within 48 hrs of sampling Once at lab maintain at <6deg C-can freeze	If <6 deg C or frozen, 90 days to prep Note: if NFDHA is needed extract ASAP		
Non-Potable Water	2 x500 mL HDPE containers 4 x 500 mL HDPE for MS/MSD (2 each)	Field Blank-PFAS Free water 500 mL volume needed	Maintain 0-6 deg.C during transport to lab Must arrive at lab within 48 hrs of sampling Once at lab maintain at <6deg C-can freeze	If frozen, 90 days to prep If <6 degC - 28 Days-certain species may degrade* * Perfluorooctanesulfonamide ethanols and Perfluorooctanesulfonamidoacetic acids after 7 days		

# PFC Sampling – Prohibited and Acceptable Items

Prohibited	Acceptable
Field Eq	uipment
Teflon <sup>®</sup> containing materials	High-density polyethylene (HDPE) materials
Low density polyethylene (LDPE) materials	Acetate Liners
	Silicon Tubing
Waterproof field books	Loose paper (non-waterproof)
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
	Sharpies <sup>®</sup> , pens
Post-It Notes®	
Chemical (blue) ice packs	Regular ice
Field Cloth	ing and PPE
New cotton clothing or synthetic water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex <sup>TM</sup>	Well-laundered clothing made of natural fibers (preferable cotton)
Clothing laundered using fabric softener	No fabric softener
Boots containing Gore-Tex <sup>TM</sup>	Boots made with polyurethane and PVC
Tyvek®	Cotton clothing
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	<ul> <li>Sunscreens - Alba Organics Natural Sunscreen, Yes         <ul> <li>To Cucumbers, Aubrey Organics, Jason Natural Sun             Block, Kiss my face, Baby sunscreens that are "free"             or "natural"</li> </ul> </li> <li>Insect Repellents - Jason Natural Quit Bugging Me,         <ul>             Repel Lemon Eucalyptus Insect repellant, Herbal             Armor, California Baby Natural Bug Spray,             BabyGanics</ul></li> </ul> <li>Sunscreen and insect repellant - Avon Skin So Soft         <ul>             Bug Guard Plus – SPF 30 Lotion</ul></li>
Sample C	Containers
LDPE or glass containers	HDPE or polypropylene
Teflon-lined caps	Unlined polypropylene caps
Rain	Events
Waterproof or resistant rain gear	Gazebo tent that is only touched or moved prior to and following sampling activities
Equipment De	contamination
Decon 90®	Alconox <sup>®</sup> and/or Liquinox <sup>®</sup>
Water from an on-site well	Potable water from municipal drinking water supply
Food Con	siderations
All food and drink, with exceptions noted on right	Bottled water and hydration fluids (i.e, Gatorade® and Powerade®) to be brought and consumed only in the staging areas

# QAPP ATTACHMENT 2

# York Analytical Laboratories. Inc. - Stratford Analytical Method Information PFAS Target compounds by LC/MS-MS

		Reporting Surrog	ate Duplicate	Matrix	Spike	Blank Spike	e / LCS
Analyte	MDL	Limit 9	6R ŘPD	%R	RPD	%R	RPD
PFAS, EPA 1633 Target List in Water (EPA 1633 Draft)			Units: ng/L	ı			
Preservation: Cool 4°C				Hold	Fime to A	nalysis 28 dag	ys
Container: 10_250mL Plastic Cool to 4° C		Amount Required:	250 mL	Hold	Fime to Ex	xtr. 28 d	lays
11CL-PF3OUdS	1.38	8.00 ng/L	30	25 - 150	30	50 - 150	30
1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	2.05	8.00 ng/L	30	25 - 150	35	50 - 150	30
1H,1H,2H,2H-Perfluorohexanesulfonic acid (4:2 FTS)	1.79	8.00 ng/L	30	25 - 150	30	50 - 150	30
1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)	1.06	8.00 ng/L	30	25 - 150	35	50 - 150	30
3-Perfluoroheptyl propanoic acid (FHpPA)	9.47	25.0 ng/L	30	25 - 150	30	50 - 150	30
3-Perfluoropentyl propanoic acid (FPePA)	7.33	25.0 ng/L	30	25 - 150	30	50 - 150	30
3-Perfluoropropyl propanoic acid (FPrPA)	2.03	5.00 ng/L	30	25 - 150	30	50 - 150	30
9CL-PF3ONS	0.700	8.00 ng/L	30	25 - 150	30	50 - 150	30
ADONA	0.530	8.00 ng/L	30	25 - 150	30	50 - 150	30
HFPO-DA (Gen-X)	3.23	8.00 ng/L	30	25 - 150	30	50 - 150	30
N-EtFOSA	1.80	2.00 ng/L	30	25 - 150	30	50 - 150	30
N-EtFOSAA	1.03	2.00 ng/L	30	25 - 150	35	50 - 150	30
N-EtFOSE	3.99	20.0 ng/L	30	25 - 150	30	50 - 150	30
N-MeFOSA	1.58	2.00 ng/L	30	25 - 150	30	50 - 150	30
N-MeFOSAA	0.790	2.00 ng/L	30	25 - 150	35	50 - 150	30
N-MeFOSE	3.99	20.0 ng/L	30	25 - 150	30	50 - 150	30
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	0.500	4.00 ng/L	30	25 - 150	30	50 - 150	30
Perfluoro-1-decanesulfonic acid (PFDS)	1.32	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluoro-1-heptanesulfonic acid (PFHpS)	0.910	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluoro-1-nonanesulfonic acid (PFNS)	0.860	2.00 ng/L	30	25 - 150	30	50 - 150	30
Perfluoro-1-octanesulfonamide (FOSA)	0.880	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluoro-1-pentanesulfonate (PFPeS)	0.760	2.00 ng/L	30	25 - 150	30	50 - 150	30
Perfluoro-3,6-dioxaheptanoic acid (NFDHA)	2.14	4.00 ng/L	30	25 - 150	30	50 - 150	30
Perfluoro-4-oxapentanoic acid (PFMPA)	0.250	4.00 ng/L	30	25 - 150	30	50 - 150	30
Perfluoro-5-oxahexanoic acid (PFMBA)	0.370	4.00 ng/L	30	25 - 150	30	50 - 150	30
Perfluorobutanesulfonic acid (PFBS)	0.470	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluorodecanoic acid (PFDA)	0.750	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluorododecanesulfonic acid (PFDoS)	0.930	2.00 ng/L	30	25 - 150	30	50 - 150	30
Perfluorododecanoic acid (PFDoA)	0.880	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluoroheptanoic acid (PFHpA)	0.710	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluorohexanesulfonic acid (PFHxS)	0.680	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluorohexanoic acid (PFHxA)	0.350	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluoro-n-butanoic acid (PFBA)	0.330	8.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluorononanoic acid (PFNA)	0.520	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluorooctanesulfonic acid (PFOS)	0.820	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluorooctanoic acid (PFOA)	0.420	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluoropentanoic acid (PFPeA)	0.230	4.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluorotetradecanoic acid (PFTA)	0.690	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluorotridecanoic acid (PFTrDA)	0.740	2.00 ng/L	30	25 - 150	35	50 - 150	30
Perfluoroundecanoic acid (PFUnA)	1.13	2.00 ng/L	30	25 - 150	35	50 - 150	30

# York Analytical Laboratories. Inc. - Stratford Analytical Method Information PFAS Target compounds by LC/MS-MS

		Reporting Surrog	ate Duplicate	Matrix	. Spike	Blank Spike	e / LCS
Analyte	MDL	Limit 9	6R RPD	%R	RPD	%R	RPD
PFAS, EPA 1633 Target List in Soil (EPA	1633 Dr	aft)		Units: ug/k	g		
Preservation: Cool 4°C				Hold '	Time to A	nalysis 28 day	ys
Container: 10_250mL Plastic Cool to 4° C		Amount Required:	250 mL	Hold '	Time to Ex	xtr. 28 d	lays
11CL-PF3OUdS	0.311	0.800 ug/kg	30	25 - 150	30	50 - 150	30
1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	0.755	0.800 ug/kg	30	25 - 150	35	50 - 150	30
1H,1H,2H,2H-Perfluorohexanesulfonic acid (4:2 FTS)	0.595	0.800 ug/kg	30	25 - 150	30	50 - 150	30
1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)	0.595	0.800 ug/kg	30	25 - 150	35	50 - 150	30
3-Perfluoroheptyl propanoic acid (FHpPA)	1.50	5.00 ug/kg	30	25 - 150	30	50 - 150	30
3-Perfluoropentyl propanoic acid (FPePA)	2.10	5.00 ug/kg	30	25 - 150	30	50 - 150	30
3-Perfluoropropyl propanoic acid (FPrPA)	0.634	1.00 ug/kg	30	25 - 150	30	50 - 150	30
9CL-PF3ONS	0.246	0.800 ug/kg	30	25 - 150	30	50 - 150	30
ADONA	0.174	0.800 ug/kg	30	25 - 150	30	50 - 150	30
HFPO-DA (Gen-X)	0.608	0.800 ug/kg	30	25 - 150	30	50 - 150	30
N-EtFOSA	0.198	0.200 ug/kg	30	25 - 150	30	50 - 150	30
N-EtFOSAA	0.194	0.200 ug/kg	30	25 - 150	35	50 - 150	30
N-EtFOSE	0.697	2.00 ug/kg	30	25 - 150	30	50 - 150	30
N-MeFOSA	0.180	0.200 ug/kg	30	25 - 150	30	50 - 150	30
N-MeFOSAA	0.148	0.200 ug/kg	30	25 - 150	35	50 - 150	30
N-MeFOSE	0.611	2.00 ug/kg	30	25 - 150	30	50 - 150	30
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	0.139	0.400 ug/kg	30	25 - 150	30	50 - 150	30
Perfluoro-1-decanesulfonic acid (PFDS)	0.191	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluoro-1-heptanesulfonic acid (PFHpS)	0.155	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluoro-1-nonanesulfonic acid (PFNS)	0.124	0.200 ug/kg	30	25 - 150	30	50 - 150	30
Perfluoro-1-octanesulfonamide (FOSA)	0.146	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluoro-1-pentanesulfonate (PFPeS)	0.157	0.200 ug/kg	30	25 - 150	30	50 - 150	30
Perfluoro-3,6-dioxaheptanoic acid (NFDHA)	0.193	0.400 ug/kg	30	25 - 150	30	50 - 150	30
Perfluoro-4-oxapentanoic acid (PFMPA)	0.0620	0.400 ug/kg	30	25 - 150	30	50 - 150	30
Perfluoro-5-oxahexanoic acid (PFMBA)	0.0960	0.400 ug/kg	30	25 - 150	30	50 - 150	30
Perfluorobutanesulfonic acid (PFBS)	0.111	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluorodecanoic acid (PFDA)	0.191	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluorododecanesulfonic acid (PFDoS)	0.199	0.200 ug/kg	30	25 - 150	30	50 - 150	30
Perfluorododecanoic acid (PFDoA)	0.163	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluoroheptanoic acid (PFHpA)	0.105	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluorohexanesulfonic acid (PFHxS)	0.179	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluorohexanoic acid (PFHxA)	0.0530	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluoro-n-butanoic acid (PFBA)	0.109	0.800 ug/kg	30	25 - 150	35	50 - 150	30
Perfluorononanoic acid (PFNA)	0.189	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluorooctanesulfonic acid (PFOS)	0.167	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluorooctanoic acid (PFOA)	0.172	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluoropentanoic acid (PFPeA)	0.109	0.400 ug/kg	30	25 - 150	35	50 - 150	30
Perfluorotetradecanoic acid (PFTA)	0.103	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluorotridecanoic acid (PFTrDA)	0.125	0.200 ug/kg	30	25 - 150	35	50 - 150	30
Perfluoroundecanoic acid (PFUnA)	0.198	0.200 ug/kg	30	25 - 150	35	50 - 150	30

# QAPP ATTACHMENT 3



# Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluoropentanesulfonic acid	PFPeS	2706-91-4
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroalkyl	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
sulfonic acids	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorononanesulfonic acid	PFNS	68259-12-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
	Perfluorododecanesulfonic acid	PFDoS	79780-39-5
	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluoroalkyl	Perfluorooctanoic acid	PFOA	335-67-1
carboxylic acids	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
	Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
Per- and	4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
Polyfluoroether	Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
carboxylic acids	Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
	Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Fluorotolomor	4:2 Fluorotelomer sulfonic acid	4:2-FTS	757124-72-4
sulfonic acids	6:2 Fluorotelomer sulfonic acid	6:2-FTS	27619-97-2
	8:2 Fluorotelomer sulfonic acid	8:2-FTS	39108-34-4
<b>F</b> huenetelensen	3:3 Fluorotelomer carboxylic acid	3:3 FTCA	356-02-5
Fluorotelomer	5:3 Fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3
	7:3 Fluorotelomer carboxylic acid	7:3 FTCA	812-70-4
	Perfluorooctane sulfonamide	PFOSA	754-91-6
Perfluorooctane	N-methylperfluorooctane sulfonamide	NMeFOSA	31506-32-8
suitonamides	N-ethylperfluorooctane sulfonamide	NEtFOSA	4151-50-2
Perfluorooctane	N-methylperfluorooctane sulfonamidoacetic acid	N-MeFOSAA	2355-31-9
sulfonamidoacetic acids	N-ethylperfluorooctane sulfonamidoacetic acid	N-EtFOSAA	2991-50-6
Perfluorooctane	N-methylperfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7
sulfonamide ethanols	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)	9CI-PF3ONS	756426-58-1
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor)	11CI-PF3OUdS	763051-92-9
	Perfluoro(2-ethoxyethane) sulfonic acid	PFEESA	113507-82-7

# QAPP ATTACHMENT 4

# **Standard Operating Procedure**

Determination of Target Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous and Solid matrices by Isotope Dilution Analysis by HPLC/MS-MS According to EPA Method 1633 Draft 2

Approvals

Krys Trafalsk

Laboratory Director/QA Officer

Vice President/Chief Scientific Officer

Robert Bradley

# V

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Controlled Copy No. PFAS\_LCMSMS1633, Rev 1.0-\_\_\_\_

Issued to: NA

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#### 1. SCOPE AND APPLICATION

This method is used to identify and quantitate specific PFAS compounds in extracts of non-potable water and solid (soil/sediment) samples using HPLC/MS-MS (high pressure liquid chromatography/tandem mass spectrometry. Currently the compounds (40) that are measured by this methodology are listed in the Table 1.0 below.

Table 1.0-Target PFAS					
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			
Perfluoroalkyl sulfonic acids Acid Form					
Perfluorobutanesulfonic acid	PFBS	375-73-5			
Perfluoropentansulfonic 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			
Fluorotelomer sulfonic acids					
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	4:2FTS	757124-72-4			
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	6:2FTS	27619-97-2			
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	8:2FTS	39108-34-4			
Perfluorooctane sulfonamides					
Perfluorooctanesulfonamide	PFOSA	754-91-6			
N-methyl perfluorooctanesulfonamide	NMeFOSA	31506-32-8			
N-ethyl perfluorooctanesulfonamide	NEtFOSA	4151-50-2			
Perfluorooctane sulfonamidoacetic acids					
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9			
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6			
Perfluorooctane sulfonamide ethanols					
N-methyl perfluorooctanesulfonamidoethanol	NMeFOSE	24448-09-7			
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1691-99-2			
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			
Ether sulfonic acids					
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9C1-PF3ONS	756426-58-1			
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9			
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7			
Fluorotelomer carboxylic acids					
3-Perfluoropropyl propanoic acid	3:3FTCA	356-02-5			
2H,2H,3H,3H-Perfluorooctanoic acid	5:3FTCA	914637-49-3			
3-Perfluoroheptyl propanoic acid	7:3FTCA	812-70-4			

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The estimated reporting limits (MRL) based upon the preparation/analysis parameters herein at the time of this revision are approximately 2.0-20.0 ng/L (ppt) for aqueous samples and 0.5-5.0 ug/kG for solids . The linear range for these PFAS can be extended by dilution. These MRLs are based upon a volume of 0.250L-0.500L extracted for aqueous samples and 2-5 g. for solids.

This method is "performance-based," which means that modifications may be made without additional EPA review to improve performance (e.g., overcome interferences, or improve the sensitivity, accuracy, or precision of the results) *provided that* all performance criteria in this method are met. Requirements for establishing equivalency are in Section 9.1.2 and include 9.1.2.2c. For CWA uses, additional flexibility is described at 40 CFR 136.6. Changes in performance, sensitivity, selectivity, precision, recovery, etc., that result from modifications within the scope of 40 CFR Part 136.6, and Section 9.0 of this method must be documented, as well as how these modifications compare to the specifications in this method. Changes outside the scope of 40 CFR Part 136.6 and Section 9.0 of this method may require prior review or approval.

# 2. SUMMARY

Environmental samples are prepared and extracted using method-specific procedures. Sample extracts are subjected to cleanup procedures designed to remove interferences. Analyses of the sample extracts are conducted by LC-MS/MS in the multiple reaction monitoring (MRM) mode. Sample concentrations are determined by isotope dilution or extracted internal standard quantification (see Section 10.3) using isotopically labeled compounds added to the samples before extraction

# 2.1 Extraction

**2.1.1** Aqueous samples are spiked with isotopically labeled standards, extracted using solid-phase extraction (SPE) cartridges and undergo cleanup using carbon before analysis.

**2.1.2** Solid samples are spiked with isotopically labeled standards, extracted into basic methanol, and cleaned up by carbon and SPE cartridges before analysis.

# 2.2 Analysis

**2.2.1** Extracts are then analyzed by HPLC-MS/MS in the MRM mode. Extracts contain Non-extracted Internal Standards (NIS) to monitor instrument performance and used for quantitative analysis.

**2.2.2** Individual PFAS analytes are identified through peak analysis of the quantification and confirmation ions (Precursor and product ions) where applicable.

**2.2.3** The concentration of each analyte is calculated using the isotope dilution technique. This approach corrects the target analytes for surrogate analog recoveries and these surrogates are essentially extracted internal standards (EIS). For QC purposes, the percent recoveries of the isotope dilution analogues are calculated using the integrated peak areas of isotope performance standards, which are added to the final extract and function as traditional internal standards (non-extracted internal standards), exclusively applied to the isotope dilution analogues.

# 3. **DEFINITIONS**

3.1 ANALYSIS BATCH – A set of samples that is analyzed on the same instrument during a 24-hour period, including no more than 20 Field Samples, that begins and ends with the analysis of the appropriate Continuing Calibration Check (CCC) standards. Additional CCCs may be required depending on the length of the analysis batch and/or the number of Field Samples.

3.2 CALIBRATION STANDARD (CAL) – A solution of the method analytes, isotope dilution analogues, and isotope performance standards (Internal standards) prepared from the Primary Dilution Standards and stock standards. The calibration standards are used to calibrate the instrument response with respect to analyte concentration.

3.3 CONTINUING CALIBRATION VERIFICATION (CCV) – A calibration standard containing the method analytes, internal standard(s) and surrogate(s). The CCV is analyzed periodically to verify the accuracy of the existing calibration for those analytes.

3.4 EXTRACTION BATCH – A set of up to 20 Field Samples (not including QC Samples) extracted together by the same person(s) during a work day using the same lot of SPE devices, solvents, surrogate, internal standard and fortifying solutions. Required QC samples include Method blank, and Matrix spike/duplicate pair.

3.5 FIELD DUPLICATES – Separate samples collected at the same time and sampling location, shipped and stored under identical conditions. Method precision, including the contribution from sample collection procedures, is estimated from the analysis of Field Duplicates. Field Duplicates are used to prepare matrix spike/matrix spike duplicate QC samples.

3.6 FIELD BLANK (FBLK) – An aliquot of reagent water that is placed in a sample container in the laboratory and treated as a sample in all respects, including shipment to the sampling site, exposure to sampling site conditions, storage, preservation, and all analytical procedures. The purpose of the FBLK is to determine if method analytes or other interferences are introduced into the sample from shipping, storage, and the field environment.

3.7 ISOTOPE DILUTION ANALOGUES - Isotopically labeled analogues of the method analytes that are added to the sample prior to extraction in a known amount. Note: Not all target PFAS currently have an isotopically labeled analogue. In these cases, an alternate isotopically labeled analogue is used as detailed in our SOP and in the reference method.

3.8 ISOTOPE DILUTION TECHNIQUE - An analytical technique for measuring analyte concentration using the ratio of the peak area of the native analyte to that of an isotopically labeled analogue, added to the original sample in a known amount and carried through the entire analytical procedure.

3.9 ISOTOPE PERFORMANCE STANDARDS (Internal Standards) - Quality control compounds that are added to all standard solutions and extracts in a known amount and used to measure the relative response of the isotopically labelled analogues that are components of the same solution. For this method, the isotope performance standards are three isotopically labeled analogues of the method analytes. The isotope performance standards are indicators of instrument performance and are used to calculate the recovery of the isotope dilution analogues through the extraction procedure. In this method, the isotope performance standards are not used in the calculation of the recovery of the native analytes.

3.10 METHOD BLANK – An aliquot of reagent water to which known quantities of the method analytes and isotope dilution analogues are added. The results of the MBLK verify method performance in the absence of sample matrix.

3.11 MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) – Aliquots of field samples that have been fortified with a known concentration of target compounds, prior to sample preparation and extraction, and analyzed to measure the effect of matrix interferences. The use of MS/MSD samples is generally not required in isotope dilution methods because the labeled compounds added to every sample provide more performance data than spiking a single sample in each preparation batch.

3.12 LIMIT OF QUANTITATION (LOQ) – The smallest concentration that produces a quantitative result with known and recorded precision and bias. The LOQ shall be set at or above the concentration of the lowest initial calibration standard (the lowest calibration standard must fall within the linear range). Determined by matrix through the entire preparation and analysis process.

3.13 METHOD DETECTION LIMIT (MDL) – The minimum measured concentration of a substance that can be reported with 99% confidence that the measured analyte concentration is distinguishable from method blank results (40 CFR 136, Appendix B).

3.14 MINIMUM LEVEL OF QUANTITATION (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. The ML represents the lowest concentration at which an analyte can be measured with a known level of confidence. It may be equivalent to the concentration of
the lowest calibration standard, assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed. Alternatively, the ML may be established by multiplying the MDL (pooled or unpooled, as appropriate) by 3.18 and rounding the result to the number nearest to 1, 2, or 5 x 10n, where n is zero or an integer (see 68 FR 11770).

3.15 PRECURSOR ION – For the purpose of this method, the precursor ion is the deprotonated molecule ([M-H]-) of the method analyte (with the exception of HFPO-DA, in which the precursor ion is formed by decarboxylation). In MS/MS, the precursor ion is mass selected and fragmented by collisionally activated dissociation to produce distinctive product ions of smaller m/z.

3.16 PRIMARY DILUTION STANDARD (PDS) SOLUTION – A solution containing the analytes prepared in the laboratory from stock standard solutions and diluted as needed to prepare calibration solutions and other needed analyte solutions.

3.17 PRODUCT ION – For the purpose of this method, a product ion is one of the fragment ions produced in MS/MS by collisionally activated dissociation of the precursor ion.

3.18 INITIAL CALIBRATION VERIFICATION (ICV) – A calibration standard prepared independently from the primary calibration solutions. For this method, the ICV is a repeat of the entire dilution scheme starting with the same stock materials (neat compounds or purchased stock solutions) used to prepare the primary calibration solutions. Independent sources and separate lots of the starting materials are not required, provided the laboratory has obtained the purest form of the starting materials commercially available. The purpose of the ICV is to verify the integrity of the primary calibration standards.

3.19 QUANTITATIVE STANDARD - A quantitative standard of assayed concentration and purity traceable to a Certificate of Analysis.

3.20 STOCK STANDARD SOLUTION - A concentrated solution containing one or more method analytes prepared in the laboratory using assayed reference materials or purchased from a reputable commercial source with a Certificate of Analysis.

3.21 TECHNICAL GRADE STANDARD – As defined for this method, a technicalgrade standard includes a mixture of the branched and linear isomers of a method analyte. For the purposes of this method, technical-grade standards are used to identify retention times of branched and linear isomers of method analytes.

3.22 ANALYTE – A PFAS compound included in this method. The analytes are listed in Table 1.

3.23 CALIBRATION STANDARD (CS) – A solution prepared from a secondary standard and/or stock solutions and used to calibrate the response of the LC-MS/MS instrument.

3.24 CONTINUING CALIBRATION VERIFICATION (CCV) STANDARD – The mid-point calibration standard that is used to verify calibration.

3.25 CFR – Code of Federal Regulations

3.26 EXTRACTED INTERNAL STANDARD (EIS) QUANTIFICATION – The response of the target compound is compared to the response of the labeled analog of another compound in the same LOC.

3.27 INSTRUMENT SENSITIVITY CHECK – solution used to check the sensitivity of the instrument. The solution contains the native compounds at the concentration of the LOQ.

3.28 IPR – INITIAL PRECISION AND RECOVERY; four aliquots of a reference matrix spiked with the analytes of interest and labeled compounds and analyzed to establish the ability of the laboratory to generate acceptable precision and recovery. An IPR is performed prior to the first time this method is used and any time the method or instrumentation is modified

3.29 OPR - ONGOING PRECISION AND RECOVERY- – Ongoing precision and recovery standard (OPR); a method blank spiked with known quantities of analytes. The OPR is analyzed exactly like a sample. Its purpose is to assure that the results produced by the laboratory remain within the limits specified in this method for precision and recovery. Applies to OPR and LLOPR (low level OPR at **2x** the LOQ level).

3.30 SPE – SOLID PHASE EXTRACTION; a technique in which an analyte is extracted from an aqueous solution or a solid extract by passage over or through a material capable of reversibly adsorbing the analyte. Also termed liquid-solid extraction.

## 4. INTERFERENCES

LC-MS/MS data from blanks, samples, and spikes must be evaluated for interferences. If any interferences are present, take corrective action if necessary. Do not use aluminum foil because PFAAs can be potentially transferred from the aluminum foil to the glassware. Only aluminum foil rinsed with LC/MS grade methanol can be used where necessary.

4.1 PFAS have been used in a wide variety of manufacturing processes, and laboratory supplies should be considered potentially contaminated until they have been tested and shown to be otherwise. The materials and supplies used during the method validation process have been tested and shown to be clean. These items are listed in the Reagents section. 4.2 Method interferences may be caused by contaminants in solvents, reagents (including DI water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. All items such as these must be routinely demonstrated to be free from interferences (less than 1/2 the Reporting Limit), under the conditions of the analysis by analyzing Method Blanks. Subtracting blank values from sample results is not permitted.

4.3 PTFE products can be a source of PFAS (PFOA) contamination. The use of PTFE in the procedure should be avoided. Polypropylene (PP) or polyethylene (PE, HDPE) products may be used in place of PTFE products to minimize PFOA contamination.

- 4.3.1 Standards and samples are injected from polypropylene autosampler vials with polypropylene or polyolefin snap caps, once. Multiple injections may be performed on Primers when conditioning the instrument for analysis.
- 4.3.2 Random evaporation losses have been observed with the polypropylene caps causing high Internal Std. recovery after the vial was punctured and sample re-injected. For this reason, it is best to inject standards and samples once in the analytical sequence, then recap with polyolefin caps for storage.
- 4.3.2 Teflon-lined screw caps have detected PFAS at low concentrations. Repeated injection from the same teflon-lined screw cap have detected PFNA at increasing concentration as each repeated injection was performed, therefore, it is best to use polypropylene snap caps.
- 4.3.3 Aqueous samples should not come in contact with any glass containers or pipettes as PFAS analytes can potentially adsorb to glass surfaces. Standards dissolved in organic solvent may be purchased in glass ampoules. These standards in organic solvent are acceptable and subsequent transfers may be performed using glass syringes and pipets. Following extraction, the eluate must be collected in a polypropylene tube prior to concentration to dryness. Concentration to dryness in glass tubes may cause poor recovery.
- 4.4 LC/MS grade methanol must be used for all steps where methanol is used in this method. HPLC grade methanol has been demonstrated to be acceptable if tested prior to use.

4.5 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the sample.

- 4.5.1 Co-extracted Organic Material Under normal LC conditions matrix effects due to co-extracted organic material enhanced the ionization of 4:2 FTS appreciably. Total organic carbon (TOC) is a good indicator of humic content of the sample.
- 4.5.2 Solid phase extraction cartridges may be a source of interferences. The analysis of field and laboratory reagent blanks can provide important information regarding the presence or absence of such interferences. SPE cartridges should be sealed while in storage to prevent ambient contamination of the SPE sorbent.

4.6 Contamination by carryover can occur whenever a high-concentration and low concentration samples are sequentially analyzed. To reduce carryover, the sample syringe in automatically rinsed with solvent between injections. These operations are programmed into the LC multi-sampler system.

4.7 Volumetric glassware and syringes are difficult to clean after being used for solutions containing high levels of PFOA. These items should be labeled for use only with similarly concentrated solutions or verified clean prior to reuse. To the extent possible, disposable labware is used.

4.8 Both branched and linear PFAS isomers can potentially be found in the environment. Linear and branched isomers are known to exist for PFOS, PFOA, PFHxS, and PFBS, based upon the scientific literature. We have also seen branched isomers for PFHpA, NMeFOSAA, NEtFOSAA and PFNA. If multiple isomers are present for one of these PFAS they likely are adjacent peaks that completely resolve or not, but usually with a deflection point resolved during peak integration. The later of these peaks matches the retention time of its labeled linear analog. In general, earlier peaks are the branched isomers and are not the result of peak splitting.

Currently, all these species are available as linear isomers. Some available branched and linear reference standards of the technical mixtures for these specific PFAS are used to ensure that all appropriate peaks are included during peak integration. These species currently include PFOA, PFHxS, NMeFOSAA, and NEtFOSAA. These branched isomers elute before the linear isomer and are integrated and reported as total for those species. Others are also included at this time such as those listed in section 7.3.4.

4.9 In an attempt to reduce PFOS bias, it is required that m/z 499>80 transition be used as the quantitation transition.

### 5. SAMPLE HANDLING

- 5.1 Aqueous Samples samples are collected by our clients in 250 or 500ml HDPE bottles with unlined HDPE or polypropylene caps and filled to the neck. Each sample submitted should be submitted in triplicate-with one used for determination of Suspended solids and possible pre-screening. Sub-sampling should be avoided whenever possible. When historical data are available indicating high levels of PFAS, sub-sampling may be an advisable option.
- 5.2 **Soil Samples** samples are collected in wide mouth 125 or 250 mL HDPE bottles with PP unlined caps.
- 5.3 SAMPLE SHIPMENT AND STORAGE/HOLDING TIMES Maintain all aqueous samples protected from light at 0 - 6 °C from the time of collection until shipped to the laboratory. Samples must be shipped as soon as practical with sufficient ice to maintain the sample temperature below 6 °C during transport. Sample are to be received by the laboratory within 48 hours of collection. The laboratory must confirm that the sample temperature is 0 - 6 °C upon receipt. Once received by the laboratory, the samples may be stored at  $\leq$  -20 °C, or at 0 - 6 °C, until sample preparation. However, the allowable holding time for samples depends on the storage temperature, as described below:
  - **5.3.1 Aqueous samples** may be held in the laboratory for up to 90 days from collection, when stored at  $\leq$  -20 °C and protected from the light. When stored at 0 6 °C and protected from the light, aqueous samples may be held for up to **28 days**, with the caveat that issues were observed with certain perfluorooctane sulfonamide ethanols and perfluorooctane sulfonamidoacetic acids after **7 days**. These issues are more likely to elevate the observed concentrations of other PFAS compounds via the transformation of these precursors if they are present in the sample.
  - **5.3.2** Solid samples (soils and sediments) may be held for up to 90 days, if stored in the dark at either 0 6 °C or  $\leq$  -20 °C, with the caveat that samples may need to be extracted as soon as possible if NFDHA is an important analyte.
- 5.4 SAMPLE EXTRACT HOLDING TIMES Store sample extracts in the dark at less than 0 4 °C until analyzed. If stored in the dark at less than 0 4 °C, sample extracts may be stored for up to 90 days, with the caveat that issues were observed for some ether sulfonates after 28 days. These issues may elevate the observed concentrations of the ether sulfonates in the extract over time. Samples may need to be extracted as soon as possible if NFDHA is an important analyte.

### 6. **APPARATUS AND MATERIALS** (as listed or demonstrated equivalents)

- 6.1 250-500 mL polypropylene bottles with polypropylene caps. VWR Scientific or equivalent: Part no. 414004-125, 12 pk. Alternate: White PP unlined lid L238WH and 16oz. clarified PP single wall jar 70-400 neck, item J066-Containers and Packaging.com or equivalent.
- 6.2 Transport Tube: Virgin Polypropylene, White, Plastic, 10 mL Capacity, 16 mm OD, 93 mm Overall Lg, Self-Standing, 250 PK, Item 710Z420, Gamut.com (Grainger), with PP cap or equivalent.
- 6.3 Graduated cylinders, 50, 100, 250, 500 and 1000mL, Polypropylene, VWR Scientific or equivalent
- 6.4 Analytical Balance, 0.0001g., checked for accuracy each day of use with Class S weights, certified annually by an outside service
- 6.5 Extract concentrators: Organomation Model N-EVAP 112, 24 position concentrator with water batch control and nitrogen supply controls or equivalent
- 6.6 3.1 Micron in-line filters, Promochrom only
- 6.7 1.0-2.0 mL polypropylene snap cap vials, Agilent part no. 5182-0567 or equivalent
- 6.8 Snap caps, polypropylene or olefin, 11 mm, 11/9k, Agilent Part no. 5182-0542
- 6.9 Solid Phase Extraction Tubes: for EPA 1633: WAX (weak anion exchange mixed mode polymeric sorbent Phenomenex No. 8B-S038-HCH 200 mg or Waters Oasis 150 mg Cat. # 186002493. Must have a pKa > 8 to remain positively charged during the extraction. Alternate is Agilent Bond Elute WAX 200 mg-cat. No. 5610-2151
- 6.10 Syringes, Hamilton or equivalent 5.0 uL, 10 uL 25 uL, 100 uL, 250 uL, 500 uL, teflon free
- 6.11 Solid Phase Extraction System-automated-Promochrom 8 position autosampler system for 6 mL capacity SPE tubes. System retrofit to remove all PTFE components and replaced with PEEK tubing or PFAS free tubing. Automated bottle rinsing feature required with 3.1 um in line PP filters
- 6.12 Nitrogen Evaporation System- TurboVap nitrogen evaporation system operated at less than 55C.

- 6.13 LC/MS-MS system- Agilent 1260 or 1290 HPLC system interfaced to an Agilent 6470A or 6460C Triple Quadrupole system. The instrument control and qualitative/quantitative software is Mass Hunter versions B.8.0 and B.9.0 or later.
  - 6.13.1 HPLC System-Agilent 1260 or 1290 Infinity II

6.13.1.1 The Agilent 1260 or 1290 Infinity II HPLC system is configured with temperature controlled column oven compartment. 4 column configuration, temperature controlled (refrigerated) auto sampler compartments, injection valve, proportioning valves, variable flow controls and variable injection capabilities.

- 6.13.1.2 The delay column (PFAS and other interference removal) is an Agilent Eclipse Plus C18, 4.6mm x 50 mm, 3.5 um-Part no. 959943-902 or equivalent.
- 6.13.1.3 The analytical column is a Restek Raptor C18 part no. 9304252 50mm x 2.1 mm ID, 1.8 u particle size or equivalent

6.13.2 Agilent LC/MS-MS- Agilent 6470AAR/6460C

6.14.2.1 Agilent model 6470AAR/6460C triple Quadrupole system with Agilent Jet Stream ESI source. UHP nitrogen is used as cell gas and High purity nitrogen is delivered for the sheath gas from a Peak Scientific nitrogen generator system.

- 6.14 Vortex Mixer- Benchmark Industries or equivalent
- 6.15 Variable Speed shaker table, 18" x 12"- Orbital Shaker- Jiangau Tenlin Instr. Co., Ltd., Model no. TLSK-III 20-230 RPM, 0-999 min, or equivalent
- 6.16 Centrifuge, 50 mL, Premiere Model XC-2450 Series Centrifuge 6 x 50 mL, 3500 RPM max., or equivalent
- 6.17 Mechanical Pipettors- 10-100 uL; 100-1000 uL; 1000-5000 uL-4 E'S Scientific or equivalent, calibrated quarterly.
- 6.18 Vortex Mixer- Benchmark Industries or equivalent
- 6.19 pH paper, short range 6-8 and full range with 0.5 pH readability- VWR Scientific or equivalent
- 6.20 15 mL PP or HDPE Centrifuge tubes, Corning Part no. 430791
- 6.21 3 mL Disposable Transfer pipets, PE, VWR part no. 16001-176
- 6.22 1.0 mL polypropylene snap cap vials, Agilent part no. 5182-0567
- 6.23 Snap caps, polypropylene, 11 mm, 11/9k, Agilent Part no. 5182-0542
- 6.24 2mL self standing PP microcentrifuge snap cap tubes, SKS Scientific part no. 0747-17

- 6.25 Collection tubes, 15 mL graduated PP or HDPE Centrifuge tubes, Corning Part no. 430791
- 6.26 Disposable 10 mg scoops, PP
- 6.27 Ultrasonic mixer
- 6.28 10 mL disposable syringes, PP or HDPE, luer fitting
- 6.29 13mm or 25 mm 0.2 um Nylon membrane filters, PALL Acrodisc or equivalent

## 7. **REAGENTS AND STANDARDS-as listed or equivalents**

7.1 ALL REAGENTS and STANDARDS MUST BE LOGGED INTO THE ELEMENT LIMS SYSTEM. This includes lot numbers, expiration, open and prepared dates, receipt date, Certification/traceability documents from supplier(s) if provided and preparer.

- 7.2 SOLVENTS and REAGENTS-all as listed or equivalents
  - 7.2.1 Methanol, hypergrade for LC/MS. (Merck) from Sigma Aldrich Part no. 1060354000 or equivalent (HPLC Plus grade is an acceptable alternate)
  - 7.2.2 Water, hypergrade for LC/MS. (Merck) from Sigma Aldrich Part no. 1153334000 or equivalent (HPLC plus grade is an acceptable alternate). Alternatively, York PFAS free water demonstrated ion and PFAS free can be used.
  - 7.2.3 Acetic Acid, glacial. ACS grade or equivalent.
  - 7.2.4 Ammonium Hydroxide, conc. Cert. ACS grade, 28-30% in water, Sigma Aldrich part no.1054231000, or equivalent
  - 7.2.5 Methanolic Potassium Hydroxide (0.05 M) add 3.3 g of KOH to 1L MeOH
  - 7.2.6 Sodium Hydroxide, pellets, ACS grade- Sigma Aldrich part no. 221465-500G, or equivalent
  - 7.2.7 Potassium Hydroxide, pellets, ACS grade
  - 7.2.8 Ammonium Acetate ACS grade or better, Ammonium Acetate, HPLC or cert. ACS grade. Sigma Aldrich Part no. 73594-100-G-F or equivalent.
  - 7.2.9 Ammonium Acetate 5 mM for HPLC in aqueous solution: HPLC gradient A--Weigh 0.3854 g (+ 0.0005) Ammonium Acetate and add to 1 liter hypergrade Water. Mix until dissolved then sonicate for 5 mins. To remove air bubbles. Stability 2 weeks.

- 7.2.10 Methanolic Ammonium Hydroxide 0.3 % take 2.5 mL of conc. ammonium hydroxide into 247 mL MeOH (measure the 247 mL in a PP graduated cylinder-they are under QQ1 somewhere). Use a mechanical pipet to add the 2.5 mL (not strictly quantitative FYI)-<u>Make 4 bottles of</u> <u>this</u>. <u>Used for soil extractions</u>.- 1 month life
- 7.2.11 Methanolic Ammonium Hydroxide 1.0 % take 8.25 mL of conc. ammonium hydroxide into 242 mL MeOH (measure the 242 mL in a PP graduated cylinder-they are under QQ1 somewhere). Use a mechanical pipet to add the 8.25 mL (not strictly quantitative FYI)-<u>Make 4 bottles</u> <u>of this -used in Promochrom-1</u> month life.
- 7.2.12 Aqueous Ammonium Hydroxide 3%- take 24.8 mL of ammonium hydroxide and add to 242 mL PFAS free water. 3 month life- *used for pH adjustment*
- 7.2.13 Methanol with 4% water, 1% ammonium hydroxide and 0.625% acetic acid add ammonium hydroxide (3.3 mL, 30%), reagent water (1.7 mL) and acetic acid (0.625 mL) to methanol (92 mL), store at room temperature, replace after 1 month. This solution is used to prepare the instrument blank, calibration stds and is used to dilute the extracts of samples that exceed the calibration range.
- 7.2.14 **Formic Acid 0.1M-aqueous** add 873 uL formic acid into 250 mL PFAS free water- Make 2 bottles of this-used to prepare 7 below. 2 year life
- 7.2.15 **Formic Acid, 0.3M**-aqueous- add 2.62 mL (2619 uL) into 250 mL PFAS free water-<u>Make 4 bottles of this -used in Promochrom-</u>2 year life
- 7.2.16 Formic Acid methanolic 1:1, 0.1M formic acid- mix equal volumes of Methanol and 0.1 M formic acid- <u>Make 4 bottles of this -used in</u> <u>Promochrom-2</u> year life
- 7.2.17 **Formic Acid 5% aqueous** add 12.5 mL Formic acid into 250 mL PFAS free water. *Used for pH adjustment.* 2 year life

## 7.3 Stock Standards

Stock Standards are purchased in mid to high concentration levels from Wellington Laboratories, Inc. Guelph, ONT, CA. Currently, Wellington is the preferred supplier of these materials. As a second source verification, prepare a mid-level from the stock independently from the preparation used for initial calibration. Document this preparation in Element. See Attachments 1,2, and 3 for detailed information.

7.3.1 Internal Standards (7-Non-Extracted –NIS)) used for the method are MPFOA, MPFOS, M3PFBA, MPFDA, MPFHxA, MPFHxS and MPFNA.

These are purchased at 250 - 1000 ng/mL depending upon the ISTD in a mixture. This mixture is purchased from Wellington Labs in 1.2 mL volumes with the following **part no.: MPFAC-HIF-IS**. Stored at 4C or less unopened this solution has a 5 year life. Once opened, the life is one year from open date.

- 7.3.2 Isotopic Surrogate Analogs (24 isotopes) are purchased for the method described from Wellington Labs at 250-5000 ng/mL levels, depending upon the isotope. The part no. is **MPFAC-HIF-ES**.
- 7.3.3 Stock Standard mixtures of both linear and branched isomers of the EPA 1633 40 list are purchased from Wellington Labs at varying concentrations in 5 different mixtures under part nos. PFAC-MXJ, PFAS-MXI, PFAC-MXH, PFAC-MXG, PFAC-MXF.
- 7.3.4 <u>Qualitative branched isomers mix</u>- individual available branched and linear mixes for the following PFAS are used daily to allow for qualitative knowledge of the PFAS branched isomers so they are integrated/included in quantitative analysis: T-PFOA, lp-PFNA, br-FOSA, br-NEtFOSA, br-NMeFOSA, br-NEtFOSE and br-NMeFOSE. These are purchased at 50,000 ng/mL levels from Wellington Labs-the names above are the Catalogue nos. These have a five year life at stock concentrations.

Make a 100 ng/mL Intermediate mix by adding 2.0 uL of the individual stocks up to 1.0 mL with MeOH.

Make a working solution by taking 200 uL of the 100 ng/mL intermediate into 750 uL of cal matrix solution (7.2.13) and add 50 uL of 1:10 EIS mix.

Transfer 300 uL to an autosampler vials, add 3 uL of ISTD working mix, cap, vortex and store until needed. Life is 1 year.

The summary below details the procurement requirements for this method - All from Wellington Laboratories, Inc.:

Description	Part nos.	Comes in
40 Compound Target 1633 list targets	PFAC-MXJ	4 Days – 1.2 mL
	PFAS-MXI	
	PFAC-MXH	
	PFAC-MXG	
	PFAC-MXF	
Isotopic Surrogates-24	MPFAC-HIF-ES	4 Days – 1.2 mL
EPA 1633 - 7 Internal Stds	MPFAC-HIF-IS	4 Days – 1.2 mL

## 7.4 Preparation of Standards

7.4.1 Preparation of Working Standards and Intermediates from STOCK Materials

All stock standards are prepared by the vendor in methanol containing a bit of sodium hydroxide to prevent losses of target PFAS compounds due to potential esterification in methanolic solution. The stocks come prepared with 4 molar equivalents (a 3x excess) of sodium hydroxide for stocks at the 50 ug/mL levels. This insures their stability with respect to potential loss due to esterification. The basic solution insures that any acidic sites on the glass ampules or acidic impurities in the methanol are neutralized to prevent ester formation and forms the sodium salt of the PFAS to stabilize it.

When preparing any intermediate level standards, the dilution must be prepared in alkaline methanol to prevent the above from occurring.

In order to do this, prepare a 5.0 mM NaOH in Hypergrade Methanol (or LC/MSMS grade) by dissolving 0.02 g. of sodium hydroxide into 100 mL of MeOH. <u>This has a 2</u> week life.

For intermediate standards that are made to 10 mL final volume, add 100 uL of 5.0 mM NaOH/MeOH as part of the preparation. This results in a final concentration of NaOH at 0.05 mM.

For intermediate standards prepared to a final volume of 1.0 mL. add 10 uL of the 5.0 mM NaOH/MeOH.

For working calibration standards/CCV/SCV made to 500 uL final volume, using the mixture detailed in section 7.1.13 (MeOH/Water/acetic acid/ammonium hydroxide). This approximates the matrix of the final extracts for analysis.

## 7.4.2 Storage and Handling of Standards

All <u>working standards</u> should be stored at either room temperature or 4C provided the containers are sealed properly.

<u>Stock Standards</u> may be stored at 4-10 deg. C but before using must sit to allow equilibration to room temperature followed by either vigorous vortex mixing or sonication for 3-5 mins.

## 7.4.3 Detailed Standards Preparation Procedure-EPA 1633

## 7.4.4 Internal Standards-See Attachment 1

Internal Standards are purchased as a **stock mixture** at 250-1000 ng/mL

These as transferred to a snap cap vial that has been pre-rinsed with 5 mM NaOH/MeOH then allowed to dry.

7.4.4.1 <u>Working level of Non-Extracted Internal Standard (NIS)</u> –make a 1:1 dilution of the stock by taking 500 uL of the Stock and adding 500 uL MeOH.

Use as is by adding 3 uL to 300 uL volumes for QC, samples or calibration.

## 7.4.5 Isotopic Surrogates (Extracted Internal Standards)- See Attachment 2

7.4.5.1 Stock Surrogates are purchased as a mixture at 250-5000 ng/mL. These are transferred to a snap cap vial that has been pre-rinsed with 5 mM NaOH/MeOH then allowed to dry.

Option 1- Use Stock as received and add 25 uL to all samples/QC to be extracted

Option 2- Prepare **2** mL of Working EIS by preparing a 1:2 dilution to yield 125-2500 ng/mL for use as follows:

Take 1000 uL of the Surrogate Stock, plus 25 uL of 5 mM NaOH/MeOH and 975 uL MeOH to give 2.0 mL final volume. **50 uL are added to ALL preparation blanks, samples and QC**. This is sufficient for approx. 40 x 50 uL additions to all blanks, QC and samples.

This corresponds to adding 5 to 100 ng of EIS compounds to the initial samples and QC. The final volume of extractions will typically be 5.0 ml so this yields 1-20 ng/mL of the isotope EISs in the final extract for analysis.

For calibration, the Stock mix at 250-5000 ng/mL is used by adding 100 uL up to 1.0 mL final volume to yield 25/500 ng/mL in each calibration level as directed in the calibration section 7.4.7.1.

## 7.4.6 Target Analytes- EPA 1633- See Attachment 3

The target analytes for this method are purchased commercially from Wellington Labs under the 5 part nos. described in Section 7.3.3 which contains the method target analytes only at varying concentrations. These mixtures are transferred from their glass ampules to snap cap vials that have been pre-rinsed with 5 mM NaOH/MeOH then allowed to dry. Again these are the nominal concentrations and the actual anion concentrations for those present as salts are listed in the documentation and are reflected in both Mass Hunter and Element.

Preparation of a 1.0 mL volume of a 10 x intermediate of each of the 5 mixes for Calibration. Some of the higher levels on the curve use aliquots of the stock as shown in Figure 2.

Scale the volume accordingly if less is desired. Note that the EPA 1633 mixes come 1.2 mL per vial so this recipe may consume one vial quickly.

**7.4.6.1 OPR and LLOPR** - these are a mid-level blank spike and low level blank spike (at 2x the LOQ). These are prepared as follows from the EPA 1633 Target mixtures (5 components) by taking 200 uL of each STOCK into a snap cap vial giving 1.0 mL final volume.

- 1. Element ID Y22B199- PFAC-MXF mix 200 uL
- 2. Element ID Y22B200- PFAC-MXG mix 200 uL
- 3. Element ID Y22B201- PFAC-MXH mix 200 uL
- 4. Element ID Y22B204- PFAC-MXI mix 200 uL
- 5. Element ID Y22B205- PFAC-MXJ mix 200 uL

For OPR (BS) at mid-level add 100 uL to each matrix for the batch OPR and for the **LLOPR add 20 uL** of the spike mix and process through all steps of the specific matrix preparation.

## 7.4.7 <u>Calibration</u>

Calibration of the LC-MSMS systems is done by an eight level calibration covering the range 0.2 to 1650 ng/mL, nominal. Various PFAS species are present as salts and at differing concentrations and these are reflected in Mass Hunter and Element as their actual concentrations. Six to eight levels are prepared depending upon the analyte. These levels are prepared as directed below using the internal standards, surrogates and target analytes from above.

**This is made to a final volume of 1000 uL** in the matrix described in section 7.1.13 (MeOH/Water/acetic acid/ammonium hydroxide)

**This preparation excludes the ISTD in the initial preparation**. After preparation as directed, withdraw 300 uL of each level into a 500 uL PP vial and add 3 uL of ISTD before analysis, cap and vortex to mix.

These are stored at <10C and are stable for 6 months when prepared as directed.

7.4.7.1 Calibration Curve Preparation - Based upon a final volume of 1.0 mL in CAL Matrix Solution\*

See Attachment 4 for details.

#### EPA 1633 Calibration Standard Preparation Rev 1.,0 10/03/22

For Final volume of 1.0 mL

Recipe uses both a 1:10 intermediate for some levels AND the Stock for other points as indicated

All standards in Stds refrig. Adjacent to QQQ1 N2 generator in box labeled EPA 1633 standards- all are opened, labeled and good to use.

	Stock: Y22B201 1633 MXH Targets Intermediate @10x *	Stock: Y22B200 1633 MXG Targets Intermediate at 10x*	Stock: Y22B199 1633 MXF Targets Intermediate at 10x*	Stock: Y22B204 1633 MXI Targets Intermediate at 10x*	Stock: Y22B205 1633 MXJ Targets Intermediate at 10x*	Stock: Y22B198 1633 EIS isotope Mix Intermediate at 10x
Level	uL of MXH 10x Interm.	ul of MXG interm.	ul of MXF interm.	ul of MXI interm.	ul of MXJ interm.	uL of EIS Interm.
1	2	2	4	2	2.5	50
2	5	5	10	5	6.25	50
3	12.5	12.5	25	12.5	15.6	50
4	25	25	50	25	31.3	50
5	50	50	100	50	62.5	50
6	125	125	250	125	15.6 of Stock	50
7	25 of Stock	25 of Stock	50 of Stock	25 of Stock	31.2 of Stock	50
8	62.5 of STOCK	62.5 of STOCK	125 of STOCK	62.5 of STOCK	78.0 of Stock	50

\* 100 uL up to 1 mL in MeOH

\*CAL MATRIX: Methanol with 4% water, 1% ammonium hydroxide and 0.625% acetic acid – Prepared by adding ammonium hydroxide (3.3 mL, 30%), reagent water (1.7 mL) and acetic acid (0.625 mL) to methanol (92 mL), store at room temperature, replace after 1 month. This solution is used to prepare the instrument blank and is used to dilute the extracts of samples that exceed the calibration range.

Amount of CAL Matrix to make up to 1.0 mL Final volumes:

CAL LEVEL	uL of CAL Matrix
1	937.5
2	918.8
3	871.9
4 *	793.7
5	637.5
6	309.0
7	843.8
8	609.5

INTERNAL STANDARD MIX (non-extracted IS-NIS). Mix 500 uL of STOCK ISTD at 250-1000 ng/mL with 500 uL of Methanol. This results in 125-500 ng/mL Intermediate ISTD. See 7.4.4.1.

Add 3.0 uL to 300 uL of each level 1-8 in a 500 uL PP autosampler vials and cap with polyolefin cap, vortex to mix and run. Add 3 uL to 300 uL of all sample/QC extracts before analysis.

\*Level 4 is also used as the CCV for each analysis sequence run initially, then after every 10 samples and at the end of the sequence. Multiple vials should be prepared for this level.

### 7.4.8 <u>Checking the Efficacy of the Surrogate/Spike Mixes</u>

On a monthly basis the surrogate (EIS) and spike mixes from the vials used for spiking are assayed to ensure stability. These are prepared for the analysis by taking 3.0 uL of the surrogate (EIS) mix and 3 uL of the Spike mix into 294 uL MeOH/Water/Acetic Acid/Ammonium hydroxide from 7.1.13, then add 3 uL of NIS (ISTD). This yields a 1:100 dilution of the EIS and Spike mixes. Use 100 as the dilution factor in the Mass Hunter worklist.

## 7.4.9 Second Source - Initial Calibration Verification (ICV)

Currently, the EPA method 1633 does not require a second source ICV. Rather, the initial calibration is verified by preparing a Level 5 -5.0 ng/mL (nominal) calibration standard independently from calibration standard preparation. This serves as the ICV.

### 8. **PROCEDURE**

### 8.1 **Preventative and Routine Maintenance**

HPLC/MS/MS Preventative Maintenance			
As Needed:	Daily (When in use)		
Change pump seals.	Check solvent reservoirs for sufficient level of		
Change in-line filters in autosampler	solvent.		
(HPLC).	Verify that pump is primed, operating pulse		
Check/replace in-line frit if excessive	free. (rippie < 1%)		
pressure or poor performance.	Check heedle wash reservoir for sufficient		
Replace column if no change following in-	Verify capillary beater temperature functioning		
Clean needle	Verify vaporizer beater temperature		
Replace or clean Capillary	Verify rough pump oil levels		
Replace fused silica tube in ESI interface.	Verify turbo-pump functioning.		
Clean lenses.	Verify nitrogen pressure for auxiliary and		
Clean skimmer.	sheath gasses.		
Ballast rough pump 30 minutes.	Possible Checktune		
Check Nozzle flow pattern			
Semi-Annually	Annually		
Replace oil mist and odor elements.	Vacuum system components including fans		
Replace activated alumina filter if applicable	and fan covers.		
	Clean/replace fan filters, if applicable.		

## 8.2 Sample Preparation (Extraction, Clean-up and Concentration)-Aqueous Matrices

A summary of the steps for the steps related to aqueous samples are shown in Figure 1.0 and in the summary below.

- Determine % Suspended Solids 10.0 mLs ± 0.02 mL through a tared 0.2 um PP filter. Dry filter ≥ 12 hours @ 105C, cool in dessicator. Calc % TSS
- 2. Check pH with short range pH paper to insure  $pH = 6.5 \pm 0.5$ . Adjust if necessary with either 5% aqueous formic acid to lower pH or with 3% aqueous ammonium hydroxide to raise pH.
- 3. Weigh sample bottle as is to  $\pm 0.1$  g.-remove cap first since that will not be weighed later since autosampler caps are used
- 4. Homogenize sample by inversion 3-4 x-place full volume on Promochrom System using WAX SPE cartridges.

- 5. Set up MBLK, OPR at 2x LOQ (low LCS) and mid-level OPR (mid-level LCS)spike with 10 uL of Spike mix for LLOPR and 100 uL of spike mix for mid-OPR.
- 6. Spike all with 25 uL EIS solution (isotopic surrogates)
- 7. Follow Promochrom method for EPA 1633
- 8. Initiate SPE program EPA1633AQ on the Promochrom system
- 9. Once the program is finished there will be 5 ml in the collection tube. If less, make up to exactly 5.0 mL with MeOH.
- 10. Remove the sample bottle from the Promochrom system and weigh the empty bottle. That will determine the weight (volume for water) assume 1g. = 1.0 mL. Enter this value into the element bench sheet and the initial volume.
- 11. Add 25 uL of concentrated acetic acid to each collection tube and vortex to mix.
- 12. Add 10 mg of activated carbon to all samples and QC. Hand mix and vortex mix for no more than 2 minutes
- 13. Centrifuge at 2800 rpm for approx. 10 minutes.
- 14. Filter the final volume through 0.2 um nylon filter using a syringe.
- 15. If the client provides only 250 mL of sample, in order to meet reporting limits, it may be required to concentrate the unfiltered extract by a factor of at least 2 on a TurboVap at 1.2 Liters/min with nitrogen at <55°C.. For example if final volume is 5.0 mL, concentrate to 2.0 mL final volume (2.5 x concentration). If 500 ml provided, skip this step.</p>
- 16. Enter the final volume achieved into the bench sheet in Element.
- 17. Transfer a portion of the final extract to a 2 mL snap cap, labeled.
- 18. Take a 300 uL portion of the extract into a 500 uL PP autosampler vial, add 3 uL of NIS (non-extracted internal std.). Cap, vortex, store at  $<6^{\circ}$ C.
- 19. Sample is ready for analysis.



## Figure 1.0 Aqueous Sample Preparation Steps

- 8.2.1 To measure sample initial volume for aqueous samples, remove the cap and weight the bottle and record the weight in the sample weight. For MBLK, LLOPR and OPR use 250-500 mL volumes). After SPE processing, be sure the empty bottle is dry and weight to determine the amount of sample in grams (essentially equal to volume in mL). Use that number for the initial volume in Element LIMS.
- 8.2.2 For every 20 field samples (Field blanks are considered field samples in as they are treated as such), a blank (MBLK), blank spikes, (2 levels-LLOPR and OPR as BS1 and BS2 respectively. A matrix spike is not necessary since isotope dilution is used. If an MS/MSD is required by a specific project, spike 100 uL of the mid-level BS mix (OPR).
- 8.2.3 All polypropylene equipment including graduated cylinders and sample transfer lines/reservoirs should be washed prior to using with extraction solvent (Methanol).

8.2.4 Add 25 uL of EIS (isotopic surrogates) (250/5000 ng/mL) to each sample and QC sample, recap and invert to mix well.

8.2.5 Add, 5ul (low level spike), 50 uL (mid-level spike)

8.2.6 Using the Promochrom automated system, run a cleaning run. Be sure the reservoirs of LC/MS grade methanol and HPLC plus grade water or equivalent are full. Prime all lines and align all components.

8.2.7. Load in the EPA1633 method and adjust the sample volume to 10 ml more than the highest volume container measured by visual comparison to a calibrated bottle of the same size.

8.2.8 The SPE method solvents for extractions are as follows:

- Solvent 1 = MeOH
- Solvent  $2 = H_2O$
- Solvent 3 = 0.3 M Formic acid,
- Solvent 4 = 1:1 0.1M Formic Acid/MeOH,
- Solvent 5 = MeOH with 1% ammonium hydroxide ("Basic MeOH")
   W1 = Aqueous waste, W2 = Organic waste
- 8.2.9 Place labeled 15 mL graduated collection vessels in the sample collection tray and use Element labels to identify the vials at this point. Print 2 sets of labels for each since they will be used after the concentration step as well. These are graduated.
- 8.2.10 Connect the bottles to the automated system.
- 8.2.12 Initiate the EPA1633Aq SPE Extraction Program. Each run is approximately 1 hour 45 minutes.
- 8.2.13 Evaporation Options-Aqueous Samples

### **N-EVAP** systems

8.2.13.1 The resulting 5 mL extracts are not further concentrated unless Work Plan reporting limits need to be lower than standard RLs. When this is required by the Work Plan, the extracts and QC are transferred to the N-EVAP concentrator systems operated at 50-55 degrees C (never more than 55C) in their original collection vials. The nitrogen flow is initiated at 1.2 ml/min and adjusted on each individual sample to provide a gentle stream causing a slight disturbance at the surface of the methanol extracts.

8.2.13.2 As this evaporation proceeds the walls of each vessel are rinsed with methanol when the volume is approximately 2.5 mls and then again when the volume is reduced to just below 2.0 mL. Then Bring up the final volume to 2.5 mL. This is a 2x concentration when needed.

8.2.14 Swirl final extract, make up to 2.0 mL with methanol. Using a disposable polypropylene pipet, carefully transfer to a 2 mL PP snap cap vial.

 $8.2.15\,$  Withdraw an aliquot of 300 uL into a 500 uL autosampler vial (PP) and add 3.0 uL of ISTD (NIS) mix. .

8.2.16 Cap with polyolefin flexible caps and vortex to mix.

8.2.17 Store Extracts at <6°C until analysis.

## 8.3 Sample Preparation (Extraction, Clean-up and Concentration)-Soil Matrices

- 1. Determine % solids: use 5 grams; dry at  $110C \ge 12$  hours.
- 2. Mix sample with a stainless steel spatula to homogenize-exclude Sticks, vegetation, rocks and the like.
- 3. Remove 5.0 g. from the homogenized sample container. Add to a tared 50 mL centrifuge tube. Determine the weight  $\pm 0.01$  g.
- 4. Prepare QC using clean matrix (Ottawa Sand) wetted with 1 mL PFAS free water in 50 mL centrifuge tubes
- 5. For all samples, QC blanks and LCSs (LLOPR and ML OPR) and a 25 uL aliquot of EIS onto the soil. The current Element standard ID is Y22J305. For the OPRs add appropriate amount of spike solution (10 uL for LLOPR and 100 uL for OPR. The current Element Std ID is Y22J304.
- 6. Swirl the samples to mix then let sit for 30 minutes.
- 7. Add 10 mL of 0.3% methanolic ammonium hydroxide to each centrifuge tube.
- 8. Vortex to mix then shake on the shaker table for 30 minutes.
- 9. Next, centrifuge at 3500 rpm for 5 minutes or 2800 rpm for 10 minutes.
- 10. Transfer the supernatant liquid to a clean 50 mL centrifuge tube
- 11. Add 15 mL of 0.3% methanolic ammonium hydroxide to each of the original centrifuge tubes.
- 12. Vortex to mix then shake on the shaker table for 30 minutes
- 13. Next, centrifuge at 3500 rpm for 5 minutes or 2800 rpm for 10 minutes.
- 14. Transfer the supernatant liquid to the centrifuge tubes from 10.0 above
- 15. Add another 5 mL of 0.3% methanolic ammonium hydroxide to each of the original centrifuge tubes.
- 16. Vortex to mix then shake on shaker table for 30 minutes
- 17. Next, centrifuge at 3500 rpm for 5 minutes or 2800 rpm for 10 minutes.
- 18. Transfer the supernatant liquid to the centrifuge tubes from 10.0 above
- 19. Add 10 mg of activated carbon to the combined extract using a 10 mg scoop and hand swirl for 2 minutes (never more than 5 minutes of losses of Target PFAS will occur)
- 20. Centrifuge at 3500 rpm for 5 minutes or 2800 rpm for 10 minutes
- 21. Immediately Decant into a 50 mL centrifuge tube.
- 22. Place in Turbovap or on the N-EVAP system and concentrate at 55 deg. C to a final volume of approx..7 mL at a nitrogen flow of 1.2 ml/min.
- 23. Add 35-40 mL of PFAS free water to the tube and vortex to mix.
- 24. Check the pH=  $6.5 \pm 0.5$  if not adjust accordingly using 5% formic acid to lower pH or 3% aqueous ammonium hydroxide to raise pH rto within this range.

- 25. Set up the soil EPA 1633 method on the Promochrom be sure volume is set to 50 ml for sample size.
- 26. Place samples and QC centrifuge tubes on the autosampler
- 27. Once the program is finished, note the final volume and use that in the Element benchsheet as final volume. Should be 5.0 mL. If less make up to 5.0 mL with MeOH.
- 28. Add 25 uL of concentrated acetic acid to each collection tube and vortex to mix.
- 29. Add 10 mg of carbon to all samples and QC and mix for 2 minutes (no more than 5 minutes).
- 30. Immediately centrifuge at 2800 rpm for 10 minutes.
- 31. Filter the extract through a 0.2 um nylon membrane using a syringe and filter into a 2 mL snap cap vial.
- 32. When ready for analysis, remove 300 uL of extract and transfer to a 500 uL autosampler vial. Add 3 uL of NIS (internal standard), vortex to mix. Cap with polyolefin flexible caps and vortex to mix.
- 33. Store Extracts at <6°C until analysis
- 34. Samples/QC are now ready for analysis.

## 8.4 Sample Analysis--Running Samples/QC - Acquisition Method

The acquisition method is detailed in Attachment 4 (HPLC) and Attachment 5 (MS/MS) of this SOP. The method is a HPLC with dynamic MRM method with precursor and product ions with specific acquisition parameters to maximize sensitivity and specificity. This list may be modified to add other PFAS target analytes as necessary.

8.3.1 The triple Quadrupole (QQQ) system must be optimized for each target analyte (including surrogates and internal standards) using the Mass Hunter Optimizer program. This program determines the most abundant precursor and product ions for each compound and their abundances. These data are then used to build an MRM (multiple reaction monitor) method for acquisition. This is done initially or after any major maintenance procedures are performed to the triple quadrupole system. A high level standard is used for this in the [M-H]<sup>-</sup> mode or M-COOH for HFPO-DA.

8.3.2 The QQQ is checked for tuning on a weekly basis (if necessary) before analysis using the Tune context by selecting the CHECKTUNE radio button. This is done only in negative ion mode since that what we are operating under. If the Checktune fails, run the Autotune program-note: this takes approx. 45 mins. in negative mode. After autotune or any tuning adjustment, a re-calibration of the instrument is required.

8.3.3 Before any QC or samples can be run, the HPLC must be allowed to purge for at least thirty minutes. This purge must be done using the initial mobile phase conditions used in the method must be allowed to run for 15 minutes or until pressure has stabilized (ripple must be < 1%)

8.3.4 An instrument sequence (Worklist) is then made. It should begin with a blank, a primer (5 ng/mL) followed by a blank with ISTD to establish system cleanliness.

8.3.5 After a successful initial calibration has been completed, the analytical sequence for a batch of samples analyzed during the same time period is as follows. Standards and sample extracts must be brought to room temperature and vortexed prior to aliquoting into an instrument vial in order to ensure homogeneity of the extract.

## 8.3.6 Analysis Sequence

- 1. Instrument Blank \*
- 2. Instrument Sensitivity Check -LOQ Standard Level (SEQ-CAL 1) S/N > 3:1
- 3. Calibration Verification Standard (CCV)
- 4. Qualitative Identification Standards –Branched PFAS PFOA, PFNA, PFOSA, NMeFOSA, NEtFOSA, NEtFOSE, and NMeFOSE.
- 5. Instrument Blank (SEQ-CCB)\*
- 6. Method Blank (Batchxxxx-BLK1)
- 7. Low-level OPR (LLOPR) (Batchxxx-BS1)
- 8. OPR (Batchxxx-BS2)
- 9. Field Samples (10 or fewer)
- 10. Calibration Verification Standard (SEQ-CCVn)
- 11. Instrument Blank (SEQ-CCBn)\*
- 12. Field Samples (10 or fewer)
- 13. Calibration Verification Standard (SEQ-CCVn)
- 14. Instrument Blank (SEQ-CCBn)\*
- \* Contains solvent system for calibration, NIS and EIS
- 8.3.7 The run can end with a script to put the instrument into standby mode.

## 8.4 Daily Sample Preparation/Analysis Sequence

- Prepare extracts for analysis by placing a 300 ul aliquot of sample extract containing 3 uL of internal standards into a PP auto-sampler vial. Apply Polyolefin cap.
- Confirm that the samples loaded on the auto-sampler were entered correctly in the injection log. Make any necessary corrections.
- Run instrument CCV checks at the RL (0.25-0.5 ng/mL), then at a mid level and high level rotating every ten samples (5, 25 ng/mL) and ending with a mid level CCV.
- Enter the Worklist (<u>injection sequence</u>) into the instrument software and load samples onto the auto-sampler in the order shown above in Section 8.3.6

### 8.5 Data Review

The Agilent Mass Hunter Quantitation program is used to review all data. All identifications are based upon acceptable ion ratios for the abundance of both precursor and product ions along with retention time information. All positive detections of target PFAS must be less that the high point conc. of the Cal. Curve.

- 8.5.1 Since certain PFAS species are manufactured by different processes the presence of branched as well as linear isomers may be found. In order to properly quantitate these species, the analyst must sum the related branched and linear isomers. This affects the following species: PFOS, PFHxS, PFOA, PFNA, PFOSA, NMeFOSA, NEtFOSA, NEtFOSE, and NMeFOSE.
- 8.5.2 Any detection greater than the upper limit of the calibration curve requires dilution into the upper half of the curve, where possible.

## 9. CALIBRATION

## 9.1 Initial Calibration

The initial calibration covers the range 0.20 ng/mL to 1560 ng/mL nominal conc. or higher depending upon the linearity of the PFAS species. After acquisition, the data are quantitated in Mass Hunter and the default calibration model for target compounds is generated using Quadratic regression, FORCED through the origin where applicable. All same level species (EIS) used average response factor model. Depending upon the response and accuracy at each level as shown in the Mass Hunter program, use Linear, Forced, weighted (1/x) or quadratic, Forced, with or without weighting to achieve the best fit which is based upon the best accuracy on a compound by compound basis. In any case, the correlation coefficient must be greater than 0.990. Average response factor RSD should be  $\leq$  20% where used.

9.1.1 The calibration levels as shown in Section 7.6.3 use 8 levels. All points are included in the calibration with exception of some species that saturate at levels 7 and 8.

## 9.2 ICV/SCV

An independently prepared Initial Calibration Verification must be run immediately following initial calibration. The concentration of this standard should be in the middle of the calibration range (e.g. 5.0 ng/mL) and prepared from a separate preparation as that of the calibration. Unless project-specific data quality objectives are required, the values from the second-source check should be  $\pm$  30% of the expected concentration.

### 9.3 Continuing Calibration Verification

The first CCV is at a mid-level and run every 10 client samples including a closing CCV.

The mid-Level CCV must be  $\pm$  30% of the true value.

**Corrective Action**: If any of the required calibration check criteria fail, the system must be evaluated and any appropriate instrument repair or maintenance must be performed. Sample data are unacceptable and must be rerun. Reinjection the standard may be done. If the calibration check standard still fails, the system must be recalibrated.

## 10. Quality Control

10.1 Initial Demonstration of Capability (IDOC)

10.1.1 The initial demonstration requirement of EPA 1633 must be acceptable before analysis of samples may begin. To establish the ability to generate acceptable precision and recovery, the laboratory must perform the following operations for each sample matrix type to which the method will be applied by that laboratory.

The IDOC includes the following key elements:

- Initial Demonstration of Precision and Recovery (IPR)
- MDL determination

## 10.1.2 Initial Demonstration of Precision and Recovery-IPR

• Extract, concentrate, and analyze four aliquots of aqueous and soil matrices spiked with 100 uL of the native spike solution OPR Mix Y22J304, 50  $\mu$ L of the EIS solution no. Y22J305. At least one method blank, matching the matrix being analyzed, must be prepared with the IPR batches by matrix. All sample processing steps that are used for processing samples, including preparation and extractions, cleanup and concentration, must be included in this test.

- Using results of the set of four analyses, compute the average percent recovery (R) of the extracts and the relative standard deviation (RSD) of the concentration for each target and EIS compound.
- For each native and isotopically labeled compound, compare RSD and % recovery with the corresponding limits for initial precision and recovery in Table 5. If RSD and R for all compounds meet the acceptance criteria, system performance is acceptable, and analysis of blanks and samples may begin. *Note these acceptance criteria are not finalized and are based upon a single lab validation. Data for this table are derived from the single-laboratory validation study, and are only provided as examples for this draft method. The data will be updated to reflect the inter-laboratory study results in a subsequent revision. Therefore, these criteria will change after inter-laboratory validation. Several sections of this method state that Table 5 criteria are required, this is standard language that will be applicable when the method is finalized.*

## **10.1.3 MDL Determination**

<u>MDL Determination</u> –In order to perform the MDL study, 7 total extractions are performed on 3 different days (Extraction day 1=3 LRBs and 3 LFBs); Extraction day 2 is 2 of each, and Extraction day 3 is also 2 of each).

The levels extracted represent approx. 3-5 x the expected LOQ.

Once extracted, the analyses are conducted on 3 separate days (we use only QQQ2 for EPA 1633 so all runs are on that system). The MDL is determined according to the EPA MDL protocol defined in Definition and Procedure of the Determination of the Method Detection Limit, Revision 2 Dec. 2016 as detailed below:

Make all computations as specified in the analytical method and express the final results in the method-specified reporting units.

Calculate the sample standard deviation (SD) of the replicate spiked sample measurements and the sample standard deviation of the replicate method blank measurements from all instruments to which the MDL will be applied.

Compute the MDLs (the MDL based on spiked samples) as follows:

#### $MDL_s = 3.143 \times SD$ (for seven replicates; SD = Standard Deviation)

Compute the MDLb (MDL based on method blanks-LRBs) as follows:

- If none of the blanks give numerical results then the MDLb does not apply
- If only some of the blanks (but not all) give a result, set the MDLb to the highest result found

• If ALL method blanks show a detections then use the following calculation to determine MDLb:

### MDLb = Average of Blank Detections + (3.143 x Std. Dev.)

Calculate the final MDL by selecting the greater of MDLs or MDLb.

### 10.2 **On-going QC Requirements**

Preparation Batches are defined at the sample preparation step. Batches should be kept together through the whole analytical process as far as possible, but it is not mandatory to analyze prepared extracts on the same instrument or in the same sequence.

The quality control batch is a set of up to 20 samples of the same matrix processed using the same procedure and reagents within the same time period. The quality control batch may contain a matrix spike/matrix spike duplicate (MS/MSD), two laboratory control sample (LCS-LLOPR and OPR) and a method blank. Laboratory generated QC samples (Blank, LLOPR, OPR, MS/MSD) do not count toward the maximum 20 samples in a batch. Field QC samples are included in the batch count. In some cases, at client request, the MS/MSD may be replaced with a matrix spike and sample duplicate.

10.2.1 <u>METHOD BLANK</u> - One method blank must be extracted with every prep batch of similar matrix, not to exceed twenty (20) samples. For aqueous samples the matrix is Lab reagent water. For Soils the method blank matrix is Ottawa sand. Criteria:

- The method blank must not contain any analyte at or above 1/2 the LOQ (Reporting Limit).
- Re-extraction and reanalysis of samples associated with an unacceptable method blank is required when reportable concentrations are determined in the samples.

10.2.2 LABORATORY CONTROL SAMPLES (LCS- also called OPR and LLOPR) must be extracted with every process batch of similar matrix, not to exceed twenty (20) samples. The LCS is an aliquot of laboratory matrix (e.g. water for aqueous spiked with analytes of known identity and concentration and isotopic surrogate analogs. The OPRs must be processed in the same manner and at the same time as the associated samples. Recovery for Aqueous low level OPR target analytes is 40-150% until more data are derived. For all other Aqueous OPR levels recovery targets are 50-150%. These data are based upon EPA 1633 draft ranges that will change and are not used for acceptance/rejection but are reported until such time that fully validated acceptance ranges are provided in the final version of the method.

10.2.3 <u>Matrix spike/Matrix spike duplicate</u> (MS/MSD or MS/MSD). <u>These are</u> not typically required since each sample contains isotopic PFAS analogues that correct for any matrix effects. If the client requests them, then they are processed accordingly but are not a requirement of this method. If done they are by matrix, not to exceed twenty (20) samples. An MS/MSD pair is aliquots of a selected field sample spiked with analytes of known identity and concentration. The MS/MSD pair must be processed in the same manner and at the same time as the associated samples. Spiked analytes with recoveries or precision outside of the Laboratory control limits are flagged accordingly. Until enough statistical data per matrix is available, no criteria are offered. If a specific QA Project Plan has required limits, this is preempted. Any outliers must be qualified accordingly.

10.2.4 <u>Initial calibration verification (ICV)</u> –A second source standard is not required for this method. A second independently prepared mid-level standard is prepared and used for this purpose and analyzed after the ICAL. The concentration should be at the mid range of the curve and must recover within 70-130 % of expected value.

Corrective actions for the ICV include:

- Rerun the ICV
- Remake or acquire a new ICV.
- Evaluate the instrument conditions.
- Evaluate the initial calibration standards.
- Rerun the initial calibration.

10.2.5 <u>Internal Standard</u>- The Non-extracted Internal Standard (NIS) is added to each field and QC sample prior to analysis. The IS response (peak area) must not deviate by more than 50-200% from the mean response (peak area) of the initial calibration. If the areas are low for all the field samples and QC samples in the batch, it suggests a loss of instrument sensitivity, while low areas in only some field or QC samples suggests a possible bad injection.

Corrective action includes:

- Reinject the questionable samples
- Verifying the CCV NIS areas are compliant with the range, if so, this suggests either matrix effects and may require a small dilution to mitigate interference if only some of the NIS compounds are affected
- Qualify affected data

## 10.3 Initial Demonstration of Capability (IDC)

Initial Demonstration of Capability involves the following processes listed ion Table 1.0 as follows.

## Table 1.0 - Initial Demonstration of Capability (IDC)

Requirement	Specification and Frequency	Acceptance Criteria
Initial Demonstration of Precision and Recovery (IPR)	Extract, concentrate, and analyze four aliquots of the matrix (aqueous and soil) spiked with target native standard solution, EIS solution and finally the NIS (ISTD). Extract a method blank of each matrix with each matrix IPR batch. All steps that are used for processing samples, including preparation and extraction must be included.	Using results of the set of four analyses, compute the average percent recovery (R) of the extracts and the relative standard deviation (RSD) of the concentration for each target and EIS compound.
		For each native and isotopically labeled compound, compare RSD and % recovery with the corresponding limits for initial precision and recovery in Table 5. If RSD and R for all compounds meet the acceptance criteria, system performance is acceptable, and analysis of blanks and samples may begin.
Method Detection Limit (MDL)	Method detection limit (MDL) - Each laboratory must also establish MDLs for all the analytes using the MDL procedure at 40 CFR Part 136, Appendix B. An MDL determination must be performed for all target compounds.	The minimum level of quantification (ML) can be calculated by multiplying the MDL by 3.18 and rounding to the nearest integer
Calibration Verification (ICV or SCV) Section 9.1.5	Analyze a mid-level ICV, each time a new calibration is performed or at a minimum, quarterly. The ICV must be an independent dilution beginning with the common starting materials used for ICAL. No 2 <sup>nd</sup> source is required due to availability.	Results must be 70-130% of true value.

## 10.4 **QC Requirements**

Ongoing QC requirements are detailed in Table 3.0 as follows.

## Table 3.0 QC Requirements

Summary of Quality Control		
Method Reference	Requirement	Specification and Frequency
Section 10.1	Mass Calibration	Annually and on as-needed basis
Section 10.1.7	Mass Calibration Verification	After mass calibration
Section 10.3	Initial Calibration (ICAL)	Minimum 6 calibration standards for linear model and 7 calibration standards for non-linear models.
Sections 10.2.2, 14.4	Retention Time (RT) window	After ICAL and at the beginning of analytical sequence
Sections 7.3.1, 9.4	Extracted Internal Standard (EIS) Analytes	All CAL standards, batch QC and field samples

	YORK ANALYTICAL LABORATORIES, Inc.	
		Title: PFAS_LCMSMS1633
		Revision 1.1
		Effective Date: 02/10/2023
Sections 7.3.2	Non-extracted Internal Standards	All CAL standards, batch QC and
	(NIS)	field samples
Sections 7.3.4, 10.3.1, 13.3	Instrument Sensitivity Check (ISC)	Daily, prior to analysis
Section 14.2	Calibration Verification (CV) (CCV)	At the beginning and every 10 samples and at the end
Section 14.6	Instrument Blank	Daily prior to analysis and after high standards
Sections 9.1.3, 9.5, 14.7	Method Blank (MB)	One per preparation batch
Section 14.5	Ongoing Precision Recovery (OPR)	One per preparation batch
Section 11.0	Limit of Quantitation Verification (LLOPR)	Prior to analyzing samples
Section 11.0	Matrix Spike (MS/MSD)	One per preparation batch (if required) Normally not needed, since Isotope dilution is employed

## 11.0 DATA REVIEW, CALCULATIONS AND REPORTING

Samples concentrations are determined using either or linear regression or quadratic regression FORCED through the origin. Weighted  $(1/x \text{ or } 1/x^2)$  may assist with low level accuracy and is recommended where necessary. All calibration curves have greater than 6 points. Any target analyte exceeding the calibration range will require dilution.

### 11.1 Data interpretation

All sample data calculations are performed by the Agilent Mass Hunter software in ng/mL and then final data are calculated taking into account final extract volumes and the initial sample volumes extracted which are entered into the Element bench sheet.

11.2 Linear and Branched Isomers are addressed in Section 8.5 and are reported for the noted species as Total which is a sum of the linear and branched isomers for affected species.

11.3 All Data are uploaded into Element LIMS and all final concentration calculations and associated recoveries are detailed. All pdfs of Mass Hunter Quant reports are uploaded to the Element Raw\_Data drive for association with ICALs and all batch and analysis sequence runs. Data are set to Analyzed status once uploaded and initially reviewed, then locked.

11.4 The Data are then evaluated using the York Qualinator <sup>TM</sup> data review tool which evaluates all data CCVs, QC, ISTDS, Recoveries, etc. and automatically assigns outlier qualifiers for review and acceptance by the reviewer. The accepted data are then uploaded to Element and final reviewed in Laboratory Data Entry/Review module. Once reviewed, the status is set to Reviewed indicating the data are ready to be Reported by the Reporting Group.

## 12. HEALTH AND SAFETY

12.1 General safety considerations and requirements are detailed in the York Laboratory Safety and Health Standard Operating Procedure No. Safety011600.

Specific safety rules applying to the conduct of this analysis requiring the following:

- When handling standards and samples, latex gloves are required.
- Also, when handling neat materials, a fume hood and safety glasses are required.
- When handling samples, gloves and glasses are required.
- Highly odorous samples must be handled in a fume hood.
- Refer to SDSs for specific safety/health information.

12.2 The analysts must exercise normal care and be supervised and trained to work in an analytical chemistry laboratory. The analysts will be handling fragile glassware, needles, syringes, volatile and flammable chemicals, toxic chemicals and corrosive chemicals.

- No smoking or open flames are allowed.
- No food or food products may be brought into the laboratory.

Solvents should not be left uncovered on the laboratory benches. All solvent transfers should be done in the hoods.

Hood doors must be kept in the position which yields approx. 100 fpm face velocity. Solvent evaporation must be done in the hood with exhaust elevated and in the rear.

Waste containers that had solvents must be vented to a hood until all solvents have evaporated.

Safety glasses are provided and must be worn at all times in the laboratory. Gloves are provided and must be worn when working with chemicals. Laboratory coats are provided and should be worn to protect the analysts' clothes. Syringes and needles must be kept in their original cases when not in use. Care must be exercised in using and handling syringes to avoid injury. Report any sticking with a needle immediately to your supervisor.

## 12.3 Specific Safety Concerns

12.3.1 Preliminary toxicity studies indicate that PFAS could have significant toxic effects. In the interest of keeping exposure levels as low as reasonably achievable, PFAS must be handled in the laboratory as hazardous and toxic chemicals.

12.3.2 Exercise caution when using syringes with attached filter

disc assemblies. Application of excessive force has, upon occasion, caused a filter disc to burst during the process.

12.3.3 Laboratory procedures such as repetitive use of pipets, repetitive transferring of extracts and manipulation of filled separatory funnels and other glassware represent a significant potential for repetitive motion or other ergonomic injuries. Laboratory associates performing these procedures are in the best position to realize when they are at risk for these types of injuries.

12.3.4 Eye protection, laboratory coat, and nitrile gloves must be worn while handling samples, standards, solvents, and reagents. Disposable gloves that have been contaminated will be removed and discarded; other gloves will be cleaned immediately.

12.3.5 Perfluorocarboxylic acids are acids and are not compatible with strong bases.

12.3.6 Primary Materials Used- The following is a list of the materials used in this method, which have a serious or significant hazard rating. NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the SDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

irritant to the mucous membranes. Toxic effects exerted vous system, particularly the optic nerve. Symptoms of sure may include headache, drowsiness and dizziness. lcohol is a defatting agent and may cause skin to become racked. Skin absorption can occur; symptoms may parallel n exposure. Irritant to the eyes.
i N I

#### YORK ANALYTICAL LABORATORIES, Inc. Title: PFAS\_LCMSMS1633 Revision 1.1 Effective Dete: 02/10/2021

			Effective Date. 02/10/2023
Acetic Acid, Glacial	-Flammable liquid and vapor. -Irritation	10 ppm TWA; 25 mg/m3 TWA	<b>Eye:</b> Causes severe eye irritation. Contact with liquid or vapor causes severe burns and possible irreversible eye damage. <b>Skin:</b> Causes skin burns. May be harmful if absorbed through the skin. Contact with the skin may cause blackening and hyperkeratosis of the skin of the hands. <b>Ingestion:</b> May cause severe and permanent damage to the digestive tract. Causes severe pain, nausea, vomiting, diarrhea, and shock. May cause polyuria, oliguria (excretion of a diminished amount of urine in relation to the fluid intake) and anuria (complete suppression of urination). Rapidly absorbed from the gastrointestinal tract. <b>Inhalation:</b> Effects may be delayed. Causes chemical burns to the respiratory tract. Exposure may lead to bronchitis, pharyngitis, and dental erosion. May be absorbed through the lungs. <b>Chronic:</b> Chronic exposure to acetic acid may cause erosion of dental enamel, bronchitis, eye irritation, darkening of the skin, and chronic inflammation of the respiratory tract. Acetic acid can cause occupational asthma. One case of a delayed asthmatic response to glacial acetic acid has been reported in a person with bronchial asthma. Skin sensitization to acetic acid is rare, but has occurred.
Ammonium Hydroxide, conc. 28-30%	- Inhalation hazard - Skin Corrosion -Eye Damage and Irritation	OSHA PEL: 35 mg/m3 ; 50 ppm OSHA TWA: 18 mg/m3; 25 ppm	Ammonia is an irritant and corrosive to the skin, eyes, respiratory tract and mucous membranes. May cause severe chemical burns to the eyes, lungs and skin. Skin and respiratory related diseases could be aggravated by exposure. The extent of injury produced by exposure to ammonia depends on the duration of the exposure, the concentration of the liquid or vapor and the depth of inhalation. Exposure Routes: Inhalation (vapors), skin and/or eye contact (vapors, liquid), ingestion (liquid).
Formic Acid, conc.	-Flammable liquid and vapor -Harmful if swallowed -Causes severe skin burns and eye damage -Toxic if inhaled -May cause respiratory irritation	OSHA TWA: 5 ppm or 9 mg/m3 OSHA PEL: 10 ppm	Formic acid is an irritant and corrosive to the skin, eyes, respiratory tract and mucous membranes. May cause severe chemical burns to the eyes, lungs and skin. Skin and respiratory related diseases could be aggravated by exposure. The extent of injury produced by exposure to ammonia depends on the duration of the exposure, the concentration of the liquid or vapor and the depth of inhalation. Exposure Routes: Inhalation (vapors), skin and/or eye contact (vapors, liquid), ingestion (liquid).

## 13. WASTE MANAGEMENT/POLLUTION PREVENTION

### Neat Materials

Waste management procedures require the prudent use of neat materials. The ordering of neat standards and materials must be done to minimize unused material which would result in storage or handling of excess material. Quantities ordered should be sufficient to provide for necessary standards with consideration to shelf life. When ordering a unique material for a standard, be sure to order the smallest practical quantity.

### Solvents

The solvents used at York for this procedure include isopropanol and Methanol. These solvents are used for sample extraction or LC cleanup, all amounts are either consumed during concentration or placed in one liter amber jars in the hood areas for evaporation. Any remaining solvent/water is transferred to a drum designated for solvent waste.

### Acids and Bases

The acids and bases used for this procedure include: Acetic Acid and Formic Acid. The bases used are Ammonium hydroxide, sodium hydroxide and potassium hydroxide. Store concentrated base and acids separately whether waste or neat material.

### Samples 1 -

Unused or remaining water samples are returned to the sample control room for continued storage for proper disposal by the sample control group.

### **14. REFERENCES**

1. EPA METHOD 1633 Draft 2 June, 2022- Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS; EPA 821-D-22-001

### **15. REVISION HISTORY**

Revision 1.0	10/24/2022	First issue.
Revision 1.1	02/10/2023	Modified LLOPR in Section 7.4.6.1 to reflect 2x the MRL

## Attachment 1 – Non-Extracted Internal Standards (NIS)

# YORK

Analytical Standard Record

Standard ID;	Y22B197

Description: Standard Typ Solvent: Final Volume Vials: Vendor:	æ: e (mls):	MPFAC-HIF-IS-EPA 1633 ISTD STOCK Other Methanol/Water (<1%) 1 1 Wellington Laboratories	Prepared: Expires: Prepared By: Department: Lot No.:	02/16/2022 09/07/2026 Robert Q. Bradley PFAS MPFACHIFTS0921	
Comments:	Stock IS	STD for EPA method 1633			
Analyte			CAS Number	Concentration	Units
M3PFBA				1.	ug/mL
MPFDA				0.25	ug/mL
MPFHxA				0.5	ug/mL
MPFHxS				0.474	ug/mL
MPFNA				0.25	ug/mL
MPFOA				0.5	ug/mL
MPFOS				0.479	ug/mL

#### YORK ANALYTICAL LABORATORIES, Inc. Title: PFAS\_LCMSMS1633 Revision 1.1 Effective Date: 02/10/2023



### CERTIFICATE OF ANALYSIS DOCUMENTATION

#### MPFAC-HIF-IS

Mass-Labelled Perfluoroalkyl Substance Injection Standard Solution/Mixture

PRODUCT CODE: LOT NUMBER: SOLVENT(S): DATE PREPARED: (mmtddyyyy)

LAST TESTED: (mm/dd/yyyy)

RECOMMENDED STORAGE:

EXPIRY DATE: (mm/dd/yyyy)

MPFAC-HIF-IS MPFACHIFIS0921 Methanol/Water (<1%) 09/07/2021 09/07/2021 09/07/2026 Store ampoule in a cool, dark place

#### **DESCRIPTION:**

MPFAC-HIF-IS is a solution/mixture of five mass-labelled (<sup>13</sup>C) perfluoroalkylcarboxylic acids ( $C_4$ ,  $C_5$ ,  $C_6-C_{10}$ ) and two mass-labelled (<sup>13</sup>O and <sup>13</sup>C) perfluoroalkanesulfonates ( $C_6$  and  $C_6$ ). The components and their concentrations are given in Table A.

The individual mass-labelled perfluoroalkylcarboxylic acids and mass-labelled perfluoroalkanesulfonates all have chemical purities of >98% and isotopic purities of ≥99% per <sup>13</sup>C or >94% per <sup>13</sup>O.

#### DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture Figure 1: LC/MS Data (SIR) Figure 2: LC/MS/MS Data (Selected MRM Transitions)

#### ADDITIONAL INFORMATION:

.

See page 2 for further details.

Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acids to their respective methyl esters.

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Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23

MPFACHIFIS0921 (1 of 5)

#### INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

#### HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

#### SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

#### HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of internest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

#### UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty,  $u_{e}(y)$ , of a value y and the uncertainty of the independent parameters

$$u_e(y(x_1, x_2, \dots, x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

#### TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

#### EXPIRY DATE / PERIOD OF VALIDITY:

 $x_1, x_2, \dots, x_n$  on which it depends is:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

#### LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

#### QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA: A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).





\*\*For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at <u>www.well-labs.com</u> or contact us directly at <u>info@well-labs.com</u>\*\*

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Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23

Compound	Acronym	Concentration (ng/mL)		Peak Assignment in Figure 1
Perfluoro-n-(2,3,4-13C <sub>s</sub> )butanoic acid	M3PFBA	1000		1
Perfluoro-n-(1,2-13C3)hexanoic acid	MPFHxA	500		2
Perfluoro-n-(1,2,3,4-13C <sub>4</sub> )octanoic acid	MPFOA	500		4
Perfluoro-n-(1,2,3,4,5-13Cs)nonanoic acid	MPFNA	250		5
Perfluoro-n-(1,2-13C,)decanoic acid	MPFDA	250		7
Compound	Acronym	Concentration* (ng/mL)		Peak
		as the salt	as the acid	in Figure 1
Sodium perfluoro-1-hexane("02)sulfonate	MPFHxS	500	474	3
Sodium perfluoro-1-(1,2,3,4-13C,)octanesulfonate	MPFOS	500	479	6

MPFAC-HIF-IS; Components and Concentrations (ng/mL, ± 5% in methanol/water (<1%))

\* Concentrations have been rounded to three significant figures.

Table A:

Certified By: B.G. Chittim, General Manager

Date: 10/13/2021

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# Attachment 2 – Extracted Internal Standards (EIS)

# YORK

# Analytical Standard Record

Standard ID: Y22B198

Description:	MPFAC-HIF-ES-EPA 1633 STOCK EIS mix	Prepared:	02/17/2022	
Standard Type:	Other	Expires:	08/06/2024	
Solvent	McOH/IPA/1% H2O	Prepared By:	Robert Q. Bradley	
Final Volume (mls):	1	Department	PFAS	
Vials:	1	Lot No.:	MPFACHIFES0821	
Vendor:	Wellington Laboratories			
Comments:				

Analyte	CAS Number	Concentration	Units
d3-N-McFOSAA		1	ug/mL
d5-N-EtFOSAA		1	ug/mL
d7-N-MeFOSE		5	ug/mL
d9-N-EtFOSE		5	ug/mL
d-N-EtFOSA		0.5	ug/mL
d-N-MeFOSA		0.5	ug/mL
M2-4:2FTS		0.938	ug/mL
M2-6:2FTS		0.951	ug/mL
M2-8:2FTS		0.96	ug/mL
M2PFTeDA		0.25	ug/mL
M3HFPO-DA		2	ug/mL
M3PFBS		0.466	ug/mL
M3PFHxS		0.474	ug/mL
M4PFHpA		0.5	ug/mL
M5PFHxA		0.5	ug/mL
MSPFPeA		1	ug/mL
M6PFDA		0.25	ug/mL
M7PFUdA		0.25	ug/mL
M8FOSA		0.5	ug/mL
M8PFOA		0.5	ug/mL
M8PFOS		0.479	ug/mL
M9PFNA		0.25	ug/mL
MPFBA		2	ug/mL
MPFDoA		0.25	ug/mL

## YORK ANALYTICAL LABORATORIES, Inc. Title: PFAS\_LCMSMS1633 Revision 1.1 Effective Date: 02/10/2023



# CERTIFICATE OF ANALYSIS DOCUMENTATION

# MPFAC-HIF-ES

### Mass-Labelled Per- and Poly-fluoroalkyl Substance Extraction Standard Solution/Mixture

PRODUCT CODE: LOT NUMBER: SOLVENT(S): DATE PREPARED: (mm/dd/yyy) LAST TESTED: (mm/dd/yyy) EXPIRY DATE: (mm/dd/yyy) RECOMMENDED STORAGE: MPFAC-HIF-ES MPFACHIFES0821 Methanol/Isopropanol (1%)/Water (<1%) 08/05/2021 08/16/2021 08/16/2024 Refrigerate ampoule

## DESCRIPTION:

MPFAC-HIF-ES is a solution/mixture of ten mass-labelled (<sup>15</sup>C) perfluoroalkylcarboxylic acids ( $C_4$ - $C_{12}$ ,  $C_{14}$ ), three mass-labelled (<sup>15</sup>C) perfluoroalkanesulfonates ( $C_4$ ,  $C_6$ , and  $C_6$ ), three mass-labelled (one <sup>15</sup>C and two <sup>2</sup>H) perfluoro-1-octanesulfonamides, three mass-labelled (<sup>15</sup>C) fluorotelomer sulfonates (4:2, 6:2, and 8:2), two mass-labelled (<sup>2</sup>H) perfluorooctanesulfonamidoacetic acids, two mass-labelled (<sup>2</sup>H) perfluorooctane-sulfonamidoacetic acids, two mass-labelled (<sup>3</sup>C) perfluorooctane-

The individual mass-labelled perfluoroalkylcarboxylic acids, mass-labelled perfluoroalkanesulfonates, mass-labelled fluorotelomer sulfonates, perfluoro-1-(<sup>13</sup>C<sub>8</sub>)octanesulfonamide, and mass-labelled hexafluoropropylene oxide dimer acid all have chemical purities of >98% and isotopic purities of ≥99%. The individual mass-labelled perfluorooctanesulfonamidoacetic acids, mass-labelled perfluoroctanesulfonamidoacetic acids, mass-labelled perfluoroctanesulfonamidoethanols, and two mass-labelled (<sup>2</sup>H) perfluoro-1-octanesulfonamides all have chemical purities of >98% and isotopic purities of ≥98%.

#### DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture Figure 1: LC/MS Data (SIR) Figure 2: LC/MS/MS Data (Selected MRM Transitions)

#### ADDITIONAL INFORMATION:

- See page 2 for further details.
  - Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acids to their respective methyl esters.

## FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

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### INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

#### HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

#### SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and Our products are synthesized using single-product orianiogous others whenever possible, high are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, IC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

#### HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline Iot and, after the addition of an appropriate internal standard, they are compared by GCMS, LCMS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

#### UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty,  $u_c(y)$ , of a value y and the uncertainty of the independent parameters

$$u_{e}(y(x_{1}, x_{2}, ..., x_{n})) = \sqrt{\sum_{i=1}^{n} u(y, x_{i})^{2}}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

#### TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

x., x....x. on which it depends is:

EXPIRY DATE / PERIOD OF VALIDITY: Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

## LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

#### QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).





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MPFACHIFES0821 (2 of 7)

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23



Table A: MPFAC-HIF-ES; Components and Concent (ng/mL, ± 5% in Methanol/Isopropanol (1%)	trations )/Water (<1%))			
Compound	Acronym	Concer (ng/	ntration mL)	Peak Assignment in Figure 1
Perfluoro-n-(13Ca)butanoic acid	MPFBA	20	00	1
Perfluoro-n-(13C,)pentanoic acid	M5PFPeA	10	00	2
Perfluoro-n-(1,2,3,4,6-13C <sub>s</sub> )hexanoic acid	M5PFHxA	50	00	5
Perfluoro-n-(1,2,3,4-13C,)heptanoic acid	M4PFHpA	50	00	7
Perfluoro-n-(13C,)octanoic acid	M8PFOA	500		10
Perfluoro-n-(13C,)nonanoic acid	M9PFNA	25	50	11
Perfluoro-n-(1,2,3,4,5,6-13C)decanoic acid	M6PFDA	25	50	14
Perfluoro-n-(1,2,3,4,5,6,7-13C,)undecanoic acid	M7PFUdA	25	17	
Perfluoro-n-(1,2-13C3)dodecanoic acid	MPFDoA	250		19
Perfluoro-n-(1,2-13C_)tetradecanoic acid	M2PFTeDA	25	50	22
Perfluoro-1-(13C,)octanesulfonamide	M8FOSA	50	00	18
N-methyl-d <sub>3</sub> -perfluoro-1-octanesulfonamide	d-N-MeFOSA	50	00	21
N-ethyl-d,-perfluoro-1-octanesulfonamide	d-N-EtFOSA	50	00	24
N-methyl-d <sub>3</sub> -perfluoro-1-octanesulfonamidoacetic acid	d3-N-MeFOSAA	10	00	15
N-ethyl-dperfluoro-1-octanesulfonamidoacetic acid	d5-N-EtFOSAA	10	00	16
2-(N-methyl-d,-perfluoro-1-octanesulfonamido)ethan-d,-ol	d7-N-MeFOSE	50	00	20
2-(N-ethyl-dperfluoro-1-octanesulfonamido)ethan-dol	d9-N-EtFOSE	5000		23
2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)("C3)propanoic acid	M3HFPO-DA	20	00	6
	Aaranum	Concen (ng/	tration* mL)	Peak
Compound	Actonym	as the salt	as the acid	in Figure 1
Sodium perfluoro-1-(2,3,4-19C3)butanesulfonate	M3PFBS	500	466	3
Sodium perfluoro-1-(1,2,3-13C3)hexanesulfonate	M3PFHxS	500	474	8
Sodium perfluoro-1-(13Ca)octanesulfonate	M8PFOS	500	479	12
Sodium 1H,1H,2H,2H-perfluoro-(1,2-13C3)hexanesulfonate	M2-4:2FTS	1000	938	4
Sodium 1H,1H,2H,2H-perfluoro-(1,2-13Ca)octanesulfonate	M2-6:2FTS	1000	951	9
Sodium 1H,1H,2H,2H-perfluoro-(1,2-13C,)decanesulfonate	M2-8:2FTS	1000	960	13

\* Concentrations have been rounded to three significant figures.

Date: 10/13/2021

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 MPFACHIFES0821 (3 of 7) rev1



Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 MPFACHIFES0821 (4 of 7) rev1



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# Attachment 3 – Target Analyte Mixtures

## INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains

#### HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

#### SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using using HRGC/HRMS and/or LC/MS/MS.

#### HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing the relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing the relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing the relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing the relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing the relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing the relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing the relative response factors of the solution are required to be <5% RSD. New solution lots of existing the relative response factors of the solution are required to be <5% RSD. New solution lots of existing the relative response factors of the solution are required to be <5% RSD. New solution lots of existing the relative response factors of the solution are required to be <5% RSD. New solution lots of existing the relative response factors of the solution are required to be <5% RSD. New solution lots of existing the relative response factors of the solution are required to be <5% RSD. New solution lots of existing the relative response factors of the solution are required to be <5% RSD. New solution lo products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

## UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty,  $u_c(y)$ , of a value y and the uncertainty of the independent parameters

$$u_{c}(y(x_{1}, x_{2}, \dots, x_{n})) = \sqrt{\sum_{i=1}^{n} u(y, x_{i})^{2}}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

## TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

#### EXPIRY DATE / PERIOD OF VALIDITY:

 $x_1, x_2, \dots, x_n$  on which it depends is:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

#### LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

#### QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA: A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).





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PFACMXF0122 (2 of 5)

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23

Compound	Acronym	Concentration* (ng/ml) 2000		Peak Assignment in Figure 1
2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid	HFPO-DA			A
		Concer (ng	tration* mL)	Peak
Compound	Acronym	as the salt	as the acid	in Figure 1
Sodium dodecafluoro-3H-4,8-dioxanonanoate	NaDONA	2000	1890	В
Potassium 9-chlorohexadecafluoro-3-oxanonane-1-sulfonate	9CI-PF3ONS	2000	1870	С
Potassium 11-chloroeicosafluoro-3-ovaundecane-1-sulfonate	11CLPE3OUAS	2000	1890	D

## -Table A: PFAC-MXF; Components and Concentrations (ng/mL; ± 5% in Methanol/Water (<1%))

\* Concentrations have been rounded to three significant figures.

×

Certified By: Æ B.G. Chittim, General Manager

Date: 01/12/2022

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 PFACMXF0122 (3 of 5) rev0

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aters Acquity Ultra Performance LC								
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olumn: Acquity UPLC BEH Shield RP <sub>18</sub>				MS Para	meters:			222.12
1.7 μm, 2.1 x 100 mm			1	Experime	nt: SIR			
obile phase: Gradient Start: 45% H O / 55% (80:20 MeOH:	ACN)			Source: E Capillary	Electrospr Voltage (	ay (nega kV) = 2.0	ative) 00	
(both with 10 mM NH OAc buffer)	d hold for 2 min			Cone Vol	tage (V)	= variable	e (15-74)	
before returning to initial conditions i	in 0.75 min.		i	Desolvati	on Gas F	low (L/h	r) = 1000	
Time: 12 min								9.00
ow: 300 uL/min								
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# Analytical Standard Record

Standard ID: Y22B199

Description:	PFAC-MXF-Native Repl.STOCK EPA 1633 PFAS	Prepared:	02/17/2022		
Standard Type:	Other	Expires:	01/11/2025		
Solvent:	MeOH/H20	Prepared By:	Robert Q. Bradley		
Final Volume (mls):	1	Department:	PFAS		
Vials:	1	Lot No.:	PFACMXF0122		
Vendor:	Wellington Laboratories				
Comments:					
Analyte		CAS Number	Concentration	Units	
11CL-PF3OUdS		763051-92-9	1.89	ug/mL	
9CL-PF3ONS		756426-58-1	1.87	ug/mL	
ADONA		919005-14-4	1.89	ug/mL	

13252-13-6

2

ug/mL

HFPO-DA (Gen-X)

Reviewed By

Page 1 of 1

Date

# YORK ANALYTICAL LABORATORIES, Inc. Title: PFAS\_LCMSMS1633 Revision 1.1 Effective Date: 02/10/2023



# CERTIFICATE OF ANALYSIS DOCUMENTATION

# PFAC-MXF

## Native Replacement PFAS Solution/Mixture

PRODUCT CODE: LOT NUMBER: SOLVENT(S): DATE PREPARED: (mmiddlyyy) LAST TESTED: (mmiddlyyy) EXPIRY DATE: (mmiddlyyy) RECOMMENDED STORAGE: PFAC-MXF PFACMXF0122 Methanol / Water (<1%) 01/10/2022 01/11/2022 01/11/2025 Refrigerate ampoule

## DESCRIPTION:

PFAC-MXF is a solution/mixture of sodium dodecafluoro-3H-4,8-dioxanonanoate (NaDONA), the major and minor components of F-53B (9CI-PF3ONS and 11CI-PF3OUdS), and GenX (HFPO-DA). The components and their concentrations are given in Table A.

The individual native components of this mixture all have chemical purities of >98%.

## DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture Figure 1: LC/MS Data (SIR) Figure 2: LC/MS/MS Data (Selected MRM Transitions)

## ADDITIONAL INFORMATION:

- See page 2 for further details.
  - Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acid to the methyl ester.

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Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 PFACMXF0122 (1 of 5)

Compound	Acronym	Concentration (µg/mL)	Peak Assignment in Figure 1
N-methylperfluoro-1-octanesulfonamide	N-MeFOSA	1.00	В
N-ethylperfluoro-1-octanesulfonamide	N-EtFOSA	1.00	D
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol	N-MeFOSE	10.0	A
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol	N-EtFOSE	10.0	С

# Table A:

PFAC-MXI; Components and Concentrations (µg/mL; ± 5% in methanol)

Certified By: B.G. Chittim, General Manager

Date: 09/23/2021

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 PFACMXI0921 (3 of 5) rev0







# Analytical Standard Record

Standard ID: Y22B204

Description:	PFAC-MXI-EPA 1633 Stock	Prepared:	02/17/2022		
Standard Type:	Other	Expires:	02/17/2023		
Solvent:	Methanol	Prepared By:	Robert Q. Bradley	Ý	
Final Volume (mls):	1	Department:	PFAS		
Vials:	1	Lot No.:	PFACMXI0921		
Vendor:	Wellington Laboratories				
Comments:					
Analyte		CAS Number	Concentration	Units	
N-EtFOSA		4151-50-2	1	ug/mL	
N-EtFOSE		1691-99-2	10	ug/mL	
N-MeFOSA		31506-32-8	1	ug/mL	
N-MeFOSE		24448-09-7	10	ug/mL	

Reviewed By

Page 1 of 1

Date

# YORK ANALYTICAL LABORATORIES, Inc. Title: PFAS\_LCMSMS1633 Revision 1.1 Effective Date: 02/10/2023



# CERTIFICATE OF ANALYSIS DOCUMENTATION

# PFAC-MXI

## Native Perfluorooctanesulfonamide and Perfluorooctanesulfonamidoethanol Solution/Mixture

PRODUCT CODE: LOT NUMBER: SOLVENT(S): DATE PREPARED: (mm/dd/yyy) LAST TESTED: (mm/dd/yyy) EXPIRY DATE: (mm/dd/yyy) RECOMMENDED STORAGE: PFAC-MXI PFACMXI0921 Methanol 09/08/2021 09/14/2021 09/14/2026 Store ampoule in a cool, dark place

## DESCRIPTION:

PFAC-MXI is a solution/mixture of two native perfluorooctanesulfonamides (FOSAs) and two native perfluorooctanesulfonamidoethanols (FOSEs). The components and their concentrations are given in Table A.

The individual components have a chemical purity of >98%.

#### DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture Figure 1: LC/MS Data (SIR) Figure 2: LC/MS/MS Data (Selected MRM Transitions)

## ADDITIONAL INFORMATION:

See page 2 for further details.

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Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 PFACMXI0921 (1 of 5)

#### INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

#### HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

#### SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

#### HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

## UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, u<sub>c</sub>(y), of a value y and the uncertainty of the independent parameters

$$u_e(y(x_1, x_2, ..., x_n)) = \sqrt{\sum_{i=1}^n u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

#### TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to International interlaboratory studies has also been established.

#### EXPIRY DATE / PERIOD OF VALIDITY:

x, x, ....x, on which it depends is:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

#### LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

#### QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).





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PFACMXI0921 (2 of 5)

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23



**CONFIDENTIAL DOCUMENT** Page 64 of 96

## INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains

#### HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

#### SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using using HRGC/HRMS and/or LC/MS/MS.

#### HOMOGENEITY:

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## UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty,  $u_c(y)$ , of a value y and the uncertainty of the independent parameters

$$u_{c}(y(x_{1}, x_{2}, \dots, x_{n})) = \sqrt{\sum_{i=1}^{n} u(y, x_{i})^{2}}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

## TRACEABILITY:

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#### EXPIRY DATE / PERIOD OF VALIDITY:

 $x_1, x_2, \dots, x_n$  on which it depends is:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

#### LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

#### QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA: A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).





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PFACMXF0122 (2 of 5)

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23

Compound	Acronym	Concentration* (ng/ml) 2000		Peak Assignment in Figure 1
2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid	HFPO-DA			А
		Concer (ng	tration* mL)	Peak
Compound	Acronym	as the salt	as the acid	in Figure 1
Sodium dodecafluoro-3H-4,8-dioxanonanoate	NaDONA	2000	1890	В
Potassium 9-chlorohexadecafluoro-3-oxanonane-1-sulfonate	9CI-PF3ONS	2000	1870	С
Potassium 11-chloroeicosofluoro-3-ovaundecane-1-sulfonate	11CL-PE3OUdS	2000	1890	D

## -Table A: PFAC-MXF; Components and Concentrations (ng/mL; ± 5% in Methanol/Water (<1%))

\* Concentrations have been rounded to three significant figures.

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Certified By: X B.G. Chittim, General Manager

Date: 01/12/2022

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 PFACMXF0122 (3 of 5) rev0

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# Analytical Standard Record

Standard ID: Y22B199

Description:	PFAC-MXF-Native Repl.STOCK EPA 1633 PFAS	Prepared:	02/17/2022		
Standard Type:	Other	Expires:	01/11/2025		
Solvent:	MeOH/H20	Prepared By:	Robert Q. Bradley		
Final Volume (mls):	1	Department:	PFAS		
Vials:	1	Lot No.:	PFACMXF0122		
Vendor:	Wellington Laboratories				
Comments:					
Analyte		CAS Number	Concentration	Units	
11CL-PF3OUdS		763051-92-9	1.89	ug/mL	
9CL-PF3ONS		756426-58-1	1.87	ug/mL	
ADONA		919005-14-4	1.89	ug/mL	

13252-13-6

2

ug/mL

HFPO-DA (Gen-X)

Reviewed By

Page 1 of 1

Date

CONFIDENTIAL DOCUMENT Page 68 of 96

# YORK ANALYTICAL LABORATORIES, Inc. Title: PFAS\_LCMSMS1633 Revision 1.1 Effective Date: 02/10/2023



# CERTIFICATE OF ANALYSIS DOCUMENTATION

# PFAC-MXF

## Native Replacement PFAS Solution/Mixture

PRODUCT CODE: LOT NUMBER: SOLVENT(S): DATE PREPARED: (mmiddlyyy) LAST TESTED: (mmiddlyyy) EXPIRY DATE: (mmiddlyyy) RECOMMENDED STORAGE: PFAC-MXF PFACMXF0122 Methanol / Water (<1%) 01/10/2022 01/11/2022 01/11/2025 Refrigerate ampoule

## DESCRIPTION:

PFAC-MXF is a solution/mixture of sodium dodecafluoro-3H-4,8-dioxanonanoate (NaDONA), the major and minor components of F-53B (9CI-PF3ONS and 11CI-PF3OUdS), and GenX (HFPO-DA). The components and their concentrations are given in Table A.

The individual native components of this mixture all have chemical purities of >98%.

## DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture Figure 1: LC/MS Data (SIR) Figure 2: LC/MS/MS Data (Selected MRM Transitions)

## ADDITIONAL INFORMATION:

- See page 2 for further details.
  - Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acid to the methyl ester.

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Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 PFACMXF0122 (1 of 5)

# Table A:

PFAC-MXJ; Components and Concentrations (µg/mL; ± 5% in methanol)

Compound	Acronym	Concentration (μg/mL)
3-Perfluoropropyl propanoic acid	FPrPA	4.00
3-Perfluoropentyl propanoic acid	FPePA	20.0
3-Perfluoroheptyl propanoic acid	FHpPA	20.0

Certified By: B.G. Chittim, General Manager

Date: 10/02/2021

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 PFACMXJ0921 (3 of 5) rev1





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# Analytical Standard Record

Standard ID: Y22B205

ланую		CAS Humber	Concert High	V=48	-
Analyte		CAS Number	Concentration	Tinite	
Comments:					
Vendor:	Wellington Laboratories				
Vials:	1	Lot No.:	PFACMXJ0921		
Final Volume (mls):	1	Department:	PFAS		
Solvent:	Methanol	Prepared By:	Robert Q. Bradley		
Standard Type:	Other	Expires:	09/14/2026		
Description:	PFAC-MXJ-EPA 1633 Stock mix	Prepared:	02/17/2022		

Апшук	CAS Number	Concentration	ULITS
3-Perfluoroheptyl propanoic acid (FHpPA	812-70-4	20	ug/mL
3-Perfluoropentyl propanoic acid (FPePA)	914637-49-3	20	ug/mL
3-Perfluoropropyl propanoic acid (FPrPA)	356-02-2	4	ug/mL

Reviewed By

Page 1 of 1

Date

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# YORK ANALYTICAL LABORATORIES, Inc. Title: PFAS\_LCMSMS1633 Revision 1.1 Effective Date: 02/10/2023



# CERTIFICATE OF ANALYSIS DOCUMENTATION

## PFAC-MXJ

## Native X:3 Fluorotelomer Carboxylic Acid Solution/Mixture

PRODUCT CODE: LOT NUMBER: SOLVENT(S): DATE PREPARED: (mm/dd/yyy) LAST TESTED: (mm/dd/yyy) EXPIRY DATE: (mm/dd/yyy) RECOMMENDED STORAGE: PFAC-MXJ PFACMXJ0921 Methanol 09/08/2021 09/14/2021 09/14/2026 Store ampoule in a cool, dark place

# DESCRIPTION:

PFAC-MXJ is a solution/mixture of three native X:3 fluorotelomer carboxylic acids. The components and their concentrations are given in Table A.

The individual components have a chemical purity of >98%.

## DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture Figure 1: LC/MS Data (SIR) Figure 2: LC/MS/MS Data (Selected MRM Transitions)

## ADDITIONAL INFORMATION:

See page 2 for further details.

# FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA 519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 PFACMXJ0921 (1 of 5)

## INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

#### HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

#### SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

#### HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

#### UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, u<sub>c</sub>(y), of a value y and the uncertainty of the independent parameters

$$u_{c}(y(x_{1}, x_{2}, ..., x_{n})) = \sqrt{\sum_{i=1}^{n} u(y, x_{i})^{2}}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of  $\pm 5\%$  (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

#### TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

#### EXPIRY DATE / PERIOD OF VALIDITY:

x, x, ....x, on which it depends is:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

#### LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

#### QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).





\*\*For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at <u>www.well-labs.com</u> or contact us directly at <u>info@well-labs.com</u>\*\*

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lsomer	Compound	Structure	Percent Composition by "F-NMR	
1	Potassium perfluoro-1-octanesulfonate	CF <sub>3</sub> CF <sub>2</sub> SO <sub>3</sub> ·K <sup>+</sup>	78.8	78.8
2	Potassium 1-trifluoromethylperfluoroheptanesulfonate**	CF <sub>3</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>5</sub> O <sub>3</sub> <sup>-</sup> K <sup>+</sup> CF <sub>3</sub>	1.2	
3	Potassium 2-trifluoromethylperfluoroheptanesulfonate	CF <sub>3</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> SO <sub>3</sub> ·K* CF <sub>3</sub>	0.6	
4	Potassium 3-trifluoromethylperfluoroheptanesulfonate	CF <sub>3</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> SO <sub>3</sub> <sup>-</sup> K <sup>+</sup> CF <sub>3</sub>	1.9	
5	Potassium 4-trifluoromethylperfluoroheptanesulfonate	CF <sub>3</sub> CF <sub>2</sub> CF <sub>2</sub> CFCF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> SO <sub>3</sub> -K <sup>+</sup> CF <sub>3</sub>	2.2	
6	Potassium 5-trifluoromethylperfluoroheptanesulfonate	$\begin{array}{c} CF_3CF_2CFCF_2CF_2CF_2CF_2SO_3\text{`K}^*\\ CF_3\end{array}$	4.5	21.1
7	Potassium 6-trifluoromethylperfluoroheptanesulfonate	CF <sub>3</sub> CFCF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> SO <sub>3</sub> ·K* CF <sub>3</sub>	10.0	21.1
8	Potassium 5,5-di(trifluoromethyl)perfluorohexanesulfonate	CF <sub>3</sub> CF <sub>3</sub> CCF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> SO <sub>3</sub> <sup>-</sup> K <sup>+</sup> CF <sub>3</sub>	0.2	
9	Potassium 4,4-di(trifluoromethyl)perfluorohexanesulfonate	CF <sub>3</sub> CF <sub>3</sub> CF <sub>2</sub> CCF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> SO <sub>3</sub> 'K <sup>+</sup> CF <sub>3</sub>	0.03	
10	Potassium 4,5-di(trifluoromethyl)perfluorohexanesulfonate	CF <sub>3</sub> CF <sub>3</sub> CFCFCF2CF2CF2CF2SO3'K <sup>+</sup> CF3 CF3	0.4	
11	Potassium 3,5-di(trifluoromethyl)perfluorohexanesulfonate	CF3 CF3CFCF2CF2CF2SO3'K* CF3 CF3	0.07	

de Er	BEOSK: Inomaria	Components and	Dorcont C.	omnosition	(by 19E-NMD)*
DIE E:	PFUSK: Isomeric	components and	Percent C	omposition	Dy F-INIVIR)

Percent of total perfluorooctanesulfonate isomers only.
Systematic Name: Potassium perfluorooctane-2-sulfonate.

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23

PFACMXH0921 (7 of 11) rev0

#### YORK ANALYTICAL LABORATORIES, Inc. Title: PFAS\_LCMSMS1633 Revision 1.1 Effective Date: 02/10/2023



Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 PFACMXH0921 (8 of 11)



lsomer	Compound	Structure	Percent Composition by <sup>19</sup> F-NMR	
1	N-methylperfluoro-1-octanesulfonamidoacetic acid	CF <sub>3</sub> (CF <sub>2</sub> ) <sub>7</sub> SO <sub>2</sub> NCH <sub>2</sub> CO <sub>2</sub> H CH <sub>3</sub>	76.0	76.0
2	N-methylperfluoro-3-methylheptanesulfonamidoacetic acid	$\begin{array}{c} CF_3(CF_2)_3 \underset{ }{CF}(CF_2)_2 SO_2 \underset{ }{NCH}_2 CO_2 H \\ CF_3 \qquad CH_3 \end{array}$	0.7	
3	N-methylperfluoro-4-methylheptanesulfonamidoacetic acid	CF <sub>3</sub> (CF <sub>2</sub> ) <sub>2</sub> CF(CF <sub>2</sub> ) <sub>3</sub> SO <sub>2</sub> NCH <sub>2</sub> CO <sub>2</sub> H CF <sub>3</sub> CH <sub>3</sub>	2.0	
4	N-methylperfluoro-5-methylheptanesulfonamidoacetic acid	$\begin{array}{c} CF_3CF_2CF(CF_2)_4SO_2NCH_2CO_2H\\ CF_3 & CH_3 \end{array}$	6.0	24
5	N-methylperfluoro-6-methylheptanesulfonamidoacetic acid	$\begin{array}{cc} CF_3CF(CF_2)_5SO_2NCH_2CO_2H\\ CF_3 & CH_3 \end{array}$	14.0	
6	N-methylperfluoro-5,5-dimethylhexanesulfonamidoacetic acid	$CF_3$ $CF_3C(CF_2)_4SO_2NCH_2CO_2H$ $CF_3$ $CF_3$ $CH_3$	0.2	
7	Other Unidentified Isomers		1.1	

\* Percent of total N-methylperfluorooctanesulfonamidoacetic acid isomers only.

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23

PFACMXH0921 (4 of 11) rev0

somer	Compound	Structure	Percent Compositio by "F-NMF		
1	N-ethylperfluoro-1-octanesulfonamidoacetic acid	CF <sub>3</sub> (CF <sub>2</sub> ) <sub>7</sub> SO <sub>2</sub> NCH <sub>2</sub> CO <sub>2</sub> H C <sub>2</sub> H <sub>5</sub>	77.5	77.5	
2	N-ethylperfluoro-3-methylheptanesulfonamidoacetic acid	$\begin{array}{c} CF_3(CF_2)_3CF(CF_2)_2SO_2NCH_2CO_2H\\ CF_3 & C_2H_5 \end{array}$	2.3		
3	N-ethylperfluoro-4-methylheptanesulfonamidoacetic acid	$\begin{array}{c} CF_3(CF_2)_2CF(CF_2)_3SO_2NCH_2CO_2H\\ \overset{ }{CF}_3 \qquad & C_2H_5 \end{array}$	2.2		
4	N-ethylperfluoro-5-methylheptanesulfonamidoacetic acid	$\begin{array}{c} CF_3CF_2CF_(CF_2)_4SO_2NCH_2CO_2H \\ CF_3 & C_2H_5 \end{array}$	5.4		
5	N-ethylperfluoro-6-methylheptanesulfonamidoacetic acid	$\begin{array}{c} CF_3CF(CF_2)_5SO_2NCH_2CO_2H\\ CF_3 & C_2H_5 \end{array}$	10.4	221	
6	N-ethylperfluoro-5,5-dimethylhexanesulfonamidoacetic acid	CF <sub>3</sub> CF <sub>3</sub> C(CF <sub>2</sub> ) <sub>4</sub> SO <sub>2</sub> NCH <sub>2</sub> CO <sub>2</sub> H CF <sub>3</sub> C <sub>2</sub> H <sub>5</sub>	0.3		
7	N-ethylperfluoro-4,5-dimethylhexanesulfonamidoacetic acid	$\begin{array}{c} CF_3\\ F_3\\CF_3CF_5CF(CF_2)_3SO_2NCH_2CO_2H\\ CF_3\\CF_3\\C_2H_5\end{array}$	0.3		
8	N-ethylperfluoro-3,5-dimethylhexanesulfonamidoacetic acid	$\begin{array}{c} CF_{3} \\ CF_{3}CF_{2}CF_{2}CF(CF_{2})_{2}SO_{2}NCH_{2}CO_{2}H \\ CF_{3} \\ CF_{3} \\ C_{2}H_{5} \end{array}$	0.3		
9	Other Unidentified Isomers		1.3		

ble C:	br-NEtEOSAA: Iso	omeric Components and F	Percent Composition (by <sup>19</sup> F-NMR)*
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\* Percent of total N-ethylperfluorooctanesulfonamidoacetic acid isomers only.

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23

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somer	Compound	Structure	Percent Composition by "F-NMR		
1	Potassium perfluoro-1-hexanesulfonate	CF3CF2CF2CF2CF2CF2SO3 <sup>·</sup> K*	81.1	81.1	
2	Potassium 1-trifluoromethylperfluoropentanesulfonate**	CF <sub>3</sub> CF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> CFSO <sub>3</sub> 'K* CF <sub>3</sub>	2.9		
3	Potassium 2-trifluoromethylperfluoropentanesulfonate	CF <sub>3</sub> CF <sub>2</sub> CF <sub>2</sub> CFCF <sub>2</sub> SO <sub>3</sub> 'K* CF <sub>3</sub>	1.4		
4	Potassium 3-trifluoromethylperfluoropentanesulfonate	CF <sub>3</sub> CF <sub>2</sub> CFCF <sub>2</sub> CF <sub>2</sub> SO <sub>3</sub> <sup>-</sup> K* CF <sub>3</sub>	5.0	18.9	
5	Potassium 4-trifluoromethylperfluoropentanesulfonate	CF <sub>3</sub> CFCF <sub>2</sub> CF <sub>2</sub> CF <sub>2</sub> SO <sub>3</sub> <sup>−</sup> K <sup>+</sup> CF <sub>3</sub>	8.9	10.0	
6	Potassium 3,3-di(trifluoromethyl)perfluorobutanesulfonate	CF3 CF3CCF2CF2SO3*K* CF3	0.2		
7	Other Unidentified Isomers		0.5		

Percent of total perfluorohexanesulfonate isomers only.
Systematic Name: Potassium perfluorohexane-2-sulfonate.

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 PFACMXH0921 (6 of 11) rev0

#### YORK ANALYTICAL LABORATORIES, Inc. Title: PFAS\_LCMSMS1633 Revision 1.1 Effective Date: 02/10/2023



## CERTIFICATE OF ANALYSIS DOCUMENTATION

#### PFAC-MXH

#### Native Per- and Poly-fluoroalkyl Substance Solution/Mixture

PRODUCT CODE: LOT NUMBER: SOLVENT(S): DATE PREPARED: (mm/dd/yyy) LAST TESTED: (mm/dd/yyy) EXPIRY DATE: (mm/dd/yyy) RECOMMENDED STORAGE: PFAC-MXH PFACMXH0921 Methanol / Isopropanol (2%) / Water (<1%) 09/09/2021 09/14/2021 09/14/2026 Refrigerate ampoule

#### DESCRIPTION:

PFAC-MXH is a solution/mixture of eleven native linear perfluoroalkylcarboxylic acids ( $C_4$ - $C_{14}$ ), eight native perfluoroalkanesulfonates ( $C_4$ ,  $C_5$ ,  $C_7$ ,  $C_9$ ,  $C_9$ ,  $C_{10}$ , and  $C_{12}$  linear;  $C_6$  and  $C_6$  linear and branched), three native fluorotelomer sulfonates (4:2, 6:2, and 8:2), two native linear and branched perfluorooctanesulfonamidoacetic acids, and perfluoro-1-octanesulfonamide (FOSA). The components and their concentrations are given in Table A.

The individual components of this mixture all have chemical purities of >98%.

#### DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture

Table B: Isomeric Components and Percent Composition of br-NMeFOSAA

- Table C: Isomeric Components and Percent Composition of br-NEtFOSAA
- Table D: Isomeric Components and Percent Composition of PFHxSK Table E: Isomeric Components and Percent Composition of PFOSK
- Figure 1: LC/MS Data (SIR)

Figure 2: LC/MS/MS Data (Selected MRM Transitions)

#### ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acids to their respective methyl esters.

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Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23 PFACMXH0921 (1 of 11)

#### INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

#### HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

#### SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

#### HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

#### UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, u<sub>c</sub>(y), of a value y and the uncertainty of the independent parameters

$$u_{i}(y(x_{1}, x_{2}, \dots, x_{n})) = \sqrt{\sum_{i=1}^{n} u(y, x_{i})^{2}}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of  $\pm 5\%$  (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

#### TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

#### EXPIRY DATE / PERIOD OF VALIDITY:

x, x,....x on which it depends is:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

#### LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

#### QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).





\*\*For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at <u>www.well-labs.com</u> or contact us directly at <u>info@well-labs.com</u>\*\*

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Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23

Compound	Acronym	Conce (µg/	ntration* mL)	Peak Assignment in Figure 1	
Perfluoro-n-butanoic acid	PFBA	4.0	00	1	
Perfluoro-n-pentanoic acid	PFPeA	2.0	00	2	
Perfluoro-n-hexanoic acid	PFHxA	1.0	00	5	
Perfluoro-n-heptanoic acid	PFHpA	1.0	00	7	
Perfluoro-n-octanoic acid	PFOA	1.0	00	11	
Perfluoro-n-nonanoic acid	PFNA	1.0	00	14	
Perfluoro-n-decanoic acid	PFDA	1.0	00	18	
Perfluoro-n-undecanoic acid	PFUdA	1.0	00	23	
Perfluoro-n-dodecanoic acid	PFDoA	1.0	00	26	
Perfluoro-n-tridecanoic acid	PFTrDA	1.0	00	27	
Perfluoro-n-tetradecanoic acid	PFTeDA	1.0	00	29	
Perfluoro-1-octanesulfonamide	FOSA	1.0	00	25	
	N-MeFOSAA: linear isomer	0.7	60	20	
N-methylperfluorooctanesultonamidoacetic acid -	N-MeFOSAA: $\Sigma$ branched isomers	0.2	40	17	
	N-EtFOSAA: linear isomer	0.775		22	
N-ethylperfluorooctanesulfonamidoacetic acid *	N-EtFOSAA: ∑ branched isomers	0.2	21		
	Assault	Concentration* (µg/mL)		Peak	
Compound	Acronym	as the salt	as the acid	in Figure 1	
Potassium perfluoro-1-butanesulfonate	L-PFBS	1.00	0.887	3	
Sodium perfluoro-1-pentanesulfonate	L-PFPeS	1.00	0.941	6	
	PFHxSK: linear isomer	0.811	0.741	9	
Potassium perfluorohexanesulfonate *	PFHxSK: ∑ branched isomers	0.189	0.173	8	
Sodium perfluoro-1-heptanesulfonate	L-PFHpS	1.00	0.953	12	
	PFOSK: linear isomer	0.788	0.732	15	
Potassium perfluorooctanesulfonate *	PFOSK: ∑ branched isomers	0.211	0.196	13	
Sodium perfluoro-1-nonanesulfonate	L-PFNS	1.00	0.962	19	
Sodium perfluoro-1-decanesulfonate	L-PFDS	1.00	0.965	24	
Sodium perfluoro-1-dodecanesulfonate	L-PFDoS	1.00	0.970	28	
Sodium 1H,1H,2H,2H-perfluorohexanesulfonate	4:2FTS	4.00	3.75	4	
Sodium 1H,1H,2H,2H-perfluorooctanesulfonate	6:2FTS	4.00	3.80	10	
Sodium 1H.1H.2H.2H-perfluorodecanesulfonate	8:2FTS	4.00	3.84	16	

See Table B for percent composition of linear and branched N-MeFOSAA isomers.
See Table C for percent composition of linear and branched N-EIFOSAA isomers.
See Table D for percent composition of linear and branched PFHxSK isomers.
See Table E for percent composition of linear and branched PFOSK isomers.

\* Concentrations have been rounded to three significant figures.

Certified By: B.G. Chittim, General Manager the

Date: 09/23/2021

Form#:13, Issued 2004-11-10 Revision#:9, Revised 2020-12-23

PFACMXH0921 (3 of 11) rev0

# YORK

#### Analytical Standard Record

Standard ID: Y22B201

Description:	PFAC-MXH STOCK PFAS EPA 1633	Prepared:	02/17/2022
Standard Type:	Other	Expires:	09/14/2026
Solvent:	MeOH/IPA/H2O	Prepared By:	Robert Q. Bradley
Final Volume (mls):	1	Department:	PFAS
Vials:	1	Lot No.:	PFACMXH0921
Vendor:	Wellington Laboratories		
Comments:			

Analyte	CAS Number	Concentration	Units	
1H,1H,2H,2H-Perfluorodecanesulfonic acid	39108-34-4	3.84	ug/mL	
1H,1H,2H,2H-Perfluorohexanesulfonic acid	757124-72-4	3.75	ug/mL	
1H,1H,2H,2H-Perfluorooctanesulfonic acid	27619-97-2	3.8	ug/mL	
N-EtFOSAA	2991-50-6	1	ug/mL	
N-MeFOSAA	2355-31-9	1	ug/mL	
Perfluoro-1-decanesulfonic acid (PFDS)	335-77-3	0.965	ug/mL	
Perfluoro-1-heptanesulfonic acid (PFHpS)	375-92-8	0.953	ug/mL	
Perfluoro-1-nonanesulfonic acid (PFNS)	68259-12-1	0.962	ug/mL	
Perfluoro-1-octanesulfonamide (FOSA)	754-91-6	1	ug/mL	
Perfluoro-1-pentanesulfonate (PFPeS)	2706-91-4	0.941	ug/mL	
Perfluorobutanesulfonic acid (PFBS)	375-73-5	0.887	ug/mL	
Perfluorodecanesulfonic acid(PFDS)	335-77-3	0.965	ug/mL	
Perfluorodecanoic acid (PFDA)	335-76-2	1	ug/mL	
Perfluorododecanoic acid (PFDoA)	307-55-1	1	ug/mL	
Perfluoroheptanoic acid (PFHpA)	375-85-9	1	ug/mL	
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	0.914	ug/mL	
Perfluorohexanoic acid (PFHxA)	307-24-4	1	ug/mL	
Perfluoro-n-butanoic acid (PFBA)	375-22-4	4	ug/mL	
Perfluorononanoic acid (PFNA)	375-95-1	1	ug/mL	
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	0.928	ug/mL	
Perfluorooctanoic acid (PFOA)	335-67-1	1	ug/mL	
Perfluoropentanoic acid (PFPeA)	2706-90-3	1	ug/mL	
Perfluorotetradecanoic acid (PFTA)	376-06-7	1	ug/mL	
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	1	ug/mL	
Perfluoroundecanoic acid (PFUnA)	2058-94-8	1	ug/mL	

Reviewed By

Page 1 of 1

Date

# Attachment 4 – Calibration Concentrations, nominal

Calibration Solutions (ng/mL) Compound											
CS1 (LOQ)	CS2 Perfluor	oalkyl carboxyli	¢	CS3	CS4 (CV <sup>1</sup> )	CS5	CS6	CS7 <sup>2</sup>			
acids											
PFBA		0.8	2	5	10	20	50	250			
PFPeA		0.4	1	2.5	5	10	25	125			
PFHxA		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFHpA		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFOA		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFNA		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFDA		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFUnA		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFDoA		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFTrDA		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFTeDA		0.2	0.5	1.25	2.5	5	12.5	62.5			
Perfluoroalky	l sulfonic acids				_						
PFBS		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFPeS		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFHxS		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFHpS		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFOS		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFNS		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFDS		0.2	0.5	1.25	2.5	5	12.5	62.5			
PFDoS		0.2	0.5	1.25	2.5	5	12.5	62.5			
Fluorotelome	r sulfonic acids										
4:2FTS		0.8	2	5	10	20	50	NA			
6:2FTS		0.8	2	5	10	20	50	NA			
8:2FTS		0.8	2	5	10	20	50	NA			
Perfluoroocta	ne sulfonamide	s									
PFOSA		0.2	0.5	1.25	2.5	5	12.5	62.5			
NMeFOSA		0.2	0.5	1.25	2.5	5	12.5	62.5			
NEtFOSA		0.2	0.5	1.25	2.5	5	12.5	62.5			
Perfluoroocta	ne sulfonamido	acetic acids									
NMeFOSAA		0.2	0.5	1.25	2.5	5	12.5	62.5			
NEtFOSAA		0.2	0.5	1.25	2.5	5	12.5	62.5			
Perfluoroocta	ne sulfonamide	ethanols									
NMeFOSE		2	5	12.5	25	50	125	625			
NEtFOSE		2	5	12.5	25	50	125	625			
Per- and poly	fluoroether car	boxylic acids									
HFPO-DA		0.8	2	5	10	20	50	250			
ADONA		0.8	2	5	10	20	50	250			
PFMPA		0.4	1	2.5	5	10	25	125			
PFMBA		0.4	1	2.5	5	10	25	125			
NFDHA		0.4	1	2.5	5	10	25	125			
Ether sulfonio	e acids		-	-							
9CI-PF3ONS	2	0.8	2	5	10	20	50	250			
11Cl-PF3OUd	S	0.8	2	5	10	20	50	250			
PFEESA		0.4	1	2.5	5	10	25	125			

Calibration Solutions (ng/mL) Compound											
CS1 (LOQ) CS2 Fluorot	elomer carboxyli	c	CS3	CS4 (CV <sup>1</sup> )	CS5	CS6	CS7 <sup>2</sup>				
acids											
3:3FTCA	1.0	2.5	6.26	12.5	25	62.4	312				
5:3FTCA	5.0	12.5	31.3	62.5	125	312	1560				
7:3FTCA	5.0	12.5	31.3	62.5	125	312	1560				
Extracted Internal Standard	(EIS) Analytes										
<sup>13</sup> C <sub>4</sub> -PFBA	10	10	10	10	10	10	10				
<sup>13</sup> C <sub>5</sub> -PFPeA	5	5	5	5	5	5	5				
<sup>13</sup> C <sub>5</sub> -PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5				
<sup>13</sup> C <sub>4</sub> -PFHpA	2.5	2.5	2.5	2.5	2.5	2.5	2.5				
<sup>13</sup> C <sub>8</sub> -PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5				
<sup>13</sup> C <sub>9</sub> -PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25				
<sup>13</sup> C <sub>6</sub> -PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25				
<sup>13</sup> C <sub>7</sub> -PFUnA	1.25	1.25	1.25	1.25	1.25	1.25	1.25				
<sup>13</sup> C <sub>2</sub> -PFDoA	1.25	1.25	1.25	1.25	1.25	1.25	1.25				
<sup>13</sup> C <sub>2</sub> -PFTeDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25				
<sup>13</sup> C <sub>3</sub> -PFBS	2.5	2.5	2.5	2.5	2.5	2.5	2.5				
<sup>13</sup> C <sub>3</sub> -PFHxS	2.5	2.5	2.5	2.5	2.5	2.5	2.5				
<sup>13</sup> C <sub>8</sub> -PFOS	2.5	2.5	2.5	2.5	2.5	2.5	2.5				
<sup>13</sup> C <sub>2</sub> -4:2FTS	5	5	5	5	5	5	5				
<sup>13</sup> C <sub>2</sub> -6:2FTS	5	5	5	5	5	5	5				
<sup>13</sup> C <sub>2</sub> -8:2FTS	5	5	5	5	5	5	5				
<sup>13</sup> C <sub>8</sub> -PFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5				
D3-NMeFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5				
D5-NEtFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5				
D3-NMeFOSAA	5	5	5	5	5	5	5				
D5-NEtFOSAA	5	5	5	5	5	5	5				
D7-NMeFOSE	25	25	25	25	25	25	25				
D9-NEtFOSE	25	25	25	25	25	25	25				
<sup>13</sup> C <sub>3</sub> -HFPO-DA	10	10	10	10	10	10	10				
Non-extracted Internal Stan	dard (NIS) Anal	ytes									
<sup>13</sup> C <sub>3</sub> -PFBA	5	5	5	5	5	5	5				
<sup>13</sup> C <sub>2</sub> -PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5				
<sup>13</sup> C <sub>4</sub> -PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5				
<sup>13</sup> C <sub>5</sub> -PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25				
<sup>13</sup> C <sub>2</sub> -PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25				
<sup>18</sup> O <sub>2</sub> -PFHxS	2.5	2.5	2.5	2.5	2.5	2.5	2.5				
<sup>13</sup> C <sub>4</sub> -PFOS	2.5	2.5	2.5	2.5	2.5	2.5	2.5				

<sup>1</sup>This calibration point is used as the calibration verification (CV)

<sup>2</sup> A minimum of six contiguous calibrations standards are required for linear models and a minimum of seven calibration standards are required for second-order models.

YORK ANALYTICAL LABORATORIES, Inc. Title: PFAS\_LCMSMS1633 Revision 1.1 Effective Date: 02/10/2023

# **Attachment 5 - HPLC Method Parameters**

## **HPLC Acquisition Method Report**



s	troke A										
Automatic Stroke Calculation A							Yes			Injection	
Compress A										Injection with needle	wash
Compressibility Mode A							Com	pressibil	ity Value Set	3.00 µL	
	Compressi	bility A					70 1	0e-6/bar			
C	ompress B										
	Compressi	bility Mode B	5				Com	ipressibil	ity value Set		
6	top Time	ынку в					90 1	ue-6/bar			
3	Stontime M	ode					Time	set			
	Stoptime	ouc					10.0	0 min			
Р	ost Time										
	Posttime M	ode					Time	e set			
	Posttime						1.50	min			
Solv	ent Compos	ition									
	Channel	Name 1	Nam	ne 2	Selected	Used	Perc	cent			
1	A	Water 5mM ammonium acetate			Ch. 1	Yes	90.0	0 %			
2	В	Methanol	<u> </u>		Ch. 1	Yes	10.0	0 %			
Tim	etable		-								
	Time			A			в			Flow	]
1	3.50 min			50.00 %	0		50.00 %	50.00 %		0.400 mL/min	
2	8.00 min			10.00 %			90.00 %	0.00 % 0.400 mL/min			
3	8.50 min			90.00 %			10.00 %	10.00 % 0.400 mL/min			
											]
Nan	ne: Column (	Comp.						Modu	le: G1316C		
Left	Temperature	e Control	~				Tom	poraturo	Set		
+	emperature (	Soution Mode	e				50.0	°C	Set		
F	nable Analys	sis Left Temr	nerati	ure			50.0	0			
-	Enable Ana	Ivsis Left Te	mpe	rature O	n		Yes				
	Enable Ana	lysis Left Te	mpe	rature V	alue		0.8 °	C			
Righ	nt Temperatu	re Control	•								
R	ight tempera	ture Control	Mod	le			Tem	perature	Set		
R	ight tempera	ture					50.0	°C			
E	nable Analys	sis Right Ten	npera	ature							
Enable Analysis Right Temperature On							Yes	Yes			
Enable Analysis Right Temperature Value 0.8 °C											
stop	o Time	-									
Stoptime Mode As pump/injector											
Post Time Desting Mede											
Tim	Postume Mode Off										
Valv	e Position						Posi	tion 1 (Pr	ort 1 -> 2)		
Rea	dy when fror	nt door open					Yes				
	ready when none door open Tes										

# Attachment 6 - Triple Quadrupole Acquisition Method

Acquisition Method Report	0
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🌾 Agilent Technologies

Acquisitio	on Me	thod In	б											
Method Nam	e		PFA\$1633_ACQ_092922.m											
Method Path			D	D:\MassHunter\methods\PFAS1633_ACQ_092922.m										
Method Desc	ription		E	EPA 1633_Target PFAS Isotope Dilution_Acquisition										
Device List HiP Sample Binary Pun Column Co QQQ	er np omp.													
MS QQQ Ma	ss Spec	tro meter:												
lon Source			A	US ESI			Tune Fi	e		D:\MassH \atunes.T	lunter\Tune UNE.XML	\QQQ\G6460	с	
Stop Mode Time Filter LC->Waste Pr Time Segment	re Row		N C N	Vo Limit/As Pi Dn V/A	ump		Stop Tir Time Fil LC->Wa	ne (min) ter Width (n ste Post Row	nin) r	1 0.07 N/A				
Index	1	Start Time	5c	an Type	lon Mo	de	Div Valve	Delta EM	/ Store	ο Ογα	le Time	Triggered?	MRM R	epeats
1		(min) C	) Dy	namicMRM	ESI+Agiler Strear	nt Jet n	To MS	35	D Yes		(ms) 550	Yes		З
Time Segment	:1													
5can 5egment	s													
Cpd Name	ISTD?	Prec	lon	MS1 Res	Prod lon	MS2 Res	s Primary	Trigger	Frag (V)	CE(V)	Cell Acc (V)	RetTime (min)	Ret Window	Polarity
11-C⊦ PF3OUdS	No		631	Unit/Enh (6490)	451	Unit/Enh (6490)	Yes	No	170	33	4	7.62	3	Negative
1H,1H,2H, 2H- perfluoro-1	No		527	U nit/Enh (6490)	507	Unit/Enh (6490)	Yes	No	170	28	4	7.14	3	Negative
decanesulf onate (8 2F TS) 1H,1H,2H, 2H- perfluoro-1	No		527	U nit/Enh (6490)	80.9	Unit/Enh (6490)	Yes	No	170	40	4	7.14	3	Negative
decanesulf onate (8 2F TS) 1H, 1H, 2H, 2H- perfluoro-1	No		327	U nit/Enh (6490)	307	Unit/Enh (6490)	Yes	No	162	20	4	4.788	3	Negative
hexanesulf onate (4 2F TS) 1H,1H,2H, 2H- perfluoro-1	No		327	U nit/Enh (6490)	80.9	Unit/Enh (6490)	Yes	No	162	36	4	4.788	3	Negative
hexanesulf onate (4 2F TS) 1H, 1H,2H, 2H perfluoro 1	No		427	U nit/Enh (6490)	407	Unit/Enh (6490)	Yes	No	162	24	4	6.168	3	Negative
octanesulf onate (6 2F TS) 1H,1H,2H, 2H- perfluoro-1	No		427	U nit/Enh (6490)	79.7	Unit/Enh (6490)	Yes	No	162	48	4	6.168	3	Negative
octanesulf onate (6 2FTS)														
3:3FTCA	No		241	Unit/Enh (6490)	177	Unit/Enh (6490)	Yes	No	74	4	4	3.4	3	Negative
3-3FTCA	No		241	Unit/Enh	117	Unit/Enh	Yes	No	74	44	4	3.4	3	Negative

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## **Acquisition Method Report**

Agilent Technologies

Cpd Name	ISTD?	Prec lon	MS1 Res	Prod lon	MS2 Res	Primary	Trigger	Frag (V)	CE(V)	Cell Acc	Ret Time (min)	Ret Window	Polarity
5-3FTCA	No	341	Unit/Enh (6490)	237	Unit/Enh (6490)	Yes	No	84	12	4	5.73	3	Negative
5-3FTCA	No	341	Unit/Enh (6490)	217	Unit/Enh (6490)	Yes	No	84	24	4	5.73	3	Negative
7-3FTCA	No	441	Unit/Enh (6490)	337	Unit/Enh (6490)	Yes	No	76	12	4	6.7	3	Negative
7-3FTCA	No	441	Unit/Enh (6490)	317	Unit/Enh (6490)	Yes	No	76	24	4	6.7	3	Negative
9-CI- PF3ONS	No	531	Ù nit/Énh (6490)	351	Únit/Énh (6490)	Yes	No	175	29	4	6.89	3	Negative
ADONA	No	377	Ù nit/Énh (6490)	251	Únit/Énh (6490)	Yes	No	103	9	4	5.62	3	Negative
ADONA	No	377	Ú nit/Énh (6490)	85	Únit/Énh (6490)	Yes	No	103	37	4	5.62	3	Negative
d3- NMeFOSA	No	515	Unit/Enh (6490)	219	Unit/Enh (6490)	Yes	No	134	20	4	7.17	3	Negative
d3-N- MeFOSAA	No	572.99	Unit/Enh (6490)	418.8	Unit/Enh (6490)	Yes	No	130	20	4	7.17	3	Negative
d5- NE1FOSA	No	531	Unit/Enh (6490)	219	Unit/Enh (6490)	Yes	No	150	20	4	8.52	3	Negative
d5- NETFOSA	No	531	Unit/Enh (6490)	169	Unit/Enh (6490)	Yes	No	150	20	4	8.52	3	Negative
d5-N- EtFOSAA	No	589.02	U nit/Enh (6490)	530.9	Unit/Enh (6490)	Yes	No	130	20	4	7.36	3	Negative
d5-N- EtFOSAA	No	589.02	0 nit/Enh (6490)	418.8	Unit/Enh (6490)	Yes	No	130	20	4	7.36	3	Negative
d7- NMeFOSE	No	623	Unit/Enh (6490)	310	Unit/Enh (6490)	Yes	No	150	15	4	8.28	3	Negative
d7- NMeFOSE	No	623	0 nit/Enh (6490)	59	Unit/Enh (6490)	Yes	No	88	15	4	8.28	3	Negative
d9- NETFOSE	No	639	0 nit/Enh (6490)	59	0nt/Enh (6490)	Yes	No	150	15	4	8.6	3	Negative
HEPO-DA	NO	285	0 nt/Enh (6490)	169.1	(6490)	Yes	NO	100	20	4	4.95	3	Negative
M2-4-2F18	NO	329	(6490)	309	(6490)	Yes	NO	156	20	4	4.787	3	Negative
M2-4-2FTS	NO	329	(6490)	81	(6490)	Yes	NO	156	28	4	4.787	3	Negative
M2-6-2FTS	NO	429	(6490)	409	0nt/Enh (6490)	Yes	NO	162	24	4	6.01	3	Negative
M2-6-2FTS	NO	429	(6490)	81	(6490)	Yes	NO	162	40	4	6.01	3	Negative
NIZ-8-2115	NO	529	(6490)	01	(6490)	Yes	NO	100	28	4	0.96 6.00	3	Negative
MODE TOD	No	745	(6490)	670	(6490)	Vec	No	201	40	4	0.30		Negative
M2FFTED A M2 UEDO	No	7 IS 207	(6490)	160	(6490)	Vac	No	02	5	4	4.00	2	Negative
DA	Vec	207	(6490)	103	(6490)	Vee	No	90	5	4	4.35	2	Negative
MOPERS	No	210	(6490)	08.0	(6490) Unit/Enh	Vec	No	11/1	37	4	3.04	2	Negative
MOPERS	No	302	(6490) Unit(Enh	30.3 79.9	(6490) Unit/Enh	Yes	No	114	/0		3.04	3	Negative
M3PEHys	No	402	(6490) Unit(Enh	98.9	(6490) Unit/Enh	Yes	No	165	-0	4	5.65	3	Negative
M3PFHxS	No	402	(6490) 11 nit/Enh	80	(6490) Unit/Enh	Yes	No	165	 48	4	5.55	3	Negative
M4PF HnA	No	367	(6490) U nit/Enh	322	(6490) Unit/Enh	Yes	No	124	8	4	5.601	3	Negative
M5PFHxA	No	318	(6490) U nit/Enh	273	(6490) Unit/Enh	Yes	No	70	4	4	5.47	3	Negative
M5PFH <sub>X</sub> A	No	318	(6490) U nit/En h	120	(6490) Unit/Enh	Yes	No	70	4	4	5.47	3	Negative
M6PFDA	No	519	(6490) U nit/En h	473.9	(6490) Unit/Enh	Yes	No	59	8	4	6.99	3	Negative
M7PFUdA	No	570	(6490) U nit/En h	525	(6490) Unit/Enh	Yes	No	64	8	4	7.38	3	Negative
MPFDA	Yes	514.98	(6490) U nit/En h	469.8	(6490) Unit/Enh	Yes	No	94	5	4	6.972	2	Negative
MPFHxA	Yes	314.99	(6490) U nit/En h	269.8	(6490) Unit/Enh	Yes	No	86	4	4	4.705	2	Negative
MPFH×A	Yes	314.99	(6490) U nit/En h	120	(6490) Unit/Enh	Yes	No	86	4	4	4.705	2	Negative
MPFH×S	Yes	403	(6490) U nit/En h	103	(6490) Unit/Enh	Yes	No	110	37	4	5.63	2	Negative
MPFH×S	Yes	403	(6490) U nit/En h	84	(6490) Unit/Enh	Yes	No	110	40	4	5.63	2	Negative
MPENA	Yes	468	(6490) U nit/En h	423	(6490) Unit/Enh	Yes	No	66	4	4	6.541	2	Negative
MPFOA	Yes	417	(6490) U nit/En h	372	(6490) Unit/Enh	Yes	No	84	4	4	6.03	2	Negative
MPFOS	Yes	502.96	(6490) U nit/En h	99	(6490) Unit/Enh	Yes	No	148	48	4	6.57	3	Negative
			(6490)		(6490)								

Report generation date: 18-Oct-2022 09:01:43 AM

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## **Acquisition Method Report**

Agilent Technologies

Cpd Name	ISTD?	Prec lon	MS1 Res	Prod lon	MS2 Res	Primary	Trigger	Frag (V)	CE(V)	Cell Acc	Ret Time (min)	Ret	Polarity
MPFOS	Yes	502.96	Unit/Enh	80	Unit/Enh	Yes	No	148	54	4	6.57	3	Negative
NETFOSA	No	526	(6490) Unit/Enh (6400)	219	(6490) Unit/Enh (6490)	Yes	No	120	20	4	8.528	3	Negative
NEFFOSA	No	526	(6490) Unit/Enh (6490)	169	(0490) Unit/Enh (6490)	Yes	No	120	20	4	8.528	3	Negative
N- EtFOSAA	No	584	Unit/Enh (6490)	525.9	Unit/Enh (6490)	Yes	No	130	20	4	7.521	3	Negative
N- EtFOSAA	No	584	Unit/Enh (6490)	418.8	Unit/Enh (6490)	Yes	No	130	20	4	7.521	3	Negative
NEFOSE	No	630	Unit/Enh (6490)	59	Unit/Enh (6490)	Yes	No	120	20	4	8.301	3	Negative
NFDHA	No	295	Unit/Enh (6490)	201.1	Unit/Enh (6490)	Yes	No	92	2	4	4.641	3	Negative
NFDHA	No	295	Únit/Enh (6490)	84.9	Únit/Énh (6490)	Yes	No	92	34	4	4.641	3	Negative
NMeFOSA	No	512	Ù nit/Énh (6490)	219	Únit/Énh (6490)	Yes	No	120	20	4	8.298	3	Negative
NMeFOSA	No	512	Únit/Énh (6490)	169	Únit/Énh (6490)	Yes	No	120	20	4	8.298	3	Negative
N- MeFOSAA	No	570	Únit/Enh (6490)	511.9	Únit/Énh (6490)	Yes	No	150	20	4	7.335	3	Negative
N- MeFOSAA	No	570	Ünit/Enh (6490)	418.9	Ünit/Enh (6490)	Yes	No	150	20	4	7.335	3	Negative
NMeFOSE	No	616	Unit/Enh (6490)	59	Unit/Enh (6490)	Yes	No	120	20	4	8.301	3	Negative
Perfluoro-1	No	506	Ünit/Enh (6490)	78	Unit/Enh (6490)	Yes	No	162	48	4	7.59	3	Negative
[13C8]octa nesulfona mide													
Perfluoro-1	No	507	U nit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	174	48	4	6.59	3	Negative
[1308]octa nesulfonic acid			(,		(,								
Perfluoro-1 [13C8]octa	No	507	U nit/Enh (6490)	80	Unit/Enh (6490)	Yes	No	174	54	4	6.59	3	Negative
nesulfonic acid (MBPFOS) Bodfuero 1	No	500.0	Ligit/Eab		lla#/Eab	Vac	No	156	50	4	7648	2	Nogativo
decanesulf onate (L-	NU	096.9	(6490)	30.3	(6490)	165	NU	150	50	4	7.340	3	weyanve
PFDS) Perfluoro-1 decanesulf	No	598.9	U nit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	100	60	4	7.546	3	Negative
onate (L- PFDS)													
Perfluoro-1 heptanesul	No	448.9	U nit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	162	48	4	6.252	3	Negative
fonate (L- PF HpS) Perfluoro-1	No	448.9	Unit/Enh	80	Unit/Enh	Yes	No	162	48	4	6.252	3	Negative
heptanesul fonate (L-			(6490)		(6490)								-
PFHpS) Perfluoro-1	No	497.9	Unit/Enh (6490)	478	Unit/Enh (6490)	Yes	No	156	100	4	7.651	3	Negative
onamide (FOSA) Perfluoro 1	No	497.9	Unit/Enh	78	Unit/Enh	Yes	No	156	40	4	7.651	3	Negative
octanesulf onamide	•		(6490)		(6490)							5	
(FOSA) Perfluoro-1	No	348.9	Unit/Enh	98.9	Unit/Enh	Yes	No	150	36	4	5.042	3	Negative

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No

pentanesul fonate (L-PFPeS) Perfluoro 1

pentanesul fonate (L-PFPeS)

348.9 Unit/Enh (6490)

348.9 Unit/Enh (6490)

98.9 Unit/Enh (6490)

79.9 Unit/Enh (6490)

Yes

No

150

40

4 5.042

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3 Negative

## Acquisition Method Report

Agilent Technologies

									-	45	5		
Cpd Name	ISTD?	Prec lon	MS1 Res	Prod lon	MS2 Res	Primary	Trigger	Frag (V)	CE(V)	Cell Acc	Ret Time	Ret	Polarity
Perfluorob utanesulfo nic acid	No	298.9	U nit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	150	32	4	4.042	3	Negative
(PFBS) Perfluorob utanesulfo nic acid	No	298.9	U nit/Enh (6490)	79.9	Unit/Enh (6490)	Yes	No	150	36	4	4.042	3	Negative
(PFBS) Perfluorod ecanoic acid	No	513	Unit/Enh (6490)	468.8	Unit/Enh (6490)	Yes	No	90	8	4	7.158	3	Negative
(PFDA) Perfluorod ecanoic acid	No	513	U nit/Enh (6490)	268.8	Unit/Enh (6490)	Yes	No	90	16	4	7.158	3	Negative
(PFDA) Perfluorod odecanes u Ifonic acid	No	699	U nit/Enh (6490)	99	Unit/Enh (6490)	Yes	No	100	60	4	7.984	3	Negative
(PFDOS) Perfluorod odecanes u Ifonic acid	No	699	U nit/Enh (6490)	80	Unit/Enh (6490)	Yes	No	156	50	4	7.984	3	Negative
Perfluorod odecanoic acid	No	613	Unit/Enh (6490)	568.8	Unit/Enh (6490)	Yes	No	90	12	4	7.876	3	Negative
Perfluorod odecanoic acid	No	613	Unit/Enh (6490)	168.7	Unit/Enh (6490)	Yes	No	90	28	4	7.876	3	Negative
Perfluoroh eptanoic acid	No	363	Unit/Enh (6490)	318.8	Unit/Enh (6490)	Yes	No	90	8	4	5.601	3	Negative
Perfluoroh eptanoic acid	No	363	Unit/Enh (6490)	168.9	Unit/Enh (6490)	Yes	No	90	16	4	5.601	3	Negative
Perfluoroh exanesulfo nic acid	No	398.9	U nit/Enh (6490)	98.9	Unit/Enh (6490)	Yes	No	150	40	4	5.685	3	Negative
Perfluoroh exanesulfo nic acid	No	398.9	Unit/Enh (6490)	79.9	Unit/Enh (6490)	Yes	No	150	44	4	5.685	3	Negative
Perfluoroh exanoic acid (PEHyA)	No	313	U nit/Enh (6490)	268.9	Unit/Enh (6490)	Yes	No	70	4	4	4.856	3	Negative
Perfluoroh exanoic acid	No	313	Unit/Enh (6490)	119	Unit/Enh (6490)	Yes	No	70	20	4	4.856	3	Negative
Perfluoro n-[1,2- 13C2]dode canoic acid	No	615	U nit/Enh (6490)	570	Unit/Enh (6490)	Yes	No	53	8	4	7.71	3	Negative
(MPF DoA) Perfluoro- n- [13C4]buta noic acid	No	217	Unit/Enh (6490)	172	Unit/Enh (6490)	Yes	No	59	4	4	1.22	3	Negative
(MPFBA) Perfluoro- n- [13C54]pe ntanoic	No	268	U nit/Enh (6490)	223	Unit/Enh (6490)	Yes	No	62	4	4	3.44	3	Negative
acid (M5PFPeA )												_	
Perfluoro- n- [13C8]octa noic acid (M9PECA)	No	421	Unit/Enh (6490)	376	UntvEnh (6490)	Yes	No	59	4	4	6.05	3	Negative
Perfluoro- n- [13C8]octa noic acid (M8PFOA)	No	421	U nit/Enh (6490)	172	Unit/Enh (6490)	Yes	No	59	16	4	6.05	3	Negative

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Acquis	sition	Method	Report

Agilent Technologies

#### RetTime (min) 6.56 Ret Window 3 Cpd Name ISTD? Precion MS1 Res Prod Ion MS2 Res Primary Trigger Frag (V) CE(V)Cell Acc Polarity (V) 4 472 Unit/Enh (6490) 427 Unit/Enh (6490) Perfluoro-No Yes No 59 8 Negative n-[13C9]non anoic acid (M9PFNA) Perfluoro-472 Unit/Enh (6490) 223 Unit/Enh (6490) 59 16 6.56 No Yes No 4 3 Negative п-[1309]поп anoic acid (M9PFNA) Perfluoro-n-butanoic No 213 Unit/Enh (6490) 168.9 Unit/Enh (6490) No 70 4 4 1.246 3 Negative Yes acid (PFBA) Perfluoron 548.9 Unit/Enh 98.9 Unit/Enh 159 48 7.174 3 Negative No Yes No 4 on an es ul fo (6490) (6490) nate (L-PF NS) PFNS) Perfluoron onanes ulfo nate (L-PFNS) Perfluoron onanoic acid No 548.9 Unit/Enh 79.9 Unit/Enh Yes No 159 48 4 7.174 3 Negative (6490) (6490) 463 Unit/Enh (6490) 418.8 Unit/Enh (6490) 8 No Yes No 90 4 6.718 3 Negative acid (PFNA) Perfluoron No 463 Unit/Enh (6490) 218.8 Unit/Enh (6490) Yes No 90 16 4 6.718 3 Negative опапоіс acid (PFNA) Perfluoro 263 Unit/Enh (6490) 219 Unit/Enh (6490) No Yes No 62 4 4 3.526 3 Negative n-pentanoic acid (PF PeA) Perfluoroo 498.9 Unit/Enh 98.9 Unit/Enh 6.743 3 Negative No 150 44 No Yes 4 ctanesulfo (6490) (6490) ctanesulfo nic acid (PFOS) Perfluoroo ctanesulfo nic acid (PFOS) Perfluoroo ctanoic acid No 498.9 Unit/Enh (6490) 79.9 Unit/Enh (6490) Yes No 150 84 4 6.743 3 Negative 413 U nit/Enh (6490) 368.8 Unit/Enh (6490) No No 90 8 4 6.202 3 Negative Yes acid (PFOA) Perfluoroo No 413 Unit/Enh (6490) 168.9 Unit/Enh (6490) Yes No 90 16 4 6.202 3 Negative ctanoic ctanoic acid (PFOA) Perfluorote tradecanoi c acid (PFTA) 713 Unit/Enh (6490) 669 Unit/Enh (6490) No Yes No 110 12 4 8.414 3 Negative 713 Unit/Enh 168.8 Unit/Enh 110 28 4 8.414 3 Negative Perfluorote No Yes No tradecanoi (6490) (6490) c acid (PFTA) (PETA) Perfluorotri decanoic acid (PETrDA) Perfluorou ndecanoic 663 Unit/Enh (6490) 618.8 Unit/Enh (6490) No Yes No 90 12 4 8.164 3 Negative 563 Unit/Enh (6490) 519 Unit/Enh (6490) 90 8 7.538 3 Negative No Yes No 4 acid (PFUnA) 563 Unit/Enh 169 Unit/Enh 90 24 7.538 3 Negative Perfluorou No Yes No 4 ndecanoic (6490) (6490) acid (PFUnA) PFEESA 135 Unit/Enh (6490) 83 Unit/Enh (6490) 85 Unit/Enh No 315 Unit/Enh Yes No 112 26 4 4.464 3 Negative (6490) 315 Unit/Enh (6490) 279 Unit/Enh PFEESA No No 112 14 4 4.464 Yes 3 Negative PEMBA No 75 18 4 4.011 Yes No 3 Negative (6490) 229 Unit/Enh (6490) 85 Unit/Enh PEMPA 6 No Yes No 59 4 2.15 3 Negative

#### Scan Parameters

Data Stg Threshold

Centroid

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		Acquisi	tion Method Report	Agilent Technologies
Source Parameters				
Parameter Gas Temp (*C)	Value (+) 230	Value (-) 230		
Gas How (I/min) Nebulizer (pci)	5	5		
SheathGasHeater	350	350		
SheathGasFlow	12	12		
Capillary (V)	3500	2500		
Chrometograms		<i>v</i>		
Chrom Type TIC	Label TIC	Offset 0	Y-Range 10000000	
Instrument Curves				
Actual				
Name: HiP Sampl	er		Module: G4226A	
Auxiliary				
Draw Speed			100.0 µL/min	
Eject Speed			400.0 μL/min	
Draw Position (	Offset		1.5 mm	
Wait Time After	Drawing		1.2 s	
Sample Flush C	Dut Factor		5.0	
Vial/Well bottor	n sensing		Yes	
Injection				
Injection Mode			Injection with needle wash	
Injection Volum	ne		3.00 µL	
Needle Wash				
Needle Wash	1 Location		Flush Port	
Wash Time			10.0 s	
High throughput	.)(-luma Deduction		ble	
Automatic Dela	y volume Reduction		NU	
En abla Overlap	loopad Injaction		No	
Valve Switching	apped injection		110	
Valve Movemer	te		0	
Valve Switch Ti	ima 1		0	
Switch Time	1 Enabled		No	
Valve Switch Ti	me 2		140	
Switch Time	2 Enabled		No	
Valve Switch Ti	me 3			
Switch Time	3 Enabled		No	
Valve Switch Ti	ime 4			
Switch Time	4 Enabled		No	
Stop Time				
Stoptime Mode			As pump/No limit	
Post Time				
Posttime Mode			Off	
Name: Binary Pur	np		Module: G4220A	
Flow			0.400 mL/min	
Use Solvent Type:	S		No	
Stroke Mode			Synchronized	
Low Pressure Lim	rt.		U.00 bar	
High Pressure Lin	nπ		600.00 bar	
Max. Flow Ramp L	h		100.000 mL/min <sup>2</sup>	
Max. Flow Ramp D	own		100.000 mL/min*	
Expected Mixer			INU CRECK	

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# QAPP ATTACHMENT 5

## RENEE G. COHEN 2815 Covered Bridge Road Merrick, NY 11566 516-223-9761 FAX 516-223-0983 rgcs70@aol.com

#### EXPERIENCE PREMIER ENVIRONMENTAL SERVICES, Merrick, New York

Perform organic and inorganic data validation according to the various protocols from the USEPA EPA CLP, NYS ASP and USEPA Test Methods for the Evaluation of Solid Waste, Methods for the Chemical Analysis of Water and Waste and the Federal Register. Use the USEPA National Functional Guidelines for Organic and Inorganic Data Validation (where applicable) as well as State (NYS DEC ASP/DUSR) and EPA Region requirements to report on laboratory data quality and data usability. Review and write Quality Assurance Project Plans using Regional and State guidelines for Remedial Investigations, Ground Water Monitoring programs and Superfund Programs. Review data and work plans as they relate to project data quality objectives. Conducts seminars on client specific topics. Perform on-site laboratory QA/QC audits as required by the client and site-specific work plans. Has performed ASTM Phase 1 Assessments for engineering firms when requested.

### ENVIRONMENTAL QUALITY SERVICES, INC., Farmingdale, New York

#### 1/2011-11/11 QA Manager

(30 hrs/wk)

Perform the data review and report compilation of organic and inorganic data for report preparation. Review data for compliance with method as well as data quality objectives for specific client work plans. Perform departmental audits in compliance with NELAC and internal lab mandates. Revise laboratory logbooks for bench chemists. Revised/updated laboratory SOP's for method compliance. Participate in on-site audits by both state representatives and commercial clients. Coordinate PT studies for analyte certification for laboratory certifications. Insure analyte certification for client project requirements. Responsible for the review of new and/or updated method and implementation of these methods within the laboratory.

### ENVIRONMENTAL TESTING LABORATORIES, Farmingdale, New York

#### 8/2010-1/2011 QA Manager

(25-30 hrs/wk) Perform the data review and report compilation of organic and inorganic data for report preparation. Perform departmental audits in compliance with NELAC and internal lab mandates. Revise laboratory logbooks for bench chemists. Revised/updated laboratory SOP's for method compliance. Participate in on-site audits by both state representatives and commercial clients. Coordinate PT studies for analyte certification for laboratory certifications. Insure analyte certification for client project requirements.

## **Renee Cohen – Page 2**

#### SOUTH MALL ANALYTICAL LABORATORIES, Plainview, New York

#### 10/2004-12/2009 QA Manager (Part Time)

(10 hrs/wk) Responsible for the overall QA program at the laboratory. Revised, updated and prepared SOP's for method compliance. Wrote and prepared the annual updates to laboratory Quality Assurance Manual. Perform audits of laboratory systems and methods. Prepare corrective action reports and follow-up to audit deficiencies. Oversee client and agency on-site audits. Contact with clients to discuss sampling plans, regulations, and required analyses. Perform the data review and report compilation of organic and inorganic data for reporting. Revised all laboratory logbooks and methods to comply with EPA and method guidelines. Handled document control of logbooks, SOP's, QAPP's. Performed annual data integrity and ethics seminars for all employees. Report directly to senior management.

## ENVIRONMENTAL TESTING LABORATORIES, Farmingdale, New York

- 5/2002-10/2003 QA Specialist
- (20-24 hrs/wk) Performed the data review and report compilation of organic and inorganic data for report preparation. Performed departmental audits in compliance with NELAC and internal lab mandates. Helped to revise laboratory logbooks for bench chemists. Revised/updated laboratory SOP's for method compliance. Participated in on-site audits by both state representatives and commercial clients.

### KEYSPAN LABORATORY SERVICES, Brooklyn, New York

2/1999-5/2002 Consultant

Developed laboratory QAPP (in accordance with NELAC) and Chemical Hygiene Plan. Modified and updated laboratory SOP's. Perform audits in the different work areas. Maintained the NYS DOH proficiency program for analytes of interest. Review data for completeness and QC criteria. Implemented client inquiry system. Performed QC training and method training for bench and field chemists. Developed protocols and documentation for field PCB wipe sampling. Responsible for update/maintenance of laboratory state certifications and approvals.

#### NYTEST ENVIRONMENTAL INC., Port Washington, New York

## 1994-1998 Quality Assurance Officer

Responsible for the overall quality program at the laboratory. This included the auditing test methods, systems and data reporting. Performed the review of 10% of all data reports prior to submission to client. Oversaw the training program of new employees. Maintain the documentation of the training records. Review and maintain state certification paperwork and SOP files. Update and file annual MDL datum. Worked with sales and customer service to ensure that client needs are met. Respond to client data inquires. Work with state and federal auditors for review of laboratory to receive certification. Successfully lead the laboratory to an Army Corp of Engineer validation.

## **Renee Cohen – Page 3**

#### 1989-1993 ENSECO EAST, Somerset, New Jersey

QA/QC Scientist - Performed organic and inorganic audits of the laboratory. Performed and coordinated corrections and revisions to data reports. Wrote and reviewed laboratory Quality Assurance Project plans (QAPjP's) for client specific projects. Developed and led seminars for both client and employees on a number of topics including; data quality objectives, data review vs. data validation and laboratory QC. Interacted with clients, project managers and state personnel for regulatory concerns and data/lab issues. Performed lab audits for method compliance and project specific requirements. Acted as the Technical Representative for Ensecos EPA 3/90 Organic CLP Contract.

#### 1988-1989 INTECH BIOLABS, East Brunswick, New Jersey

QA/QC Manager - Responsible for the review of all organic and inorganic data. Performed general laboratory and safety audits. Recorded and charted all QA/QC data. Reviewed and assembled all CLP organic data reports.

## 1986-1988 INTERNATIONAL TECHNOLOGIES CORPORATION, Edison, New Jersey

Central Laboratory Chemist - REAC and EERU Contract for the Emergency Response Branch (ERB) of the USEPA. Responsible for the organic and inorganic extraction of environmental samples according to EPA Methods. This included both metals digestion as well as organic extraction's for semivolatiles, pesticides and PCB's. Performed Volatile Organic analyses using Gas Chromatography, Total Petroleum Hydrocarbon Analysis by IR, Metal Analyses by both Graphite Furnace AA and ICP. Field experience included s on site analyses for both metals and GC volatiles.

#### 1985-1986 U.S. TESTING COMPANY, Hoboken, New Jersey

Chemist - Responsible for the digestion and analysis of both soil and aqueous samples for metals according to USEPA CLP and SW 846 protocols. Responsible for the analysis of sample digestates using the Varian Graphite Furnace Atomic Absorption Spectrophotometer and a Jerall Ash ICP-61.

#### **Education**

B.S. Environmental Science, December 1984B.S. Biology, May 1984Old Dominion University, Norfolk, Virginia

20 hours of Chemistry coursework Graduate Coursework - Rutgers University, New Brunswick, New Jersey Long Island University at C.W. Post, Glen Cove, New York

## **Continuing Education**

Good Laboratory Practice (GLP) - June 1992, Center for Professional Development, East Brunswick, New Jersey

40 Hour Course, Region II-Edison, NJ (1987) 24 Hour Refresher Course (1988, 1989, 1991)

### **References**

Available upon request.

# QAPP ATTACHMENT 6



## RACHEL ATAMAN, PG PRESIDENT

## **SUMMARY OF EXPERIENCE**

Having worked in the environmental field since 2003, I have a vast understating of the Environmental world in New York State. I have worked on multiple projects ranging from Phase I ESAs, Phase II ESAs, Mold Investigations to New York State Brownfield Cleanup Projects. Additionally, I have worked closely with clients to meet their specific project needs such as deadlines, project grants and program requirements. Using my vast experience I also assisted clients in cost estimates for future investigations or remediations.

## **RELEVANT PROJECT EXPERIENCE**

- Recently completed the investigation and Remedial Design for a 3-story building on Moffat Street in Brooklyn. The investigation included the installation and sampling of a series of soil probes, monitoring wells and soil vapor probes. The remedial design included the excavation and property disposal of soils within the foundation and the installation of a vapor barrier beneath the foundation. The Investigation and Remedial Design were approved by the New York City Office of Environmental Projection since the site is going through a zoning variance.
- Was instrumental in entering the first site (Pelham Parkway) into New York City Brownfield Cleanup program (BCP) and bringing Mayor Bloomberg to the Site to announce the start of the City's BCP. I then managed the environmental requirements of the site including City Environmental Quality Review, Phase I ESAs, Site Investigations, Remedial Action Work Plans and the Site Remedation during development.
- Managed a large variety of New York City Brownfield Cleanup Projects including the preparation of the Site Investigation Work Plans, implementation of the fieldwork, the preparation of Site Investigation Report and Remediation Action Plans. Also successfully managed the implementation of Remedial Action Plans during fieldwork. On a site location on North 8th Street in Brooklyn, New York, supervised the removal of 10,000 tons of contaminated soil and the installation of a vapor barrier and sub-slab depressurization system.
- Knowledgeable in the characterization of soil for disposal. On a NYC BCP site located on Third Avenue in the Bronx I successfully investigated and managed the disposal of over 2,000 tons of hazardous soil.
- Sucessfully investigated and managed the closure of hundreds of NYSDEC Spill Sites. For example she recently completely the closusre of a Spill on Anthony Avenue by investigating soils and determining a subsurface impact was not identified. Additionally, successfully remediated a site on Burnside Avenue in Inwood through the removal of three underground storage tanks (USTs), over 100 tons of petroleum contaminated soil, the injection of Oxygen Releasing Compounds (ORC) and the performance of monthly monitoring and quarterly sampling of

groundwater over a 2 year period. The remediation was successful in reducing the levels of contamination in groundwater and the NYSDEC Spill number was closed.

- Supervised the removal of four underground storage tanks for the Rockland County Sewer District and continue to work with the RCSD on the update of the Sewer Plants from underground storage tanks to above ground storage tanks.
- Performed hundreds of Phase I ESA site inspections and has reviewed and written hundreds of Phase I ESAs as well. Based upon the results of the Phase I ESA, determined the proper scope of work for the Phase II ESAs, prepared Phase II ESA scopes of work and proposals and then properly implemented the Phase II ESA.

## **Technical Responsibilities:**

Coordinates work with regulatory agencies and organizes project schedules with clients, project geologists, and field managers. Phase I and Phase II Environmental Site Assessments Design and Management of Site Investigations "E"-Designations Site Supervision and Remediation Environmental Assessment Statements Mold testing Air Quality/control Technical review of assessment reports, remedial action plans, mold investigations Remedial Action: Implemented numerous Remedial Action Plans. Supervised the construction and managed the operation of numerous hydrocarbon and chlorinated solvent remediation systems for soil and groundwater.

## **EDUCATION**

BS Geology, SUNY Stony Brook, 2001

## Affiliations/Certifications:

New York State Professional Geologist License #000900

Certified GPR Operator (Subsurface Interface Radar in Engineering)

10-Hour OSHA Hazard Recognition Training for The Construction Industry Course on 2/13/2018 Certified by ASTM for the E-1527 Phase I ESA

## PUBLICATIONS

"Sick Building Syndrome: How it is affecting you and what you can do about it" New York Real Estate Journal.

"Managing Lead-Based Pain in Houses/Apartments" New York Real Estate Journal

"Without Profit Brownfield Development will Not be Sustaniable" New York Real Estate Journal "What are the options for Soil Disposal During the Construction of the Next Property" New York Real Estate Journal



## Gabrielle Castro

Senior Project Manager for Touchstone Environmental Geology, P.G.

## SUMMARY OF EXPERIENCE

Working in various sections of environmental sciences throughout the course of my career has provided me with an understanding of the local environment in New York State. I have worked on projects including Phase I and Phase II Environmental Site Assessments as well as New York Brownfield Cleanup Projects and investigations for the New York City Office of Environmental Remediation. Throughout my career, I have worked effectively to meet deadlines and program requirements and to ensure accuracy in the data I have collected and analyzed.

## **RELEVANT PROJECT EXPERIENCE**

- Recently completed waste characterization testing as part of a Phase II Investigation on Fulton Street in Brooklyn, New York. The investigation included the installation, sampling, and collection of a series of soil probes. The investigation and Remedial Design were approved by the New York City Office of Environmental Remediation.
- Written a number of for Phase I Environmental Site Assessments (ESAs). Recommendations for Phase II ESAs were then based upon the results of the Phase I ESAs and Phase II ESAs were then properly implemented.
- Knowledgeable in soil disposal characterization. Supervised the excavation and disposal of soil at a site on Jericho Turnpike in Queens, New York.
- Performed a Phase I ESA site inspection at 88 North 1<sup>st</sup> Street in Brooklyn, New York. Based upon the results of the Phase I ESA, the proper scope of work for a Phase II ESA was determined and a Phase II ESA scope of work and proposal was prepared.
- Managed a variety of New York City Brownfield Cleanup Projects including the preparation of the Remedial Investigation Work Plans, Remedial Action Work Plans, and implementation of the fieldwork.
- Successfully managed the implementation of Remedial Action Plans during fieldwork.

## **TECHNICAL RESPONSIBILITIES**

- Compile information on properties for Phase I and Phase II Environmental Site Assessments.
- Conduct Phase I and Phase II Environmental Site Assessments.
- Management of site investigations and site supervision.
- Conduct air quality/dust monitoring control.
- File Freedom of Information Act (FOIA) Requests with various agencies to collect further information about the properties in order to assess the environmental quality.
- Create reports to evaluate the potential environmental impacts associated with the Subject Properties.

- Supervise disposal of excavated soil.
- Collect indoor and outdoor air samples, soil vapor samples, and soil probe samples for laboratory analyses.
- Air Quality/Control

## **EDUCATION**

Master of Science Integrated Biology, *Hofstra University*, Hempstead, NY, December 2019 Bachelor of Science Biology, *SUNY University at Albany*, Albany, NY, May 2014

## CERTIFICATIONS

OSHA Outreach Certification ASTM Training and E-Learning: Phase I & II ESA Workshop September 14, 2020 October 1, 2020



Project Manager for Touchstone Environmental Geology, P.G.

## **RELEVANT PROJECT EXPERIENCE**

- Performance of Phase I Environmental Site Assessment (ESA) inspections.
- Performance of Phase II ESA and site investigation fieldwork including the collection of soil, groundwater, vapor samples, indoor/outdoor ambient air samples.
- Installation of monitoring wells and soil vapor/subslab probes.
- Performance of waste characterization studies. Knowledgeable in soil disposal characterization.

## **TECHNICAL RESPONSIBILITIES**

- Compile information on properties for Phase I and Phase II Environmental Site Assessments.
- Conduct Phase I and Phase II Environmental Site Assessments.
- Management of site investigations and site supervision.
- Conduct air quality/dust monitoring control.
- Create reports to evaluate the potential environmental impacts associated with the Subject Properties.
- Supervise disposal of excavated soil.
- Supervise underground storage tank removals.
- Collect indoor and outdoor air samples, soil vapor samples, and soil probe samples for laboratory analyses.
- Air Quality/Control

## **EDUCATION**

Bachelor of Science Computer Science, SUNY Farmingdale NY, May 2005

## **CERTIFICATIONS**

OSHA Outreach Certification 08/31/2019 UST A/B Operator

# ATTACHMENT E HEALTH AND SAFETY PLAN

# INVESTIGATION HEALTH AND SAFETY PLAN 100 EAST 149<sup>TH</sup> STREET SITE 100 East 149<sup>th</sup> Street, Bronx, New York Block 2351, Lot 35

APRIL 2023

# Prepared by:

Touchstone Environmental Geology, P.C. 1919 Middle Country Road, Suite 205 Centereach, New York 11720 rachelataman@touchstoneenvironmental.com (631) 315-2733

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Figure 1 Route to Hospital (Appendix D)

## APPENDICES

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# STATEMENT OF COMMITMENT

This Health and Safety Plan (HASP) has been prepared to ensure that workers are not exposed to risks from hazardous materials during the planned Subsurface Investigation at the Site. This HASP, which applies to persons present at the site actually or potentially exposed to hazardous materials, describes emergency response procedures for actual and potential chemical hazards.

This HASP is also intended to inform and guide personnel entering the work area or exclusion zone. Persons are to acknowledge that they understand the potential hazards and the contents of this Health and Safety policy by signing off on receipt of their individual copy of the document. Contractors and suppliers are retained as independent contractors and are responsible for ensuring the health and safety of their own employees.

# **1.0 INTRODUCTION AND SITE ENTRY REQUIREMENTS**

This document describes the This document describes the health and safety guidelines developed by Touchstone Environmental Geology, P.C. (Touchstone) for the subsurface investigation to be performed to protect on-site personnel, visitors, and the public from physical harm and exposure to hazardous materials or wastes during subsurface investigation activities. In accordance with the Occupational Safety and Health Administration (OSHA) 29 CFR Part 1910.120 Hazardous Waste Operations and Emergency Response Final rule, this HASP, including the attachments, addresses safety and health hazards related to subsurface sample collection activities and is based on the best information available. The HASP may be revised by Touchstone at the request of the client and/or a regulatory agency upon receipt of new information regarding site conditions. Changes will be documented by written amendments signed by Touchstone's project manager, site safety officer and/or the Touchstone health and safety consultant.

# **1.1 Training Requirements**

Personnel entering the exclusion zone or decontamination zone are required to be certified in health and safety practices for hazardous waste site operations as specified in the Federal OSHA Regulations CFR 1910.120e (revised 3/6/90).

Paragraph (e - 3) of the above referenced regulations requires that all on-site management personnel directly responsible for or who supervise employees engaged in hazardous waste operations, must initially receive 8 hours of supervisor training related to managing hazardous waste work.

Paragraph (e - 8) of the above referenced regulations requires that workers and supervisors receive 8 hours of refresher training annually on the items specified in Paragraph (e-1) and/or (e-3).

Additionally, all on-site personnel must receive adequate site-specific training in the form of an on-site Health and Safety briefing prior to participating in field work with emphasis on the following:

- Protection of the adjacent community from hazardous vapors and / or dust which may be released during intrusive activities.
- Identification of chemicals known or suspected to be present on-site and the health effects and hazards of those substances.
- The need for vigilance in personnel protection, and the importance of attention to proper use, fit and care of personnel protective equipment.
- Decontamination procedures.
- Site control including work zones, access, and security.
- Hazards and protection against heat or cold.
- The proper observance of daily health and safety practices, such as entry and exit of work zones and site. Proper hygiene during lunch, break, etc.
- Emergency procedures to be followed in case of fire, explosion, and sudden release of hazardous gases.

Health and Safety meetings will be conducted on a daily basis and will cover protective clothing and other equipment to be used that day, potential and chemical and physical hazards, emergency procedures, and conditions and activities from the previous day.

# 1.2 Site Safety Plan Acceptance, Acknowledgement, and Amendments

The project superintendent and the site safety officer are responsible for informing personnel (Touchstone employees and/or owner or owners' representatives) entering the work area of the contents of this plan and ensuring that each person signs the safety plan acknowledging the on-site hazards and procedures required to minimize exposure to adverse effects of these hazards. A copy of the Acknowledgement Form is included in **Appendix A**.

Site conditions may warrant an amendment to the HASP. Amendments to the HASP are acknowledged by completing forms included in **Appendix B**.

Name	Title	Address	<b>Contact Numbers</b>
Rachel Ataman	Project Manager	1919 Middle Country	(631) 672-3530
		Road, Suite 205,	
		Centereach, NY 11720	
Gabrielle Castro	Site Safety Officer	1919 Middle Country	(631) 885-3873
		Road, Suite 205,	
		Centereach, NY 11720	
Firat Ataman	Alternate Site	1919 Middle Country	(631) 220-9208
	Safety Officer /	Road, Suite 205,	
	Field Operations	Centereach, NY 11720	
	Officer		

# 1.3 Key Personnel – Roles and Responsibilities

Personnel responsible for implementing this Health and Safety Plan are:

The project manager is responsible for overall project administration and, with guidance from the site safety officer, for supervising the implementation of this HASP. The site safety officer will conduct daily (tail gate or toolbox) safety meetings at the project site and oversee daily safety issues. Each subcontractor and supplier (defined as an OSHA employer) is also responsible for the health and safety of its employees. If there is any dispute about health and safety or project activities, on-site personnel will attempt to resolve the issue. If the issue cannot be resolved at the site, then the project manager will be consulted.

The site safety officer is also responsible for coordinating health and safety activities related to hazardous material exposure on-site. The site safety officer is responsible for the following:

1. Educating personnel about information in this HASP and other safety requirements to be observed during site operations, including, but not limited to, decontamination procedures, designation of work zones and levels of protection, air monitoring, fit testing, and emergency procedures dealing with fire and first aid.

- 2. Coordinating site safety decisions with the project manager.
- 3. Designating exclusion, decontamination, and support zones on a daily basis.
- 4. Monitoring the condition and status of known on-site hazards and maintaining and implementing the air quality monitoring program specified in this HASP.
- 5. Maintaining the work zone entry/exit log and site entry/exit log.
- 6. Maintaining records of safety problems, corrective measures and documentation of chemical exposures or physical injuries (the site safety officer will document these conditions in a bound notebook and maintain a copy of the notebook on-site).

The person who observes safety concerns and potential hazards that have not been addressed in the daily safety meetings should immediately report their observations/concerns to the site safety officer or appropriate key personnel.
## 2.0 SITE BACKGROUND AND SCOPE OF WORK

A Remedial Investigation is being conducted at the site to identify and characterize known and potential petroleum contaminants, solvents and metals within the subsurface soils, groundwater, or soil gas at the site.

The results from this investigation will help determine what actions may be required, if any, to prevent exposure to contaminants from the change in use of the site from its current operations to a mixed-use commercial retail and office building. Touchstone notes that a zoning change is not anticipated during redevelopment. The work will be conducted in accordance with the procedures as required by the New York State Brownfield Cleanup Program (NYSBCP) as administered by the New York State Department of Environmental Conservation.

## 2.1 Remedial Investigation Scope

The subsurface investigation will include the installation of soil borings, groundwater monitoring wells, and / or soil vapor implants. Site sampling locations are shown on **Figures 3, 4, and 5** of the Remedial Investigation Work Plan.

Soil borings will be advanced with Geoprobe direct push equipment and sampled with a 5foot macro core sampler using disposable acetate liners. Soil will be characterized by an environmental professional and field screened for the presence of volatile organic compounds (VOCs) using a photo-ionization detector (PID). Retained samples from each boring will be submitted to a New York State Department of Health ELAP-certified laboratory for analysis.

The groundwater samples will be collected by installing a temporary monitoring well approximately 85 feet below the water table. Sub-slab soil gas samples will be collected through the installation of soil vapor probes directly beneath the foundation slab of the existing buildings at the Site.

## **3.0 SITE HAZARD EVALUATION**

This section identifies the hazards associated with the proposed scope of work, general physical hazards that can be expected at most sites; and presents a summary of documented or potential chemical hazards at the site. Every effort must be made to reduce or eliminate these hazards. Those that cannot be eliminated must be guarded against using engineering controls and/or personal protective equipment.

This HASP has been developed for work performed at the site in association with a Phase II subsurface investigation. The primary hazards to the field crew will be physical hazards related to sample collection procedures and equipment, and chemical exposures to the sampling crew from exposure to potential contaminants which may be present at the site.

#### 3.1 Physical Hazards

#### 3.1.1 Tripping Hazards

An area of risk associated with on-site activities are presented by uneven ground, concrete, curbstones, or equipment which may be present at the site thereby creating a potential tripping hazard. During intrusive work, care should be taken to mark or remove any obstacles within the exclusion zone).

#### 3.1.2 Cuts and Lacerations

Field activities that involve drilling and boring equipment may result in cuts or lacerations from machinery and tools used in collecting samples, cutting disposable tubing, and opening acetate sleeves and liners. A first aid kit approved by the American Red Cross will be available during all subsurface investigative activities.

#### 3.1.3 Lifting Hazards

Improper lifting by workers is one of the leading causes of industrial injuries. Field workers and drillers may be required to lift heavy objects such as drilling tools, buckets of decontamination water, cement, etc. Therefore, all members of the field crew should be trained in the proper methods of lifting heavy objects. All workers should be cautioned against lifting objects too heavy for one person.

#### 3.1.4 Utility Hazards

Before conducting any subsurface boring or sampling, the drilling contractor will be responsible for locating and verifying all existing utilities at each excavation.

#### 3.1.5 Traffic Hazards

All traffic, vehicular and pedestrian, shall be maintained and protected at all times consistent with local, state, and federal agency regulations regarding such traffic and in accordance with NYCDOT guidelines. The drilling contractor shall carry on his operations without undue interference or delays to traffic. The drilling contractor shall furnish all labor, materials, guards, barricades, signs, lights, and anything else necessary to maintain traffic and to protect his work and the public, during operations.

#### **3.2 Work in Extreme Temperatures**

Work under extremely hot or cold weather conditions requires special protocols to minimize the chance that employees will be affected by heat or cold stress.

#### 3.2.1 Heat Stress

The combination of high ambient temperature, high humidity, physical exertion, and personal protective apparel, which limits the dissipation of body heat and moisture, can cause heat stress.

The following prevention, recognition and treatment strategies will be implemented to protect personnel from heat stress. Personnel will be trained to recognize the symptoms of heat stress and to apply the appropriate treatment.

1. Prevention

- a. Provide plenty of fluids. Available in the support zone will be a 50% solution of fruit punch and water or plain water.
- b. Work in Pairs. Individuals should avoid undertaking any activity alone.
- c. Provide cooling devices. A spray hose and a source of water will be provided to reduce body temperature, cool protective clothing and/or act as a quick-drench shower in case of an exposure incident.
- d. Adjustment of the work schedule. As is practical, the most labor-intensive tasks should be carried out during the coolest part of the day.
- 2. Recognition and Treatment
  - a. Heat Rash (or prickly heat):

a.	Tieat Kasii (01	prickly heat).	
	Cause:	Continuous exposure to hot and humid air, aggravated by	
		charing clothing.	
	Symptoms:	Eruption of red pimples around sweat ducts accompanied	
		by intense itching and tingling.	
	Treatment:	Remove source or irritation and cool skin with water or wet cloths.	
b.	Heat Cramps (or heat prostration):		
	Cause:	Profuse perspiration accompanied by inadequate	
		replenishment of body water and electrolytes.	
	Symptoms:	Muscular weakness, staggering gait, nausea, dizziness,	
		shallow breathing, pale and clammy skin, approximately	
		normal body temperature.	
	Treatment:	Perform the following while making arrangement for	
		transport to a medical facility. Remove the worker to a	
		contamination reduction zone. Remove protective clothing.	
		Lie worker down on back in a cool place and raise feet 6 to	
		12 inches. Keep warm but loosen all clothing. If conscious,	
		provide sips of salt-water solution, using one teaspoon of	
		salt in 12 ounces of water. Transport to a medical facility.	
c.	Heat Stroke:		

Cause: Same as heat exhaustion. This is also an extremely serious condition.

Symptoms:	Dry and hot skin, dry mouth, dizziness, nausea, headache,
	and rapid pulse.
Treatment:	Cool worker immediately by immersing or spraying with
	cool water or sponge bare skin after removing protective
	clothing. Transport to hospital.

#### 3.2.2 Cold Exposure

Exposure to cold weather, wet conditions and extreme wind-chill factors may result in excessive loss of body heat (hypothermia) and /or frostbite. To guard against cold exposure and to prevent cold injuries, appropriate warm clothing should be worn, warm shelter must be readily available, rest periods should be adjusted as needed, and the physical conditions of on-site field personnel should be closely monitored. Personnel and supervisors working on-site will be made aware of the signs and symptoms of frost bite and hypothermia such as shivering, reduced blood pressure, reduced coordination, drowsiness, impaired judgment, fatigue, pupils dilated but reactive to light and numbing of the toes and fingers.

#### 3.3 Chemical Hazards

Historic fill, present at the Site was found to contain elevated levels of semi-volatile organic compounds and metals. These "contaminants" are not related to a chemical release occurring on the Site but are inherent in the reworked fill material in the area which contains ash bits or tar and asphalt.

Based on the findings of previous investigations performed at the Site, the following compounds are considered for the Site as potential contaminants: volatile organic compounds (VOCs) related to spills of petroleum fuels and possibly chlorinated solvents, semi-volatile organic compounds (SVOCs) related to petroleum fuel spills and / or inherent in historic fill, polychlorinated biophenyl's (PCBs), and heavy metals such as arsenic, barium, chromium, lead and mercury.

The primary routes of exposure to these contaminants are inhalation, ingestion, and absorption. **Appendix C** includes information sheets for suspected chemicals that may be encountered at the site.

#### 3.3.1 Respirable Dust and Direct Contact with Soil and Groundwater

Dust may be generated from drilling activities. If visible observation detects elevated levels of dust, a program of wetting will be employed by the site safety officer. If elevated dust levels persist, the site safety office will employ dust monitoring using a particulate monitor (Miniram or equivalent). If monitoring detects concentrations greater than the OSHA action level of  $100 \mu g/m3$  over daily background, the site safety officer will take corrective actions as defined herein, including the use of water for dust suppression and if this is not effective, requiring workers to wear APRs with efficiency particulate air (HEPA) cartridges.

Absorption pathways for dust and direct contact with soil and groundwater will be mitigated with the implementation of latex gloves, hand washing and decontamination exercises when necessary.

## 3.3.2 Organic Vapors

Considering the past and present use of the properties, VOCs may be encountered at the site in soil and/or groundwater. Therefore, soil boring activities may cause the release of organic vapors to the atmosphere. The site safety officer will periodically monitor organic vapors with a Photoionization Detector (PID) during drilling activities to determine whether organic vapor concentrations exceed action levels shown below.

PID Response	Action
Sustained readings of 5 ppm or greater	Shut down equipment and allow area to
	vent. Resume when readings return to
	background.
Sustained readings of 5 ppm or greater	Implement Vapor Release Plan (Section
that do not subside after venting	6.8). Re-evaluate respiratory protection as
	upgrade may be required.

## 4.0 PERSONAL PROTECTIVE EQUIPMNENT

Personal protective equipment (PPE) shall be selected in accordance with the site air monitoring program, OSHA 29 CFR 1910.120(c), (g), and 1910.132. Protective equipment shall be NIOSH approved and respiratory protection shall conform to OSHA 29 CFR Part 1910.133 and 1910.134 specifications; head protection shall conform to 1910.135; eye and face protection shall conform to 1910.133; and foot protection shall conform to 1910.136. The only true difference among the levels of protection from D thru B is the addition of the type of respiratory protection. It is anticipated that work will be performed in Level D PPE.

## 4.1 Level D

Level D PPE shall be donned when the atmosphere contains no known hazards and work functions preclude splashes, immersion, or the potential for inhalation of, or contact with, hazardous concentrations of harmful chemicals. Level D PPE consists of:

- standard work uniform, coveralls, or tyvek, as needed;
- steel toe and steel shank work boots;
- high visibility safety vest;
- hard hat;
- gloves, as needed;
- safety glasses;
- hearing protection;
- equipment replacements are available as needed.

## 4.2 Level C

Level C PPE shall be donned when the concentrations of measured total organic vapors in the breathing zone exceed background concentrations (using a portable OVA, or equivalent), but are less than 5 ppm. The specifications on the APR filters used must be appropriate for contaminants identified or expected to be encountered. Level C PPE shall be donned when the identified contaminants have adequate warning properties and criteria for using APR have been met. Level C PPE consists of:

- chemical resistant or coated tyvek coveralls;
- steel-toe and steel-shank workboots;
- high visibility safety vest;
- chemical resistant overboots or disposable boot covers;
- disposable inner gloves (surgical gloves);
- disposable outer gloves;
- full face APR fitted with organic vapor/dust and mist filters or filters appropriate for the identified or expected contaminants;
- hard hat;
- splash shield, as needed; and,
- ankles/wrists taped with duct tape.

The site safety officer will verify if Level C is appropriate by checking organic vapor concentrations using compound and/or class-specific detector tubes.

The exact PPE ensemble is decided on a site-by-site basis by the Site Safety Officer with the intent to provide the most protective and efficient worker PPE.

## 4.3 Activity-Specific Levels of Personal Protection

The required level of PPE is activity-specific and is based on air monitoring results (Section 4.0) and properties of identified or expected contaminants. It is expected that site work will be performed in Level D. If air monitoring results indicate the necessity to upgrade (i.e dust above 5,000  $\mu$ g/m3 or sustained VOCs above 5 ppm in the breathing zone) the level of protection engineering controls (i.e., Facing equipment away from the wind and placing site personnel upwind of excavations, active venting, etc.) will be implemented before requiring the use of respiratory protection.

## 5.0 SITE CONTROL

#### 5.1 Work Zones

The primary purpose of site controls is to establish the perimeter of a hazardous area, to reduce the migration of contaminants into clean areas, and to prevent access or exposure to hazardous materials by unauthorized persons. When operations are to take place involving hazardous materials, the site safety officer will establish an exclusion zone, a decontamination zone, and a support zone. These zones "float" (move around the site) depending on the tasks being performed on any given day. The site safety officer will outline these locations before work begins and when zones change. The site safety officer records this information in the site logbook. It is expected that for soil boring and sampling activities, identification of an exclusion zone, decontamination zone, and support zone will not be necessary.

Tasks requiring OSHA 40-hour Hazardous Waste Operations and Emergency Response Operations training are carried out in the exclusion zone. The exclusion zone is defined by the site safety officer but will typically be a 50-foot area around work activities. Gross decontamination (as determined by the site Health and Safety Officer) is conducted in the exclusion zone; all other decontamination is performed in the decontamination zone or trailer.

Protective equipment is removed in the decontamination zone. Disposable protective equipment is stored in receptacles staged in the decontamination zone, and non-disposable equipment is decontaminated. All personnel and equipment exit the exclusion zone through the decontamination zone. If a decontamination trailer is provided the first aid equipment, an eye wash unit, and drinking water are kept in the decontamination trailer.

The support zone is used for vehicle parking, daily safety meetings, and supply storage. Eating, drinking, and smoking are permitted only in the support zone. When a decontamination trailer is not provided, the eye wash unit, first aid equipment, and drinking water are kept at a central location designated by the site safety officer.

## 6.0 CONTINGENCY PLAN/EMERGENCY RESPONSE PLAN

Site personnel must be prepared in the event of an emergency. Emergencies can take many forms: illnesses, injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful contaminants, or sudden changes in the weather.

Emergency telephone numbers and a map to the hospital will be posted in the command post. Site personnel should be familiar with the emergency procedures, and the locations of site safety, first aid, and communication equipment.

#### 6.1 Emergency Equipment On-site

Private telephones:	Site personnel.
Two-way radios:	Site personnel where necessary.
Emergency Alarms:	On-site vehicle horns*.
First aid kits:	On-site, in vehicles or office.
Fire extinguisher:	On-site, in office or on equipment.

\* Horns: Air horns will be supplied to personnel at the discretion of the project superintendent or site safety officer.

#### 6.2 Emergency Telephone Numbers

General Emergencies	911
New York City Police	911
Maimonides Medical Center	1-718-283-6000
NYSDEC Spills Division	1-800-457-7362
NYSDEC Division of Env. Remediation	1-718-482-4900
NYCDEP	1-718-699-9811
NYC Department of Health	1-212-788-4711
NYC Fire Department	911
National Response Center	1-800-424-8802
Poison Control	1-212-340-4494
Site Safety Officer	1-631-885-3873
Alternate Site Safety Officer	1-631-220-9208

#### 6.3 Personnel Responsibilities During an Emergency

The project manager is primarily responsible for responding to and correcting any emergency situations. However, in the absence of the project manager, the site safety officer shall act as the project manager's on-site designee and perform the following tasks:

- Take appropriate measures to protect personnel including withdrawal from the exclusion zone, evacuate and secure the site, or upgrade/downgrade the level of protective clothing and respiratory protection;
- Ensure that appropriate federal, state, and local agencies are informed, and emergency response plans are coordinated. In the event of fire or explosion, the local fire department should be summoned immediately. If toxic materials are

released to the air, the local authorities should be informed in order to assess the need for evacuation;

- Ensure appropriate decontamination, treatment, or testing for exposed or injured personnel;
- Determine the cause of incidents and make recommendations to prevent recurrence; and,
- Ensure that all required reports have been prepared.

The following key personnel are planned for this project:

- Project Manager Ms. Rachel Ataman (631) 672-3530
- Site Safety Officer Ms. Gabrielle Castro (631) 885-3873
- Alternate Mr. Firat Ataman (631) 220-9208

#### 6.4 Medical Emergencies

A person who becomes ill or injured in the exclusion zone will be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination will be completed and first aid administered prior to transport. First aid will be administered while waiting for an ambulance or paramedics. A Field Accident Report (**Appendix D**) must be filled out for any injury.

A person transporting an injured/exposed person to a clinic or hospital for treatment will take the directions to the hospital (**Appendix D**) and information on the chemical(s) to which they may have been exposed (**Appendix C**).

#### 6.5 Fire or Explosion

In the event of a fire or explosion, the local fire department will be summoned immediately. The site safety officer or his designated alternate will advise the fire commander of the location, nature, and identification of the hazardous materials on-site. If it is safe to do so, site personnel may:

- use firefighting equipment available on site; or,
- remove or isolate flammable or other hazardous materials that may contribute to the fire.

## 6.6 Evacuation Routes

Evacuation routes established by work area locations for each site will be reviewed prior to commencing site operations. As the work areas change, the evacuation routes will be altered accordingly, and the new route will be reviewed.

Under extreme emergency conditions, evacuation is to be immediate without regard for equipment. The evacuation signal will be a continuous blast of a vehicle horn, if possible, and/or by verbal/radio communication. When evacuating the site, personnel will follow these instructions:

• Keep upwind of smoke, vapors, or spill location.

- Exit through the decontamination corridor if possible.
- If evacuation through the decontamination corridor is not possible, personnel should
- remove contaminated clothing once they are in a safe location and leave it near the
- exclusion zone or in a safe place.
- The site safety officer will conduct a head count to ensure that all personnel have been
- evacuated safely. The head count will be correlated to the site and/or exclusion zone
- entry/exit log.
- If emergency site evacuation is necessary, all personnel are to escape the emergency
- situation and decontaminate to the maximum extent practical.

#### 6.7 Spill Control Procedures

Spills associated with site activities may be attributed to project equipment and include gasoline, diesel, and hydraulic oil. In the event of a leak or a release, site personnel will inform their supervisor immediately, locate the source of spillage and stop the flow if it can be done safely. A spill containment kit including absorbent pads, booms and/or granulated speedy dry absorbent material will be available to site personnel to facilitate the immediate recovery of the spilled material. Daily inspections of site equipment components including hydraulic lines, fuel tanks, etc. will be performed by their respective operators as a preventative measure for equipment leaks and to ensure equipment soundness. In the event of a spill, site personnel will immediately notify the NYSDEC (1-800-457-7362), and a spill number will be generated.

#### 6.8 Vapor Release Plan

If work zone organic vapor (excluding methane) exceeds 5 ppm, then a downwind reading will be made either 200 feet from the work zone or at the property line, whichever is closer. If readings at this location exceed 5 ppm over background, the work will be stopped.

If 5 ppm of VOCs are recorded over background on a PID at the property line, then an offsite reading will be taken within 20 feet of the nearest residential or commercial property, whichever is closer. If efforts to mitigate the emission source are unsuccessful for 30 minutes, then the designated site safety officer will:

- contact the local police;
- continue to monitor air every 30 minutes, 20 feet from the closest off-site property. If two successive readings are below 5 ppm (non-methane), off-site air monitoring will be halted.
- All property line and off-site air monitoring locations and results associated with vapor
- releases will be recorded in the site safety logbook.

## ATTACHMENT F COMMUNITY AIR MONITORING PLAN

## COMMUNITY AIR MONITORING PLAN 100 EAST 149<sup>TH</sup> STREET SITE 100 East 149<sup>th</sup> Street, Bronx, New York Block 2351, Lot 35

APRIL 2023

## **Prepared by:**

Touchstone Environmental Geology, P.C. 1919 Middle Country Road, Suite 205 Centereach, New York 11720 rachelataman@touchstoneenvironmental.com (631) 315-2733

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## APPENDICES

Appendix A Action Limit Reporting

## **1.0 INTRODUCTION**

This Community Air Monitoring Plan (CAMP) has been prepared for the drilling and sampling activities to be performed under a Remedial Investigation Work Plan (RIWP) at the 100 East 149<sup>th</sup> Street Site. The CAMP provides measures for protection for the downwind community (i.e., off-site receptors including residences, businesses, and on-site workers not directly involved in the investigation activities) from potential airborne contaminant releases resulting from investigative activities at the site.

Compliance with this CAMP is required during all activities associated with drilling and sampling activities that have the potential to generate airborne particulate matter and volatile organic compounds (VOCs). These activities include drilling and soil and groundwater sampling. This CAMP has been prepared to ensure that investigation activities do not adversely affect passersby, residents, or workers in the area immediately surrounding the Site and to preclude or minimize airborne migration of investigation-related contaminants to off-site areas.

## **1.1 Regulatory Requirements**

This CAMP was established in accordance with the following requirements:

- New York State Department of Health's (NYSDOH) Generic Community Air Monitoring Plan as presented in DER-10 Technical Guidance for Site Investigation and Remediation (NYSDEC May 3, 2010). This guidance specifies that a community air-monitoring program shall be implemented to protect the surrounding community and to confirm that the work does not spread contamination off-site through the air;
- New York State Department of Environmental Conservation (NYSDEC) Technical and Guidance Memorandum (TAGM) #4031 Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites: This guidance provides a basis for developing and implementing a fugitive dust suppression and particulate monitoring program as an element of a hazardous waste site's health and safety program.

## 2.0 AIR MONITORING

Petroleum VOCs, SVOCs, and metals are the contaminants of concern at the Site along with metals in historic fill. Touchstone notes that the list of contaminants of concern will be updated as results are received during the remedial investigation. The appropriate method to monitor air for these constituents during investigation activities is through real-time VOC and air particulate (dust) monitoring.

## 2.1 Meteorological Data

At a minimum, wind direction will be evaluated at the start of each workday, noon of each workday, and the end of each workday. These readings will be utilized to position the monitoring equipment in appropriate upwind and downwind locations.

## 2.2 Community Air Monitoring Requirements

To establish ambient air background concentrations, air will be monitored at several locations around the site perimeter before activities begin. These points will be monitored periodically in series during the site work. When the drilling area is within 20 feet of potentially exposed populations or occupied structures, the perimeter monitoring points will be located to represent the nearest potentially exposed individuals at the downwind location.

Fugitive respirable dust will be monitored using a MiniRam Model PDM-3 aerosol monitor (or equivalent). Air will be monitored for VOCs with a portable Ionscience 3000 photoionization detector (PID), or equivalent. All air monitoring data will be documented in a site logbook by the designated site safety officer. The site safety officer or delegate must ensure that air monitoring instruments are calibrated and maintained in accordance with manufacturer's specifications. All instruments will be zeroed daily and checked for accuracy. A daily log will be kept. If additional monitoring is required, the protocols will be developed and appended to this plan.

## 3.0 VOC MONITORING, RESPONSE LEVELS, AND ACTIONS

Volatile organic compounds (VOCs) will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present.

The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown. All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

All readings will be recorded and made available for NYSDEC and NYSDOH personnel to review. If an exceedance of the Action Limits occurs, an Action Limit Report, as shown in **Appendix A**, will be completed.

#### 3.1 Potential Corrective Measures and VOC Suppression Techniques

If the 15-minute integrated VOC level at the downwind location persists at a concentration that exceeds the upwind level by more than 5 ppm but less than 25 ppm during remediation activities, then vapor suppression techniques will be employed. The following techniques, or others, may be employed to mitigate the generation and migration of fugitive organic vapors:

- collection of purge water in covered containers;
- storage of excess sample and drill cuttings in drums or covering with plastic.

## 4.0 PARTICULATE MONITORING

Air monitoring for particulates (i.e., dust) will be performed continuously during drilling activities using both air monitoring equipment and visual observation at upwind and downwind locations. Monitoring equipment capable of measuring particulate matter smaller than 10 microns (PM10) and capable of integrating (averaging) over periods of 15 minutes or less will be set up at upwind (i.e., background) and downwind locations, at heights approximately four to five feet above land surface (i.e., the breathing zone). Monitoring equipment will be MIE Data Ram monitors, or equivalent. The audible alarm on the particulate monitoring device will be set at 90 micrograms per cubic meter ( $\mu$ g/m3). This setting will allow proactive evaluation of worksite conditions prior to reaching the action level of 100  $\mu$ g/m3 above background. The monitors will be calibrated at least once per day prior to work activities and recalibrated as needed thereafter. In addition, fugitive dust migration will be visually assessed during all intrusive work activities.

The following summarizes particulate action levels and the appropriate responses:

- If the downwind PM-10 particulate level is 100 µg/m3 greater than background (upwind perimeter) for the 15-minute period, or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 µg/m3 above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 µg/m3 above the upwind level, work must be stopped, and an evaluation of activities initiated. Work can resume provided that dust suppression measures (as described in Section 2.3.1 below) and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 µg/m3 of the upwind level and in preventing visible dust migration.

All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review. If an exceedance of the Action Limits occurs, an Action Limit Report as shown in **Appendix A** will be completed.

#### 4.1 Potential Particulate Suppression Techniques

If the integrated particulate level at the downwind location exceeds the upwind level by more than 100  $\mu$ g/m3 at any time during drilling activities, then dust suppression techniques will be employed. The following techniques, or others, may be employed to mitigate the generation and migration of fugitive dusts:

- Placement of drill cuttings in drums or covering stockpiles with plastic;
- Misting of the drilling area with a fine water spray from a hand-held spray bottle

Work may continue with dust suppression techniques provided that downwind PM10 levels are not more than  $150 \ \mu g/m3$  greater than the upwind levels.

There may also be situations where the dust is generated by drilling activities and migrates to downwind locations but is not detected by the monitoring equipment at or above the action level. Therefore, if dust is observed leaving the working area, dust suppression techniques such as those listed above will be employed.

If dust suppression techniques do not lower particulates to below 150  $\mu$ g/m3, or visible dust persists, work will be suspended until appropriate corrective measures are identified and implemented to remedy the situation.

All air monitoring readings will be recorded in the field logbook and will be available for the NYSDEC and NYSDOH personnel to review.

## 5.0 DATA QUALITY ASSURANCE

## 5.1 Calibration

Instrument calibration shall be documented on instrument calibration and maintenance sheets or in the designated field logbook. All instruments shall be calibrated as required by the manufacturer. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response.

## 5.2 Operations

All instruments shall be operated in accordance with the manufacturer's specifications. Manufacturers' literature, including an operations manual for each piece of monitoring equipment will be maintained on-site by the SSO for reference.

#### 5.3 Data Review

The SSO will interpret all monitoring data based the established criteria and his/her professional judgment. The SSO shall review the data with the PM to evaluate the potential for worker exposure, upgrades/downgrades in level of protection, comparison to direct reading instrumentation and changes in the integrated monitoring strategy.

Monitoring and sampling data, along with all sample documentation will be periodically reviewed by the PM.

## 6.0 RECORDS AND REPORTING

All air readings must be recorded on daily air monitoring log sheets and made available for review by personnel from NYSDEC and NYSDOH. Data will be reported to the NYSDEC and NYSDOH Project Managers on a daily or weekly basis, with the exception being exceedances of action levels. Any exceedances and Corrective Actions will be reported on the same business day of occurrence. The reports will also include a figure depicting work zones, wind direction, and other appropriate site information (i.e., specific work activities).