HydroTech Environmental
ENGINEERING AND GEOLOGY, DPC

NYC Office
15 Ocean Avenue, Suite 2B
Brooklyn, New York 11225
T (718) 636-0800 ; F (718) 636-0900

Long Island Office
77 Arkay Drive, Suite K
Hauppauge, New York 11788
T (631) 462-5866 ; F (631) 462-5877

WWW.HYDROTECHENVIRONMENTAL.COM

77-57 Vleigh Place

77-39/63 Vleigh Place

Queens, NEW YORK

Block 6630, Lot 1

SITE MANAGEMENT PLAN

NYSDEC Site Number: C241168

Prepared for:

Aldrich Management Co., LLC

1975 Hempstead Turnpike, Suite 309, East Meadow, New York 11554

&

VP Capital Holdings LLC

62 West 47th Street, Suite 603, Manhattan, New York 10036

Prepared by:

HydroTech Environmental Engineering and Geology, DPC

15 Ocean Avenue, Suite 2B, Brooklyn, NY 11225

718-636-0800

Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

DECEMBER 2019

CERTIFICATION STATEMENT

I Tarek Z. Khouri certify that I am currently a NYS registered professional engineer as in defined in 6 NYCRR Part 375 and that this Site Management 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).

Tarek Z. Khouri P.E

12/19/2019

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LIST OF ACRONYMS

AS	Air Sparging
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CO2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
EWP	Excavation Work Plan
GHG	Green House Gas
GWT	Groundwater Treatment
HASP	Health and Safety Plan
IC	Institutional Control
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan

RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Remedial Party
RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SSD	Sub-slab Depressurization
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program

ES EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance and reporting activities required by this Site Management Plan:
Site Identification:

NYSDEC Site Number: C241168
77-57 Vleigh Place
77-39/63 Vleigh Place, Queens, New York

Institutional Controls:	1. The property may be used for restricted residential use consistent with the recorded Environmental Easement;
	2. All ECs must be operated and maintained as specified in this SMP and required by the Environmental Easement recorded for the property;
	3. All ECs must be inspected at a frequency and in a manner defined in the SMP and required by the Environmental Easement;
	4. The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Queens Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
	5. Groundwater and other environmental or public health monitoring must be performed as defined in this SMP, consistent with the Environmental Easement;
	6. Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP and required by the Environmental Easement;
	7. All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;

	8. Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;	
	9. Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;	
	10. Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;	
	11. The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 15, as well as any nearby off-site buildings, and any potential impacts that are identified must be monitored or mitigated; and	
	12. Vegetable gardens and farming on the Site are prohibited consistent with the Environmental Easement in place on the property.	
Engineering Controls:	1. Cover system;	
	2. Soil Vapor Extraction System;	
	3. Off-Site Sub-slab Depressurization System at Regency Garden Company;	
	4. Additional In-situ Chemical Oxidant (ISCO) and Bioremediation Treatments as required by NYSDEC.	
Inspections:		Frequency
1. **Cover inspection**		
Monitoring:		Annually

2. **Soil Vapor Extraction System**	
• Blower on/off function • Effluent Parameters • Alarm sound and on/off light • Flow, PID, Vacuum pressure at SVE well heads • Vacuum pressure at the Vacuum Monitoring points • Weather conditions	Monthly
• GAC drum testing	Semi-annually
• Soil vapor sampling from off-site soil vapor points	Annually
3. **Off-Site Sub-slab Depressurization System at Regency Gardens Corp. apartment complex located at 78-05 141 Street, 141-15/141-17 78 Road and 141-12/141-18/141-24/141-34 78th Avenue, Flushing, NY (Block 6631, Lot 1)**	
• Fans on/off function • Alarm sound and on/off light Vacuum pressure at the Vacuum Monitoring points	Annually
• Indoor air/outdoor sampling	30 days after start-up and Annually
• Soil vapor evaluations in adjacent structures	30 days after start-up
4. **In-situ Chemical Oxidant (ISCO) and Bioremediation Treatment**	
• All monitoring well sampling	Quarterly
• Select monitoring well sampling	60 days after 3rd or subsequent ISCO injections

Maintenance:	
SVE Blower	As needed
SSDS Fans	As needed
Reporting:	
1. Groundwater Data	Quarterly
2. Soil Vapor Data	Annually
3. Soil Vapor Extraction System Monitoring	Monthly
4. Cover and SSDS Inspections	Annually
5. Periodic Review Report	Annually

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan.

1.0 INTRODUCTION

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the 77-57 Vleigh Place Site locate at the property identified as 77-39/63 Vleigh Place, and located in Flushing, New York (hereinafter referred to as the "Site"). See Figure 1. The Site is currently in the New York State (NYS) Brownfield Cleanup Program (BCP), Site No. C241168 which is administered by New York State Department of Environmental Conservation (NYSDEC).

Aldrich Management Co., LLC entered into a Brownfield Cleanup Agreement (BCA) as a participant, on April 6, 2015 with the NYSDEC to remediate the site. VP Capital Holdings LLC was then added to Brownfield Cleanup Agreement as a Participant following a purchase transaction of the Site from Aldrich Management Co., LLC on July 2, 2018 and pursuant to an amended BCA on July 10, 2018. A figure showing the site location and boundaries of the Site is provided in Figure 2. The boundaries of the Site are more fully described in the metes and bounds site description that is part of the Environmental Easement provided in Appendix 1.

After completion of the remedial work, some contamination was left at the Site, which is hereafter referred to as "remaining contamination". Institutional and Engineering Controls (ICs and ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC and recorded with the Office of the City Register of the City of New York (under recording number 2019000306865), requires compliance with this SMP and all ECs and ICs placed on the site. A copy of the proof of filing of the easement is provided in Appendix 1.

This SMP was prepared to manage remaining contamination at the Site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the Site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC);
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the BCA, (Index #C241168-03-15; Site #C241168) for the Site, and thereby subject to applicable penalties.

All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the Site is provided in Appendix 2 of this SMP.

This SMP was prepared by HydroTech Environmental Engineering and Geology, DPC, on behalf of Aldrich Management Co., LLC and VP Capital Holdings LLC, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the Site.

1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shut down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the Site conditions. In accordance with the Environmental Easement for the Site, the NYSDEC will provide a notice of any approved changes to the SMP and append these notices to the SMP that is retained in its files.

1.3 Notifications

Notifications will be submitted by the property owner to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- 60-day advance notice of any proposed changes in Site use that are required under the terms of the BCA, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 7-day advance notice of any field activity associated with the remedial program.
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.
- Notice within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

- Follow-up status reports on actions taken to respond to any emergency event

requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the Site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the Brownfield Cleanup Agreement (BCA), and all approved work plans and reports, including this SMP.
- Within 15 days after the transfer of all or part of the Site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

Table 1 on the following page includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Site-related contact information is provided in Appendix 2.

Table 1: Notifications*

Name	**Contact Information**
NYSDEC Project Manager Daniel McNally	(518) 402-9767
NYSDEC Regional HW Engineer Jane O'Connell	(718)482-4599

* Note: Notifications are subject to change and will be updated as necessary.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The Site is located in Flushing, Queens County, New York and is identified as Section 30, Block 6630 and Lot 1 on the New York City Tax Map (see Figure 1). The Site was initially listed in the BCA dated April 6, 2015 with an area of approximately 0.9-acres, which included New York City public road easements. The Site acreage was then reduced to 0.66915 acres pursuant to a BCA amendment dated (July 29, 2019) by excluding the New York City public road easements. The Site is bounded by 77th Road to the north, 78th Avenue to the south, three 3-story multi-family building complexes (Kew Gardens) to the east, and Vleigh Place to the west (see Figure 2 – Site Layout Map). The boundaries of the Site are more fully described in Appendix 1–Environmental Easement. The owner of the Site parcel at the time of issuance of this SMP is:

VP Capital Holdings, LLC
62 West 47th Street, Suite 603
New York, New York 10036

2.2 Physical Setting

2.2.1 Land Use

The Site consists of the following: a vacant and undeveloped lot and was previously developed along the western portion with an approximately 11,500 square foot one-story commercial building with full basement and a rear open unpaved yard in the eastern portion. The building housed thirteen (13) tenant spaces. The eastern portion of the Site consisted of an open yard and was utilized for parking by on-Site tenants. The one-story building was completely destroyed by a fire, on December 30, 2016. The building was demolished and removed of between August 8 and 21, 2017.

Demolition activities consisted of the removal of all building structures with the exception of sub-grade foundation walls and basement slab, which were compromised during demolition and remained in place.

The Site is zoned R3-2 residential district with C1-2 commercial overlay. The R3-2 residential district allows for development of low-rise attached, detached or semi-detached one- and two-family residences with a maximum building height of 35 feet and with off-street parking requirements. The C2-1 commercial overlay allows for limited retail uses below residential spaces in mixed buildings and off-street parking requirements. The entire Site underwent remedial excavation for the development of a 4-story residential, community and commercial use building covering the entire property perimeter with a sub-grade basement and sub-basement levels that will be set-back 9 feet from the boundary of excavation along Vleigh Pl. The sub-basement will be used for building mechanics and attended parking space. The basement will be used as an office space. The first floor will be used as a commercial space and a community facility lobby. The second floor will consist of a community assembly space. Floors 3 and 4 will consist of 18 residential units. The building will be serviced with three elevators that will stop at the basement level. The proposed use is consistent with existing zoning for the property. The development at the Site excludes the two areas of utility easements located in the southern and northern portions.

The properties adjoining the Site and the surrounding neighborhood primarily include residential and institutional properties. The property immediately to the east includes a residential development composed of three adjoining buildings identified as Kew Gardens located a residential development composed of three adjoining buildings identified as Kew Gardens located at 141-27 77th Road, 141-23 & 141-25 78th Avenue. The property to the south includes a residential development composed of four adjoining residential buildings identified as Regency Gardens Apartment Corp. and located at 141-05, 141-12, 141-18 & 141-24 78th Avenue. The property to the west includes an institutional building identified as Steppingstone Day School located at 77-40 Vleigh Place. The property to the north and northeast includes another institutional facility identified as North Queens High School and located at 141-25 77th Road.

2.2.2 Geology

According to the previous Remedial Investigation (RI) and observations made during the Site remedial excavation, bedrock resides at a depth greater than 48 feet below ground surface (bgs). Historic fill, which is composed of a mixture of fine- to coarse-grained sand, bricks, glass and concrete, extends from surface down to about 10 feet bgs. The fill layer is underlain by native soils identified as medium to fine grained sand with pebbles to a depth of approximately 34 feet bgs.

2.2.3 Hydrogeology

The property has an elevation of approximately 77 feet above mean sea level. The depth to groundwater beneath the Site, as determined from field measurements during the RI in December 2015, March 2016, May 2016 and October 2016, ranges from 29.84 to 36.60 feet below grade. The RI determined that groundwater generally flows from southeast to northwest. The RI groundwater elevation data is provided in Table 2. Groundwater contour maps reported in the RI are shown in Figure 3. A total of thirteen monitoring wells (MW1, MW-2, MW-4, and MW-6 to MW-13), including two well nests (MW-3S, MW-3D, MW-5S, MW-5D), were installed on- and off-site. Their locations can be found in Figure 4. Five of the wells were located on-site, while eight were located off-site. Note that two wells, MW-4 and MW-10, were destroyed during site demolition activities following the fire incident and were then removed from the groundwater monitoring program.

Original monitoring wells MW-5S and MW-5D were later destroyed during soil disturbance activities in April 2018, however, were later re-constructed in June 2018. These groundwater monitoring wells were later decommissioned along with MW-1, MW-6 MW-8, MW-9 and MW-11 in April 2019 prior to site remedial excavation. Six decommissioned monitoring wells MW-1, MW-5D, MW-6, MW-9 and MW-11 were subsequently re-installed at the conclusion of site excavation.

Re-installed monitoring wells were located in the immediate vicinity of their prior locations except for MW-11, which was relocated approximately 8 feet from the southeastern corner of the Site to the south-adjacent sidewalk. Groundwater monitoring well construction logs can be found in Appendix 3.

2.3 Investigation and Remedial History

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Section 8.0 - References.

2.3.1 Phase I and Phase II Investigations

Historic Phase I and Phase II investigation reports were previously submitted to the NYSDEC as part of the BCA. These reports included:

- *July 1993 – Environmental Property Assessment by Merritt Engineering Consultants, P.C.*
- *July 1999 – Phase I Environmental Site Assessment Report by Middleton, Konekosta Associates., Ltd.*
- *August 2013 – Phase I Environmental Site Assessment by Environmental Affiliates, Inc.*
- *October 2013 – Phase II Environmental Site Assessment by Hydro Tech Environmental, Corp.*
- *April 2015 – Subsurface Investigation by Hydro Tech Environmental, Corp.*
- *February 2014 – Focused Subsurface Investigation by Hydro Tech Environmental, Corp*
- *August 2014 – Focused Subsurface Investigation by Hydro Tech Environmental, Corp.*

Based on the review of the Phase I ESA reports, a Site history was established. According to a review of NYC records and historic Sanborn maps, the Site was vacant land that was then partially developed in 1939 with a former 1-story commercial building. The building housed 13 storefronts with basements. Past uses of the commercial units included retail shops, offices, restaurants, bakeries, beauty salons, dance studios and a drycleaner, which was until most recently identified as "Paragon Cleaners" at 77-57 Vleigh Place. Two (2) 275-gallon aboveground number 2 fuel oil tanks feeding fuel oil heating systems are in the basement alley at 77-41 Vleigh Place. These two ASTs were destroyed during a sever fire alarm that damaged the commercial building on December 30, 2019. The damaged commercial building was immediately condemned by New York City Department of Building and then demolished and removed during August 2017. The ASTs were apparently removed and disposed as part of burned building debris and rash. The Site was previously owned by Aldrich Management Co., LLC, by deed dated June 19, 2007 and is currently owned by VP Capital Holdings LLC by deed dated July 17, 2018.

The Areas of Concern (AOC) identified in the Phase I ESA reports included the presence of an active drycleaners identified as Paragon Cleaners situated in the southwestern portion of the Site. Subsurface Phase II investigation were then performed in order to characterize potential impacts associated with this AOC. These investigations involved the installation and sampling of five (5) soil probes (SP-1 to SP-5) inside of Paragon Cleaners, the installation and sampling of two (2) soil probes (SP-6 and SP-7), one (1) groundwater probe (GP-1), one (1) monitoring well (MW-1) and two (2) soil vapor probes (SV-1 and SV-2) in the eastern and western vicinities of Paragon Cleaners, and across the western boundary of the Paragon Cleaners in the immediate east-adjacent vicinity of Steppingstone Day School.

Findings of these investigations identified the presence of PCE in shallow soil in SP-3 from zero to 2 feet beneath below basement slab (bbs) the dry cleaner at a concentration of 14.6 mg/kg, which exceeds its respective Unrestricted Use Soil Cleanup Objective (SCO) of 1.3 mg/kg and also in groundwater at concentrations of 46.7 ug/L GP-1 and 350 ug/L in MW-1 in the immediate eastern and western vicinities of the drycleaners, which exceed its Groundwater Quality Standard (GQS) of 5 ug/L.

The PCE impact associated with the Areas of Concern (AOC) identified in the above-referenced reports, was then investigated in detail, as warranted, pursuant to NYSDEC-approved Remedial Investigation Work Plan dated July 14, 2015, and NYSDEC-approved approved Remedial Investigation Addendum Work Plan dated March 1, 2016 and a Qualitative Human Health Exposure Assessment requested by NYSDEC and published as part of the draft versions of the RIR dated September 29, 2017.

2.3.2 On-site Remedial Investigations

- *September 2017 – Remedial Investigation Report by HydroTech*

Remedial Investigations (RIs) were conducted by HydroTech between November 2015 and October 2016, and included the installation of eighteen (18) on-site soil borings (SP-8 to SP-25) across the Site, twelve (12) on-site and off-site groundwater monitoring wells including two (2) on-site monitoring well nests (MW-2, MW-3S; MW-3D, MW-4, MW-5S, MW-5D, MW-6 to MW-13), three sub-slab vapor points (SSB-1 to SSB-3) and three (3) indoor air samples (IA-1 to IA-3) in the basements of commercial building at the Site and one (1) outdoor air samples (OA-1), two (2) soil vapor probes in the parking area, eight (8) off-site soil vapor probes in adjacent sidewalks to the north, west and south of the Site. In addition, one (1) drywell sediment sample (DW-1) was collected from a drywell located in rear alley in the former building basement at the Site. Refer to Figure 4 for the on-Site and off-Site sampling plan. The monitoring well construction logs can be found in Appendix 3.

Soil samples, groundwater samples, and soil vapor samples were all collected for chemical analysis during the RIs. A total of twenty-five (25) deep soil samples were collected across the Site at depths ranging between 6 and 35 feet bgs to evaluate soil quality. Twenty (20) groundwater samples were collected to evaluate groundwater quality. Three (3) sub-slab samples, three (3) indoor air samples, one (1) outdoor air sample, two (2) soil vapor samples were collected around the Site perimeter and eight (8) off-site soil vapor samples were also collected. Soil samples were analyzed for volatile organic compounds (VOCs) via EPA Method 8260 and seventeen soil samples were also analyzed for semi-volatile organic compounds (SVOCs) via EPA Method 8270, herbicides via EPA Method 8151, Pesticides and Polychlorinated Biphenyls (PCBs) via EPA Method 8081/8082 and Target Analyte List (TAL) Metals. Groundwater samples collected on-Site were analyzed for VOCs via EPA Method 8260, SVOCs via EPA Method 8270, herbicides via EPA Method 8151, Pesticides and PCBs via EPA Method 8081/8082 and total/dissolved TAL Metals. All sub-slab vapor samples, soil vapor samples and ambient air samples were analyzed for VOCs via EPA TO-15. Based on the finding of this investigation Hydro Tech modified the initial list of AOCs to reflect the findings documented in the RIR as follows:

1. AOC -1: Presence of chlorinated solvents in shallow and deep soil
2. AOC-2: Presence of dissolved chlorinated solvents in groundwater on and off-site
3. AOC 3: Presence of chlorinated solvents soil vapor at the Site and off-Site

2.3.3 Off-site Remedial Investigation

- *April 2016 - Sub-slab Vapor, Indoor and Outdoor Air Sampling Results - Steppingstone Day School, by HydroTech*

This investigation was performed at the west-adjacent childcare facility identified as Steppingstone Day School. The scope of this investigation involved the installation and sampling of three (3) sub-slab vapor points throughout the basement at Steppingstone Day School and the collection of three vapor samples, seven (7) basement indoor air samples and one (1) outdoor ambient air samples for chemical analysis.

Findings of this investigation were published in the September 2017 RIR. Figure 5 provides the sampling locations at *Steppingstone Day School.*

The same scope of this investigation at Steppingstone Day School was performed again during February 2019 at the conclusion of the groundwater remediation at this BCP site. The purpose of this investigation was to re-valuate the potential for soil vapor impact inside Steppingstone Day School in light of a major increase in PCE concentrations detected during December 2018 in a monitoring well located in its direct northern vicinity. The results of the February 2019 investigation are discussed in Section 2.5.3.

- *May 2017 - Sub-slab Vapor, Indoor and Outdoor Air Sampling Results – Kew Gardens Owners Corp., by HydroTech*

This investigation was performed at Kew Gardens Owners. Corp. located at 141-27 77th Road, 141-23 & 141-25 78th Avenue and involved the installation of two (2) soil vapor probes and collection of two (2) soil vapor samples, three (3) basement crawl space air samples, three (3) staircase indoor air sample and one (1) outdoor air sample for chemical analysis. Findings of this investigation were published in the September 2017 RIR. Figure 6 provides the sampling locations at Kew Gardens Owners Corp.

The scope of this investigation was repeated during February 2018 following NYSDEC approval of the December 2017 RAWP. This investigation was requested by NYSDEC in order to monitor whether the chlorinated solvents identified at the BCP Site are impacting this adjacent site. The results of the February 2018 investigation at Kew Gardens Owners Corp are discussed in Section 2.5.3.

- *May 2017 - Sub-slab Vapor, Indoor and Outdoor Air Sampling Results – Regency Gardens Company Corp., by HydroTech*

This investigation was performed at Regency Gardens Apartment Corp. located at 141-05, 141-12, 141-18 & 141-24 78th Avenue and involved the installation of four (4) sub-slab vapor points in the basements of designated buildings at this property and the collection of four (4) soil vapor samples, four (4) basement indoor air samples and one (1) outdoor ambient air samples for chemical analysis. Figure 7 provides the sampling locations at Regency Gardens Apartments Corp.

The of this investigation was repeated annually during the two consecutive heating seasons during March 2018 and January 2019. These two investigations are discussed in Section 2.5.3.

The remainder of this section will quantitatively summarize the findings of the RIR and off-site investigations at adjacent properties.

Soil samples collected during the RI indicate that PCE was detected in six locations on-site at concentrations in exceedance of The Unrestricted Soil Cleanup Objective (UUSCO). These locations are SP-18 from 16-18 feet bgs (4.4 mg/kg) and 30-32 feet bgs (3.2 mg/kg), SP-20 from 10-12 feet bgs (94 mg/kg), SP-22 from 6 to 8 feet bgs (38 mg/kg) and 28 to 30 feet bgs (2.1 mg/kg), SP-23 from 22-24 feet bgs (21 mg/kg) and SP-24 from 28 to 30 feet bgs (1.9 mg/kg). In three of these locations (SP-18, SP-22 and SP-24), PCE extends to the soil and groundwater interface. The restricted residential SCO of PCE was exceeded in one shallow sample in SP-22 and two deep samples collected above the soil and groundwater interface in SP-20 and in SP-23. PCE is also detected at concentrations below the Track 1 UUSCO in 2 locations in deep dry samples in SP-24 and SP-25 and in 6 locations at the soil-groundwater interface in SP-14, SP-15, SP-17, SP-20, SP-23 and SP-25 and off-site in SP-21. Other chlorinated VOCs including trichloroethylene, cis-1,2-dichloroethylene (TCE) and methylene chloride were detected in 3 different locations below Track 1 UUSCOs above the groundwater interface. SVOCs and metals are present in on-site soil at concentrations below their UUSCOs. Total PCBs and Herbicides did not occur in any soil samples.

The pesticides 4,4'-DDE (0.0175 mg/kg) and 4,4'-DDT (0.026 mg/kg) were detected at concentration exceeding the Track 1 SCOs in one deep soil in SP-11 from 18 to 20 feet bgs.

Groundwater samples collected during the RI identified a groundwater plume consisting of chlorinated solvents consisting of PCE and its degradation products TCE and chloroform beneath the southeastern portion of the Site and in the west-adjacent sidewalk at concentrations exceeding their respective GA Groundwater Standards. The greatest concentrations of PCE were detected at 2,200 ug/L in MW-9 and 11,000 ug/L in MW-11, which are both located upgradient in the southeastern portion of the former parking area at the Site. A lower PCE concentration was detected at 280 ug/L in MW-1, which is located off-site in the upgradient southeastern vicinity of the Site. Still lower concentrations of PCE were detected downgradient in ten on-Site wells and five off-site wells and ranged between 16 ug/L in MW-7 and 120 ug/L in MW-1. TCE was detected in the two on-site wells MW-9 and MW-11 with the higher concentration of 75 ug/L detected in MW-11.

The VOC cis-1,2-Dichloroethylene was identified MW4 and MW-6 with the higher concentration of 40 ug/L detected in MW-4. Chloroform was detected in two monitoring wells located off-site in the west-adjacent sidewalk at a concentration of 19 ug/L detected in MW-2 and a concentration of 8.4 ug/L detected in MW-3S. The levels of TCE or chloroform do not extend downgradient beneath the southwestern portion of the Site as evidenced by the analytical results of MW-7. Other VOCs were detected at concentrations exceeding their respective GA standards including toluene at 9.3 ug/L detected in off-site monitoring well MW-2, and Tetrahydrofuran detected in 1 on-site monitoring well MW-10 and two off-site wells MW-6 and MW-12 at concentrations ranging between 8.1 ug/L and 280 ug/L. Dissolved metals including magnesium, sodium and manganese were detected in the all groundwater beneath the Site at concentrations exceeding their respective GA Standards.

Soil vapor samples collected during the RI showed PCE and TEC were commonly detected in soil vapor samples collected throughout the property and at the sidewalks in the immediate Site vicinity. PCE was found in all on-site vapor samples and occurred in high concentrations with a maximum of 740,000 ug/m^3 beneath the southeastern portion in SV-4. PCE was also present in vapor samples collected around the property at maximum concentrations of 280,000 ug/m^3 detected to the south in SV-9, 2,100 ug/m^3 detected to the north in SV-11 and 130 ug/m^3 detected to the west in SV-6. TCE ranked the second highest soil vapor compound with a maximum on-site concentration of 26,000 ug/m^3 detected in sub-slab vapor sample SSB-1. TCE was also detected at a trace concentration of 4.1 ug/m^3 to the west in SV-7 and at a maximum concentration of 6,000 ug/m^3 to the north in SV-8. TCE was detected at concentrations of 900 µg/m^3 and 13 µg/m^3 to the south of the Site in SV-9 and SV-10. PCE and TCE were also detected in the indoor air samples collected inside commercial building at the Site at concentrations that exceeded their respective NYSDOH guidance values of 30 ug/m^3 and 2 ug/m^3. Additional chlorinated compounds were also detected in the on-site and off-site soil vapor samples including 1,1,1-trichloroethane (65 ug/m^3), 1,1-dichloroethane (15 ug/m^3), acetone (maximum 96 ug/m^3), carbon tetrachloride (9.5 ug/m^3), chloroform (maximum 320 ug/m^3) and cis-1,2-DCE (7,400 ug/m^3). Of these compounds, carbon tetrachloride (0.85 ug/m^3), and chloroform (maximum 4.6 ug/m^3) were also detected in indoor air samples collected at the Site.

Sediment sample results indicated no VOCs including chlorinated hydrocarbons occurred in the sediment sample collected from the drywell located at the Site.

Off-Site Investigation at Steppingstone Day School:

PCE (max. 0.38 µg/m3), TCE (0.32 µg/m3) and 1,1,1-Trichloroethane (1,1,1-TCA) (max. 4.19 µg/m3) are present in the sub-slab vapor samples. Only PCE was detected in all indoor air samples at concentrations ranging between 0.34 µg/m^3 and 1.07 µg/m^3. The reported concentrations of PCE in indoor air samples is below the NYSDOH air guideline value of 30 ug/m^3.

Off-Site Investigation at Kew Gardens Owners. Corp:

PCE was detected in the two soil vapor samples (max. 13,000 ug/m3) and in all three crawl space samples (max.10 ug/m3). TCE occurred in 1 soil vapor sample (13 µg/m3). Only PCE was detected in the indoor air samples, at a maximum concentration of 3.6 ug/m^3. The reported concentrations of PCE in these air samples are below the NYSDOH air guideline values

Off-Site Investigation at Regency Gardens Apartment Corp.:

PCE (max. 1,300 ug/m^3) was detected in 4 sub-slab vapor sample and TCE (max. 1.9 $\mu g/m^3$) was detected in 2 vapor samples. PCE and TCE also occurred in indoor air samples at maximum concentrations of 13 $\mu g/m^3$ and 0.97 $\mu g/m^3$, respectively. PCE and TCE concentrations in indoor air samples did not exceed their respective NYSDOH guidance values of 30 ug/m^3 and 2 ug/m^3.

2.3.4 Remedial Actions

- *December 2017 – Remedial Action Work Plan by HAKS Engineers and Land Surveyors, P.C.*
- *October 2018 – Remedial Action Work Plan Addendum by HydroTech Environmental Engineering and Geology, DPC.*

In response to the findings during the RIs and off-site soil vapor investigations at adjacent properties, a Remedial Action Work Plan (RAWP) was prepared by HAKS in December 2017 and a RAWP Addendum was prepared by HydroTech Environmental Engineering and Geology, DPC in October 2018. The RAWP proposed a Track 4 remedy for a restricted residential use. Soil exceeding the Restricted Residential SCOs at the Site would be excavated to the depth 25 feet below the curb elevation at the southwest intersection between Vleigh Place and 78th Avenue (bgs).

Thirty-nine (39) confirmation post-excavation end point samples would be collected following materials removal. Since residual contaminated soil, groundwater and soil vapor will exist beneath the Site after the remedy is complete, Engineering and Institutional Controls (ECs and ICs) are required. Three (3) primary EC systems are proposed as part of this remedy: (1) a composite cover system consisting of a 6-inch thick concrete slab poured over a 6-inch layer of porous crushed stone, (2) a soil vapor extraction system (SVE) in the area of concern in the southeastern portion of the Site in order to prevent soil vapors from contaminated soil and groundwater from migrating into the on-Site structure or off-site following completion of remedial actions and (3) a groundwater remedial program that includes the implementation of in-situ chemical oxidation (ISCO) identified as PersulfOx and bioremediation agents identified as 3_D Microemulsion Factory Emulsified (3DME) mixed with additives identified as Bio-Dechlor Innoculum Plus (BDI Plus) and CRS Chemical Reducing Solution (CRS) to treat VOCs in the groundwater.

Remedial Actions Completed

Remedial actions were performed at the Site according the RAWP and RAWP Addendum and other requirements by NYSDEC. On March 26, 2018 Groundwater samples were taken from thirteen active on-site and off-site monitoring wells including MW-1, MW-2, MW-3S, MW-3D, MW-5S, MW-5D, MW-6 to MW-9, and MW-11 to MW-13 utilizing Passive Diffusion Bag (PDB) samplers in order to establish baseline data for PCE prior to groundwater remedial injections. PersulfOx as well as 3DMe with BDI and CRS add-ons were mixed with water on-Site in order to provide the requested solution, which was then injected into the saturated zone beneath the southeastern portion of the Site utilizing a Geoprobe® GS1000 Grout Machine for PersulfOx and a Geoprobe® GP800 for 3DMe via direct push using a Geoprobe. See Figure 8 for the location of the injection points.

The first round of *in-situ* chemical oxidation (ISCO) consisting of PersulfOx was completed in the southeastern upgradient portion of the Site via 8 on-site injection points and 2 off-site points during May 2018 followed by a quarterly groundwater sampling from MW-1, MW-2, MW-3S, MW-5S, MW-6 to MW-9, and MW-11 to MW-13 on August 28, 2018. Based on detected PCE concentrations during the first quarterly groundwater sampling, which exceeded 7,000 µg/L, a second round of ISCO injections was repeated during September 2018 and was followed by another quarterly groundwater sampling taken from all thirteen active on-site and off-site monitoring wells on December 26, 2018. Per NYSDEC request, five selected monitoring wells MW-1, MW-3D, MW-6, MW-11, and MW-12 were sampled for emerging contaminants identified as 1,4-dioxane and per- and polyfluoroalkyl substances (PFAS) utilizing EPA low flow sampling method. Based on the significant detections of PFAS compounds and a moderate detection of 1,4-dioxane in groundwater collected beneath the Site, NYSDEC decided that PFOAs and 1,4-Dioxine would be considered as contaminants of concern for this Site along with PCE and they should be included as part of the groundwater sampling program.

A final round of injections of 3_D Microemulsion Factory Emulsified (3DME) mixed with additives identified as Bio-Dechlor Innoculum Plus (BDI Plus) and CRS Chemical Reducing Solution (CRS) was performed in the southeastern upgradient portion of the Site via 23 on-site and 7 off-site injection points between January and February 2019. Two quarterly groundwater sampling events were performed during April 2019 and July 2019. Due to monitoring well decommissioning associated with site excavation, NYSDEC requested a modification to the groundwater sampling plan for July 2019 to include monitoring wells MW-2, MW-3S, MW-3D, MW-7, MW-12, and MW-13 and sampled for VOCs and emerging contaminants.

Due to extended delays associated with site remedial excavation permits, the SVE system which was designed as an EC to be implemented during Site remedial action, was installed and implemented as an immediate interim remedial measure per NYSDEC requirements in an effort to capture and treat soil vapors emanating from soil and groundwater beneath the southeastern portion of the Site. This interim SVE system consisted of three (3) soil vapor extraction (SVE) wells (EW-1 to EW-3) installed at varying depths of 25 to 30 feet bgs, with a 5-foot 0.030-inch slotted screen placed at the bottom of the well. The SVE wells were connected to an EN 707 5-HP Rotron blower mounted inside a shed and connected to two air treatment drums containing Granular Activated Carbon. Six (6) vacuum pressure monitoring ports (PT-1 to PT-6) were installed on- and off-site as a cluster in the area of desired influence of the SVE wells. Each point consisted of a stainless-steel screen placed at 5 feet bgs. The SVE system was operated from July 23, 2018 to April 8, 2019 and was dismantled on April 10, 2019 when site excavation commenced. Monitoring data of SVE system performance, including vacuum at three SVE wells, was reported to NYSDEC on a weekly basis. The final SVE system will be re-installed at the conclusion of site excavation activities and started-up in accordance with the start-up protocol detailed in the RAWP. Figure 9 provides a map showing the location of the previously installed interim SVE system and associated vacuum monitoring points prior to the start of site excavation during August 2018.

On June 8, 2018, monitoring wells MW-5S and MW-5D were reinstalled following their destruction during unforeseen disturbance activities that occurred in the southeastern portion of the Site. These two monitoring wells along with MW-1, MW-6 MW-8, MW-9 and MW-11 were then decommissioned on October 8, 10 and 12, 2019 prior to the on-set of excavation activities at this Site. With the completion of Site excavation, monitoring wells MW-1, MW-5D, MW-6, MW-9 and MW-11 were then reinstalled on September 5 and 6, 2019. Groundwater monitoring well construction logs can be found in Appendix 3.

Soil excavation at the Site was completed between April 3 and September 13, 2019. All solid waste produced from this activity was previously sampled and characterized for waste disposal. A technical Waste Characterization (WC) report dated October 26, 2018 by was prepared by HydroTech and a Contained-In Determination letter dated November 28, 2018 confirmed that none of the soil data presented in this WC report exhibited a hazardous waste characteristic exceeding their TCLP regulatory levels.

Soil analytical data published in historic subsurface investigations, in the RIR and in the WC report were all submitted to disposal facilities listed below for their review. In the southeastern corner of the Site, additional soil samples were collected, and an analytical report dated July 17, 2019 was prepared by Phoenix Environmental Laboratories, Inc. at the request of selected disposal facilities, for the delineation of PCE impact around SP-20 (10-12') and was also submitted to applicable disposal facilities. Acceptance letters were issued by these facilities to receive excavated soil and former concrete foundations removed from this site. A total of 48,830 cubic yards of soil / fill material was removed from the Site and sent to the following facilities:

- 8,460 cubic yards were disposed at Hoffman Griffett Mine Reclamation Site located and 426 US-46 in Belvidere, NJ
- 19,640 cubic yards were disposed at Earth Efficient Rodata Fill Site located at 401 S Bridgeville Rd in Belvidere, NJ
- 40 cubic yards of soil fill material were disposed at Earth Efficient BTL located at 339 Sullivan Trail in Pocono Summit, PA
- 1,660 cubic yards were disposed at Yannuzzi Recycling Facility located at 327 Meadow Raod in Edison, NJ
- 18,350 cubic yards were disposed at Evergreen Recycling of Corona located Willets Point Boulevard in Corona Meadows Yard in Queens, NY
- 80 cubic yards were disposed at Cumberland County Solid Waste Complex located at 2 North High Street in Millville NJ

- 600 cubic yards were disposed at Nature Choice located at 25 Baler Boulevard in Kearny, NJ

A total of 1,080 cubic yards of former concrete foundations were removed from the Site and disposed of as C&D waste at the following facilities:

- 1,040 cubic yards of C&D were disposed at Vambro Corporation located t 1900 South Avenue in Staten Island, NY
- 40 cubic yards of C&D were disposed at Earth Efficient BTL located at 339 Sullivan Trail in Pocono Summit, PA.

On April 3, 2019, an 1,100-gallon Number 2 fuel oil UST was encountered during Site excavation beneath the former driveway to the north of the former building basement at the Site. The UST was found buried in dirt without any protective encasement and was filled to the top with Number 2 fuel oil, which was pumped via a vac truck. A total of 1,100 gallons of Number 2 fuel oil was removed from the tank and was transported off-site for disposal at Dale Transfer Corp. located at 129 Dale Street in West Babylon, NY via a disposal waste manifest. On April 12, 2019, the UST was then closed and removed from the ground and a tank removal affidavit was issued with the NYC Fire Department. No evidence of staining was identified in soil around the UST. No evidence of holes or corrosion was identified on the UST. The UST was then cut open, cleaned and disposed as scrap metal. One drum containing tank bottom sludge was generated from the tank cleanup and was transported off-site for disposal via a disposal waste manifest. The UST was registered with NYSDEC Petroleum Bulk Storage file number 2-613061. The UST closure documentation including the closure affidavit, NYSDEC PBS registration, liquid and tank bottom waste disposal manifests is provided in Appendix 4.

At the conclusion of site excavation, a cover system was installed comprising of 6 to 10 inches of ¾-inch bluestone underlain by a minimum of 24 inches of clean soil fill material.

Due to the proximity of the bottom of the excavation to the water table beneath the Site, the proposed SVE design presented in the December 2017 RAWP was modified by HydroTech Environmental Engineering and Geology, DPC in a revised final system design plan dated August 2019. Consistent with the continued presence of residual PCE concentrations in the soil vapors in the immediate vicinity of the removed PCE hot spot in the southeastern portion of the Site, an interim SVE system was installed per NYSDEC requirements during October 2019 to prevent the migration of soil vapors into neighboring properties to the south and east. This interim system consists of two (2) soil vapor extraction (SVE) wells (EW-4 to EW-5) installed in the southeast-adjacent sidewalk to the Site. The SVE wells were installed at 15 and 25 feet bgs, with a 5 foot 0.030-inch slotted screen placed at the bottom of each well. The SVE wells are connected to an EN 707 5-HP Rotron blower mounted inside a shed that is placed adjacent to the wells. The blower effluent is connected to two air treatment drums containing Granular Activated Carbon. The radius of influence of the SVE system is monitored via six vacuum monitoring points. These monitoring points include two existing monitoring ports (PT-1 and PT-2), one additional vacuum monitoring point (PT-7) installed in the south-adjacent sidewalk to the Site, two existing soil vapor points (SV-8, SV-9) also located in the south-adjacent sidewalk, and one existing soil vapor point (SV-KG-1) located at Kew Garden Owners, Corp.

The interim SVE system will continue its operation until construction of the new building and final SVE is in place.

Figure 10 provides a map showing the location of the interim SVE system installed post site excavation.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the Decision Document dated January 24, 2018 are as follows:

Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles from contaminated groundwater.

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Remove the source of ground or surface water contamination.

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.

2.5 Remaining Contamination

2.5.1 Soil

Analytical results for the thirty-nine end point samples collected in accordance with the RAWP and one additional end point sample collected per NYSDEC representative witnessing the sampling, confirm that all contaminated soils have been removed from the Site and Unrestricted Use SCO for soil has been achieved. One individual pesticide, 4,4'-DDT, is present at a concentration of 0.112 ppm, which exceeds its Unrestricted Use SCO in end point sample EP-35, collected beneath the timber lagging at the base of the eastern wall of excavation. The presence of 4,4'-DDDT in EP-35 is not a representative contamination remaining at the Site, but rather can be associated with anonymous source(s) from historic rodent abatement along the eastern boundary of site as well as from rodent abatement at the abutting parking sheds at Kew Gardens to the east. Despite this isolated pesticide finding, the soil remaining on site was assessed to meet Unrestricted Use SCO.

Table 3 provides a summary of the results of all end point samples collected after completion of remedial action with a comparison to applicable SCOs.

2.5.2 Groundwater

A network of five (5) on-site monitoring wells (MW-5S, MW-5D, MW-8, MW-9, MW-11) and eight off-site monitoring wells (MW-1, MW-2, MW-3S, MW-3D, MW-6, MW-7D and MW-12 and MW-13) were utilized to determine the effectiveness of the groundwater remedial injection program implemented as part of Site remedy. The locations of the monitoring wells are shown in Figure 4.

A round of pre-injection groundwater samples was obtained on March 26, 2018 from the thirteen on-site and off-site monitoring wells. The samples were collected via PDBs and were analyzed for VOCs by EPA Method 8260.

Monthly monitoring of aquifer response to ISCO injections was conducted in five monitoring wells MW-5S, MW-8, MW-9, MW-11 and MW-12. PCE was found to exceed NYSDEC GQS Values in 10 of the 13 samples. The highest PCE concentrations were detected in southeastern portion of the Site in MW-9 at 33,000 µg/L and MW-11 at 21,000 µg/L. TCE was found to exceed NYSDEC GQS in 5 monitoring wells with highest concentrations also reported in MW-9 (29 µg/L) and MW-11 (36 µg/L). Other chlorinated compounds were also found to exceed NYSDEC GQS including 1,1,2-Trichloroethane detected in on-site monitoring well MW-11 and cis-1,2-Dichloroethylene and Chloroform detected in three off-site monitoring wells in MW-2, MW-6 and MW-7.

A first round of post-ISCO injection samples were obtained from MW-1, MW-2, MW-3S, MW-5S, MW-6 to MW-9, and MW-11 to MW-13 on August 28, 2018. The samples were also collected via PDBs and were analyzed for VOCs by EPA Method 8260. The results showed PCE and TCE in exceedance of NYSDEC GQS of PCE in all sampled monitoring wells except for MW-7 and MW-13. The highest PCE concentrations were detected at 8,880 µg/L in MW-9 and 7,510 µg/L in MW-11. The reduced PCE concentrations in the most contaminated monitoring wells at the Site (i.e. MW-8 and MW-9) indicated that the first round of ISCO application was effective. Due to the continued presence of PCE beneath the Site in excess of 7,000 µg/L after the first round of completed ISCO injections, a second round of ISCO injections was required in accordance with the RAWP. Other chlorinated VOCs that exceeded NYSDEC GQS included cis-1,2-Dichloroethylene detected in 2 groundwater samples including a sample collected on-site from MW-9 and chloroform detected in four samples off-site wells. Acetone was also reported in exceedance of NYSDEC GQS in groundwater samples and is typically considered is laboratory contaminant.

A second round of post-injection groundwater sampling was performed following the second ISCO injection from all thirteen wells on December 26, 2019. Results of this sampling event revealed a further decrease from previous results of PCE and TCE concentrations exceeding NYSDEC GQS in all monitoring wells except for downgradient wells MW-2 and MW-3D. PCE was found to increase from a benchmark value of 200 µg/L prior to injections to 8,250 µg/L in MW-2 and 2,060 µg/L in MW-3D. Concentrations of cis-1,2-Dichloroethylene and chloroform in excess of NYSDEC GQS were detected in five off-site monitoring wells. Additional groundwater samples were collected per NYSDEC request from five selected monitoring wells MW-1, MW-3D, MW-6, MW-11, and MW-12 utilizing EPA low flow sampling method. These groundwater samples were analyzed for emerging contaminants identified as 1,4-dioxane via EPA Method 8270 SIM and also for per- and polyfluoroalkyl substances (PFAS) via Modified EPA Method 537. Emerging contaminants analytical results indicated a significant detection of PFAS compounds and a moderate detection of 1,4-dioxane in groundwater collected beneath the Site. Based on these findings the NYSDEC requested that emerging contaminants should be considered as contaminants of concern for this Site along with PCE and this sampling shall be included in the groundwater sampling program for this Site.

Post-3DME injections groundwater sampling was performed during three consecutive quarterly events during April 2019, July 2019 and October 2019. The samples were collected during the April 2019 event from MW-2, MW-3S, MW-3D, MW-7, MW-12, and MW-13 as per NYSDEC requirements following decommissioning of on-site wells. The groundwater samples were analyzed for VOCs and Emerging Contaminants (1,4-Dioxane and PFAs). The April 2019 sampling method for VOCs was PDBs. The sampling method for Emerging Contaminants was EPA low flow sampling method.

Groundwater samples were also collected from MW-2, MW-3S, MW-3D, MW-7, MW-12, and MW-13 during the July 2019 sampling event. The groundwater samples were analyzed for VOCs and Emerging Contaminants.

The July 2019 sampling method for VOCs was via PDBs. Additionally, PDBs were placed at shallow and deep intervals in MW-2 and MW-13 per NYSDEC request so that the presence of PCE could be characterized at vertical intervals, consistent with the impact characterization observed in MW-3S and MW-3D. The sampling method for Emerging Contaminants was EPA low flow sampling method

During the October 2019 sampling event, the samples were collected from MW-2, MW-3S, MW-3D, MW-7, MW-12, and MW-13 and also from MW-1, MW-5D, MW-6, MW-9 and MW-11, which were reinstalled following Site excavation. The samples were analyzed for VOCs and Emerging Contaminants. The October 2019 sampling method for VOCs and Emerging Contaminants was EPA low flow sampling method as per NYSDEC requirements.

The three sampling events reveal the continued presence of PCE beneath the Site at concentrations exceeding NYSDEC GQS. The greatest PCE concentrations reported on-site prior to the start of site excavation in April 2019 were identified at 668 µg/L in MW-9 and 1,830 µg/L in MW-11, which represent a significant decrease from benchmark concentrations of 33,000 µg/L and 21,000 µg/L as a result of effective injections performed beneath the southeastern upgradient portion of the Site. Sampling results of the October 2019 investigation indicated a maximum PCE concentration of 1,640 µg/L was detected in MW-11. However, concerns were raised by NYSDEC over the continued detection of elevated levels of PCE in MW-11 during July 2019 and October 2019 following the remedial injections. PFAS compounds were also detected in all sampled monitoring wells across all sampling events. The greatest concentrations of PFAs were reported during October 2019 in MW-1 and MW-6.

Table 4 summarizes the results of all pre- and post-injection samples of groundwater that exceed the SCGs after completion of the remedial actions. Figure 11 details the pre- and post-injection PCE and TCE concentrations in groundwater. Similarly, Figure 12 shows the PFOA, PFOS and 1,4-Dioxane concentrations in groundwater.

2.5.3 Soil Vapor

Off-site Soil Vapor Investigation

During November 2018, a round of off-site soil vapor sampling was performed in eight (8) soil vapor points located in the sidewalks surrounding the Site and across the western Site vicinity. These same soil vapor points were sampled during the RI and included SV-2, SV-3, SV-6 to SV-11. Soil vapor points SV-8 and SV-11 were found to be intact and in a good sampling condition. All other soil vapor points were determined to be inactive and were then re-installed during this investigation. This sampling was required by NYSDEC to determine the efficiency of the previously installed interim SVE system beneath the southeastern portion of the Site prior to Site excavation.

A second round of off-site soil vapor sampling was also conducted during October 2019 at the conclusion of excavation activities. This investigation was requested by NYSDEC to evaluate the potential for soil vapor impact emanating from the Site in the absence of SVE system and the continued presence of PCE in groundwater samples in downgradient monitoring wells MW-2 and MW-3D. Soil vapor samples were collected from eleven off-site soil vapor points SV-2, SV-3, SV-6 to SV-13 and SV-KG-1. Soil vapor points SV-2, SV-8 and SV-11 were found to be destroyed and were re-installed during this investigation.

The same RI scope of sampling was followed during both investigations. Laboratory analytical results of the November 2018 investigation revealed a reduction of PCE and TCE concentration in the soil vapor points located around the Site. For example, PCE concentration decreased in SV-8 located in the south-adjacent sidewalk from a benchmark of 6,000 $\mu g/m^3$ to 41.4 $\mu g/m^3$ following SVE installation. On the other hand, PCE and TCE concentrations in SV-2, which is located across the western vicinity of the Site and adjacent to Steppingstone Day School, increased during November 2018 to 5,085 $\mu g/m^3$ and 59.1 $\mu g/m^3$ from their respective benchmark values of 370 $\mu g/m^3$ and 17
$\mu g/m^3$ detected during November 2014.

The overall decrease in PCE concentrations during November 2018 was likely the result of vapor mitigation by the previously installed interim SVE system.

Analytical results of the October 2019 investigation reveal elevated PCE concentrations of 66,000 µg/m^3 and 160,000 µg/m^3 detected in SV-KG-1 and SV-9, which are located to the south and east of the former PCE hot spot in the southeastern portion of the Site. These PCE concentrations represented a concern over residual vapors emanating from the Site that require continued mitigation.

Table 5 provides the off-site soil vapor analytical results over time. Figure 13 provides the PCE and TCE concentrations in off-site soil vapors.

Sub-slab Vapor, Indoor and Outdoor Air Investigation at Steppingstone Day School

On February 22, 2019, the same scope of indoor air assessment performed during the RI was also conducted inside the Steppingstone Day School located at 77-40 Vleigh Place. This scope involved the collection of sub-slab vapor samples, indoor and outdoor air samples at the same locations as in the previous investigation. This sampling was required by NYSDEC following the detection of elevated PCEs and TCE in soil vapors and in groundwater collected in the immediate vicinity of the pre-school in SV-2 and also in MW-3D. Findings of the February 2019 investigation indicated PCE was detected in one sub-slab vapor sample at a concentration of 2.4 µg/m^3 and in indoor air samples at a maximum of 9.3 µg/m^3. In addition, 1,1,1-Trichloroethane (1,1,1-TCA) was also detected in a sub-slab vapor sample at concentration of 4.7 µg/m^3. The detected concentrations of chlorinated solvents are below the NYSDOH air guideline for mitigation. As such, no soil vapor intrusion mitigation action is required inside the pre-school. Table 6 provides the results of all air samples collected inside Steppingstone Day School over time. Findings of this investigation was published in the following report:

- *March 2018 – Sub-slab Vapor, Indoor and Outdoor Air Sampling Results, Steppingstone Day School 77-40 Vleigh Place, Flushing, NY, By HydroTech Environmental Engineering and Geology, DPC*

Sub-slab Vapor, Indoor and Outdoor Air Investigation at Kew Gardens Owners Corp.

On February 28, 2018 a soil vapor intrusion assessment was performed at the three east-adjacent residential buildings identified as Kew Gardens Owners. Corp. located at 141-27 77th Road, 141-23 & 141-25 78th Avenue. This investigation consisted of the same scope of sampling performed during the RI. On November 5, 2018, one soil vapor sample was collected per NYSDEC requirements in the south-east adjacent parking area at this site to determine the efficiency of the SVE system that was installed temporarily in the southeastern portion of the BCP Site. Laboratory analytical results of the completed sampling revealed PCE detected in the parking area decreased from a maximum of 20,000 ug/m^3 detected in February 2018 to 10,169 ug/m^3 in November 2018. This decrease in PCE concentrations beneath the parking area is likely due to vapor mitigation by the previous interim SVE system. Findings from the indoor air assessment inside the three Kew Gardens buildings continue to indicate no soil vapor intrusion impact that would warrant the implementation of mitigation actions. Table 7 provided a summary of the Sub-slab Vapor, Indoor and Outdoor Air Sampling Results at Kew Gardens Owners. Corp. Findings of this investigation was published in the following report:

- *April 2018 – Sub-slab Vapor, Indoor and Outdoor Air Sampling Results, Kew Gardens Owners. Corp.- 141-27 77th Road, 141-23 & 141-25 78th Avenue, Flushing, NY, By HydroTech Environmental Engineering and Geology, DPC*

Sub-slab Vapor, Indoor and Outdoor Air Investigation at Regency Gardens

The annual indoor air assessment at the four buildings at Regency Gardens Apartment Corp. located at 141-05, 141-12, 141-18 & 141-24 78th Avenue was conducted during two consecutive heating seasons: March 1, 2017 and January 9, 2019. The January 2019 investigation was also aimed to determine the level of soil vapor mitigation at this property following the SVE temporary installation at the BCP Site. Both investigations consisted of the same scope of work performed during the RI.

Findings of these two investigations indicate elevated levels of PCE detected in sub-slab vapors beneath three of the four buildings during March 2018 ranged between 2,200 ug/m^3 to 5,800 ug/m^3. PCE concentrations beneath these three buildings decreased during January 2019 and ranged between 720 ug/m^3 to 5,200 ug/m^3. It was concluded that despite the soil vapor mitigation effort by the SVE system at the BCP site, sub-slab vapors beneath of the four buildings at Regency Gardens Apartment Corp. warrant the implementation of soil vapor mitigation measures. A Sub-Slab Depressurization System Design Work Plan was prepared in accordance with NYSDEC requirements for the four buildings and subsequently approved by the NYSDEC. An Access Agreement to install this SSDS is currently being negotiated with Regency Gardens Apartment Corp. Once this Access Agreement is finalized, the SSDS will be installed, started-up and operated.

Table 8 provided a summary of the Sub-slab Vapor, Indoor and Outdoor Air Sampling Results at Regency Gardens Company. Figure 14 provides the PCE and TCE concentrations in sub-slab vapors at Regency Gardens Company.

These two investigations were published in the following two reports:

- *April 2018 – Sub-slab Vapor, Indoor and Outdoor Air Sampling, Regency Gardens Company- 141-05, 141-12, 141-18 & 141-24 78th Avenue, Flushing, NY, By HydroTech Environmental Engineering and Geology, DPC*
- *February 2019 – Sub-slab Vapor, Indoor and Outdoor Air Sampling, Regency Gardens Company- 141-05, 141-12, 141-18 & 141-24 78th Avenue, Flushing, NY, By HydroTech Environmental Engineering and Geology, DPC*

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

Since remaining contamination exists at the site, Institutional Controls (ICs) and Engineering Controls (ECs) are required to protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the site. The IC/EC Plan is one component of the SMP and is subject to revision by the NYSDEC.

This plan provides:

- A description of all IC/ECs on the site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix 5) for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the site; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the site remedy, as determined by the NYSDEC.

3.2 Institutional Controls

A series of ICs is required by the Decision Document to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and, (3) limit the use and development of the site to Restricted Residential uses only. Adherence to these ICs on the site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown on Figure 15. These ICs are:

- The property may be used for restricted residential use;
- All ECs must be operated and maintained as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP.
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Queens Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department.
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;

- Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement.
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 15, as well as nearby buildings in the vicinity of the Site, and any potential impacts that are identified must be monitored or mitigated; and
- Vegetable gardens and farming on the site are prohibited;

3.3 Engineering Controls

3.3.1 Cover

Exposure to remaining contamination at the Site is prevented by a cover system placed over the site. In the absence of a finalized building foundation design plan, an interim composite cover comprised of a minimum of 6 to 10 inches of ¾-inch bluestone underlain by a minimum of 24 inches of clean soil fill material was installed at the bottom of excavation. This cover system is designed to be capped in the future by a 6-inch thick mat building slab. This cover system and applicable demarcation layers are shown in Figure 16. The Excavation Work Plan (EWP) provided in Appendix 5 outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) provided in Appendix 6 and associated Community Air Monitoring Plan (CAMP) prepared for the site and provided in Appendix 7.

3.3.2 Soil Vapor Extraction Systems

As a result of the continued presence of PCE detected in groundwater and soil vapor around the former hot spot area following Site remedial excavation and groundwater remediation, an interim SVE system was installed off-site in the southeast-adjacent sidewalk at the request of NYSDEC. This system consists of SVE wells EW-4 and EW-5; EW-4 was installed to 15 bgs and EW-5 was installed to 25 feet bgs. The SVE wells are connected to an EN 707 5-HP Rotron blower mounted inside a shed that is placed adjacent to the wells. The blower effluent is connected to two air treatment drums containing Granular Activated Carbon. The radius of influence of the SVE system will be monitored via six vacuum monitoring points according to the Operations and Maintenance Manual in Appendix 8 of this SMP. These vacuum monitoring points consist of three monitoring ports (PT-1, PT-2 and PT-7) and three soil vapor points (SV-8, SV-9 and SV-KG-1). The system was installed and made operational during October 2019. This interim system will remain in operation until the final SVE system is installed beneath the new building. The location of the installed interim SVE system post Site excavation is provided in Figure 10.

This interim SVE system will be decommissioned only after the final SVE system, which was approved by NYSDEC in a Revised SVE system design plan dated August 2019, is ready to become operational. This final SVE system is anticipated to be installed once the new building design plan is finalized and will consist of a triangulated-shaped loop of horizontal interconnected perforated 4-inch diameter schedule 80 PVC pipes installed within the ¾-inch bluestone layer in the southeastern portion of the Site, where the source of TCE and PCE contamination was identified. The loop of SVE piping will be connected to an EN 707 5-HP Rotron blower through a reducer to a 2-inch PVC tee. The SVE system will be connected to a moisture separator and particle filter placed prior to the blower. The effluent from the blower will be treated prior to discharge by two 55-gallon drum sized vapor phase Granulated Activated Carbon (GAC) vessels. In addition to the already installed vacuum monitoring points PT-1, PT-2, PT-7, SV-KG-1, SV-8, SV-9, four (4) sub-slab vacuum monitoring ports, identified as PT-3 to PT-6, will be installed on-site as part of the final SVE design.

Each vacuum monitoring port will consist of a stainless-steel screen placed 3-inches below the concrete slab of the proposed building. Appropriate stickers indicating the content of SVE pipes, purpose of alarm, and contact numbers for immediate assistance in case of emergency will be mounted on visible portions of the SVE piping network

Procedures for operating and maintaining the interim and final SVE systems are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP) in Appendix 8. The revised drawing for the final SVE system is also included in Appendix 8. As-built drawings of the final SVE system and an updated SVE Operation and Maintenance Manual will be provided in an SMP amendment report.

3.3.3 Off-Site Sub-slab Depressurization System at Regency Gardens Apartment Corp.

A NYSDEC-approved SSDS Design Work Plan dated July 18, 2019 was prepared to mitigate the soil vapor intrusion impact at four buildings located at the Regency Gardens Apartment complex identified as 141- 05, 141-12, 141-18 & 141-24 78th Avenue Corp. This SSDS has not been installed as of the date of this document but is anticipated to be installed once access to the property is granted. The complete installation and start-up of the SSDS at this property will be documented in an SMP amendment report. The July 2019 SSDS Design Work Plan for Regency Gardens Apartment Corp. is provided in Appendix 9.

In addition to, and in no way limiting the Department's ability to act in accordance with the terms of the BCA, SMP, COC, statutes, regulations, and any other applicable authority, the Department may revoke the Participant's Certificate of Completion if the Department finds that the Participant's progress toward remediating any or all off‐site contamination, including, but not limited to, sub‐slab soil vapor in certain portions of a property across 78th Avenue, known as "Regency Garden Apartments", is insufficient. The remediation of this off‐site area will be more fully described elsewhere in this SMP and/or work plans, as appropriate.

Participant must make reasonable efforts to obtain access to the off‐site area at least once

per month until access is granted. The Participant shall document efforts to obtain access and provide such documentation to the Department at least quarterly as well as in all otherwise required Periodic Review Reports (PRR). Once access is secured, the Participant shall complete the implementation of the off‑site remedy within three month(s).

The designed SSDS for this property will consist of two suction pits installed beneath the basement slab of each of the four target buildings. Each suction pit will consist of a sub-slab cavity of approximately 2 feet by 2 feet in area by 2 feet in depth. A 4" diameter open-ended PVC pipe will be placed in the pit and held in place with a clamp. The pit will then be filled with crushed stone to prevent displacement of soil particles under vacuum and resurfaced. Each 2 suction pits per building will be manifolded into one riser and connected in the exterior of to a rooftop mounted Radon Away GP-501 suction fan with 4-inch diameter cast iron pipe. The fan has a power requirement of 70-140 Watts, a maximum suction pressure of 4.2 inches of water, and is capable of flow rates of a maximum 10 cubic feet per minute (CFM). A Magnehelic Differential Pressure Gage, manufactured by Dwyer, and an audio/visual system alarm and a sampling port will be placed in line with each suction fan.

The suction fans will be placed at least 3 feet above the rooftop parapet and 10 feet away from any exhaust or air intake vents. All systems fans will be hardwired independently in each basement, directly from a main electric panel. The fan will be connected to exterior piping using a 4" to 3" reducer on each end. The fan will be connected to a condensate bypass constructed with a 45-degree Wye fitting that is capped and fitted with a bypass tube to allow condensation to drain away from the fan.

Two (2) vacuum pressure monitoring ports will be installed in each basement for a total of 8 ports. The vacuum pressure monitoring port will allow for system monitoring and to ensure proper communication beneath the slab. Each pressure test point will consist of a stainless-steel screen placed 3-inches below the basement slab.

The purpose of these test points is to conduct a quantitative pressure field extension test after SSDS implementation, both prior and post system start-up.

Procedures for operating and maintaining the SSDS are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP) included in Appendix 9. The as-built SSDS drawings and an updated Operation and Maintenance Plan will be provided in an SMP amendment report following system installation, start-up and testing.

3.3.4 In-situ Chemical Oxidant (ISCO) And Bioremediation Mechanism

Remediation of dissolved phase VOCs in groundwater will be accomplished through a chemical oxidant and bioremediation injection program. Remedial injections were mainly concentrated around the source area of PCE in the southeastern portion of the Site.

An initial round of ISCO treatment was completed during May 2018. A groundwater sampling event following the ISCO treatment indicated the necessity for an additional round of ISCO treatment, which was performed September 2018. Both ISCO treatments utilized 8 on-site injection points and 2 off-site injections points for PersulfOx application via direct push.

Bioremedial injections were performed 3 months following the last ISCO injection during January 2019. Bioremediation treatment utilized 23 on-site injection points and 7 off-site points for the application of 3DME and its additives BDI Plus and CRS additives via direct push. The injection point locations are shown in Figure 8A.

Due to elevated PCE concentrations detected at the site during the October 2019 sampling event, NYSDEC requested additional steps to remediate residual site-related groundwater contamination. The scope of additional groundwater remediation consisted of a third round of localized ISCO injections in the vicinity of MW-11.

Residual groundwater contamination around MW-11 was treated via PersulfOx introduced via two injections probes installed in the southeastern upgradient vicinity of the Site in the sidewalk on 78th Avenue on December 5, 2019. The two injection probes were evenly spaced approximately 8 feet from MW-11 and were installed at 48 feet bgs. Approximately, 413 pounds of ISCO material mixed with 363 gallons of water were applied in each point. The solution was introduced in the saturated zone approximately 16 feet below the soil and groundwater interface utilizing a Geoprobe® GP800 and via direct push using a Geoprobe. Prior to these injections, USEPA was notified of the construction of the injection wells by filing OMB No. 2040-0042 form with Region 2 USEPA office. The Location of these two injection point locations are shown in Figure 8B.

If the quarterly groundwater monitoring program indicates the groundwater quality beneath the site has not been improved to the satisfaction of NYSDEC, further groundwater treatment via ISCO or 3DME injections may be necessary as part of site management. If it is determined additional treatment is necessary, a scope of work will be submitted to NYSDEC for review and approval. If warranted, any future injections will be performed in the southeastern upgradient vicinity of the Site in the sidewalk on 78th Avenue and if justified, injection may be conducted in the southeastern portion of the property through the basement slab of the future building.

3.3.5 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10.

3.3.3.1 Cover (or Cap)

The composite cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP in perpetuity.

3.3.3.2 Soil Vapor Extraction System (SVE System)

The interim SVE system, which was installed at the conclusion of site excavation, will be discontinued and decommissioned once the final SVE system wells and piping network is installed beneath the new building slab.

This SVE system will not be discontinued unless prior written approval is granted by the NYSDEC. In the event that monitoring data indicates that the SVE system may no longer be required, a proposal to discontinue the system will be submitted by the remedial party. Conditions that may warrant discontinuing the SVE system include contaminant concentrations in groundwater and/or soil that: (1) reach levels that are consistently below ambient water quality standards or the site SCGs, as appropriate; (2) have become asymptotic to a low level over an extended period of time, as accepted by the NYSDEC; or (3) the NYSDEC has determined that the SVE system has reached the limit of its effectiveness. This assessment will be based in part on post-remediation contaminant levels in groundwater collected from monitoring wells located throughout the site. Systems will remain in place and operational until permission to discontinue their use is granted in writing by the NYSDEC.

3.3.3.3 Off-Site Sub-Slab Depressurization (SSD) System at Regency Gardens Apartment Corp.

The active SSDS will not be discontinued unless prior written approval is granted by the NYSDEC and the NYSDOH. In the event that monitoring data indicates that the SSDS may no longer be required, a proposal to discontinue the SSDS will be submitted by the remedial party to the NYSDEC and NYSDOH.

3.3.3.4 In-Situ Chemical Oxidant (ISCO) and Bioremediation Treatment

The GWT system, consisting of the In-Situ Chemical Oxidant and Bioremediation treatments will not be discontinued unless prior written approval is granted by the NYSDEC. In the event that monitoring data indicates that the GWT system may no longer be required, a proposal to discontinue the system, including the results of an impact study, will be submitted by the remedial party. Conditions that may warrant discontinuing the GWT system include contaminant concentrations in groundwater that: (1) reach levels that are consistently below ambient water quality standards or the site SCGs as appropriate, (2) have become asymptotic to a low level over an extended period of time as accepted by the NYSDEC; or (3) the NYSDEC has determined that the GWT system has reached the limit of its effectiveness. This assessment will be based in part on post-remediation contaminant levels in groundwater collected from monitoring wells located throughout the site. Systems will remain in place and operational until permission to discontinue their use is granted in writing by the NYSDEC.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are included in the Quality Assurance Project Plan provided in Appendix 10.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater, indoor air, soil vapor, soils);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards and Part 375 SCOs for soil; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment;

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency;
- Information on all designed monitoring systems;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 Site-wide Inspection

Site-wide inspections will be performed at a minimum of once per year. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix 11 –Management Forms for On-Site ECs. The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General site conditions at the time of the inspection;
- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that site records are up to date.

Inspections of all remedial components installed at the site will be conducted. A comprehensive site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and
- If site records are complete and up to date; and

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to the NYSDEC must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

4.3 Cover System Monitoring

EC inspections and monitoring of the composite cover will be conducted annually. These activities shall include observations of the conditions of the concrete sidewalks, concrete building slab and asphalt-paved areas surrounding the building at the Site. The composite cover will be inspected for cracks, holes or other openings that will alter the performance of the SVE system. Any cracks, holes or other openings in the composite cover that are observed during the EC inspection will be recommended to be immediately filled and/or sealed as necessary.

4.4 SVE Monitoring and Sampling

4.4.1 SVE Monitoring

The installed post Site excavation interim SVE system will be replaced in the future by a final SVE system, which was approved by NYSDEC in a revised SVE system design plan dated August 2019.

Monitoring of the interim and final SVE Systems will be performed monthly for the duration of system operation and as identified in Table 9 representing the SVE System Monitoring Requirements and Schedule (see below). Modification to the frequency or sampling requirements will require approval from the NYSDEC. A visual inspection of the complete system will be conducted during each monitoring event.

This monitoring will consist of a visual observation for any physical wear, damage and

operational issues associated with the airflow readings, vacuum readings, temperature at the GAC drums, and organic vapor concentrations at effluent. Unscheduled inspections and/or sampling may take place when a suspected failure of the SVE system has been reported or an emergency occurs that is deemed likely to affect the operation of the system. SVE system components to be monitored include, but are not limited to, the components included in Table 9 below.

Table 9 – SVE System Monitoring Requirements and Schedule

Remedial System Component	**Monitoring Parameter**	**Monitoring Schedule**
Interim SVE System		
Blower	On or Off	Monthly
Effluent	PID, Flow, Temperature	Monthly
Alarm	Alarm sound and on/off light	Monthly
SVE well head for (EW-4, EW-5)	Flow, PID, Vacuum pressure	Monthly
Vacuum Monitoring points (PT-1, PT-2, PT-7, SV-8, SV-9 and SV-KG-1)	Vacuum pressure	Monthly
Weather conditions	Temperature, barometric pressure	Monthly
Final SVE System		
Blower	On or Off	Monthly
Effluent	PID, Flow, Temperature	Monthly
Alarm	Alarm sound and on/off light	Monthly
SVE well head (horizontal piping)	Flow, PID, Vacuum pressure	Monthly
Vacuum Monitoring points (PT-1 to PT-7, SV-KG-1, SV-8, SV-9)	Vacuum pressure	Monthly
Weather conditions	Temperature, barometric pressure	Monthly

A complete list of components to be inspected for the SVE system is provided in the Inspection Checklist, provided in Appendix 11 - Management Forms for On-Site ECs. If any equipment readings are not within their specified operation range, any equipment is observed to be malfunctioning or the system is not performing within specifications; maintenance and repair, as per the SVE Operation and Maintenance Plan (Appendix 8), is required immediately.

The location of the interim SVE system and vacuum monitoring points installed post site excavation is provided in Figure 10. Appendix 8 provides the location of the proposed final SVE system design beneath the new building. As-built drawings of this final system will also be provided in an SMP amendment report.

4.4.2 SVE Sampling

Samples shall be collected from the influent and effluent of each of the two GAC drums associated with both the interim and the final SVE systems on a routine basis. Sampling analytical parameters and schedule are provided in Table 10 – SVE System Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Table 10 –SVE Sampling Requirements and Schedule

Sampling Location	Analytical Method	Schedule
Influent/Effluent at Drum #1 and Influent/Effluent at Drum #2	VOCs (EPA Method TO-15)	Semi-annually

Influent and effluent air samples to and from the two GAC drums will be collected for a sampling period of 2 hours utilizing 6 liter pre-cleaned (as certified by the laboratory). passivated and evacuated whole air Summa® Canister and analyzed for VOCs via EPA Method TO-15.

Detailed sample collection and analytical procedures and protocols are provided in Appendix 10 – Quality Assurance Project Plan.

4.5 Off-site SSDS Monitoring and Sampling

4.5.1 Off-site SSDS Monitoring

If, installed, monitoring of the off-site sub-slab depressurization system installed at Regency Gardens buildings will be performed by a QEP on an annual basis as identified in Table 11 – SSDS Monitoring Requirements and Schedule (see below). The SSDS will undergo routine inspections by the building superintendent staff to ensure that the SSDS is operating properly and that there are no obvious signs of damage that would require repair of fans, manometers or alarms. Modification to the frequency or sampling requirements will require approval from the NYSDEC. A visual inspection of the complete SSDS will be conducted during each monitoring event and groundwater sampling event. Unscheduled inspections and/or sampling may take place when a suspected failure of the SSDS has been reported or an emergency occurs that is deemed likely to affect the operation of the system. As-built drawings of the SSDS will be provided in an SMP amendment report. Appendix 9 provides the approved SSDS design plan and system components to be monitored including, but are not limited to, the components included in Table 11 below.

Table 11 – SSDS Monitoring Requirements and Schedule

SVE System Component	Monitoring Parameter	Monitoring Schedule
Fan	On or Off	Annually
Vacuum Gauge	Vacuum pressure	Annually
Alarm	Alarm sound and on/off light	Annually
Vacuum Monitoring points (PTP-1 to PTP-8)	Vacuum pressure	Annually

A complete list of components to be inspected for the off-site SSDS is provided in the Inspection Checklist, provided in Appendix 12- Management Forms for off-site SSDS. If any equipment readings are not within their specified operation range, any equipment is observed to be malfunctioning or the system is not performing within specifications; maintenance and repair, as per the Operation and Maintenance Plan (Appendix 9), is required immediately.

4.5.2 Off-site SSDS Sampling

Post SSDS startup, indoor air samples and a background outdoor sample shall be collected in the basements of the four building at Regency Gardens annually during the heating season. Samples shall be collected in accordance with October 2006 NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York. These samples will be collected for the duration of 6 hours utilizing 6 liter pre-cleaned (as certified by the laboratory), passivated and evacuated whole air Summa® Canister and analyzed for VOCs via EPA Method TO-15. Figure 7 provides the location of the indoor air samples at Regency Gardens buildings. Sampling analytical parameters and schedule are provided in Table 12 – SSDS System Sampling Requirements and Schedule.

Additionally, as part of the initial SSDS startup sampling, three additional structures at Regency Gardens will have SVI evaluations completed. These three buildings are directly adjacent to, and in some cases, connect to the structures which have previously been sampled. The goal of this supplemental sampling is to confirm the extents of Site related soil vapor contamination.

Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Table 12 –SSDS Sampling Requirements and Schedule

Sampling Location	Analytical Method	Schedule
Indoor air/outdoor samples (IA-RG-1 to IA-RG-4 and OA-RG-1)	VOCs (EPA Method TO-15)	Annually
Indoor air/sub-slab samples	VOCs (EPA Method TO-15)	One time

4.6 Groundwater Monitoring and Sampling

Groundwater monitoring and sampling was performed quarterly to assess the performance of the remedy. Groundwater samples were collected from thirteen on-site and off-site monitoring wells including two well nests (MW1, MW-2, MW-3S; MW-3D, MW-5S, MW-5D and MW-6 to MW-13) three months after each of the two rounds ISCO injections and three months after 3DME injections. Groundwater sampling was also performed six months post-3DME injections from six off-site monitoring wells including one well nest (MW-2, MW-3S; MW-3D, MW-7, MW-12 and MW-13) that remained intact during Site remedial excavation. Five decommissioned monitoring wells (MW-1, MW-5D, MW-6, MW-9 and MW-11) were re-installed at the conclusion of site remedial excavation. MW-11 was relocated approximately 8 feet from the southeastern corner of the Site to the south-adjacent sidewalk. A total of eleven on-site and off-site wells identified as MW-1, MW-2, MW-3S; MW-3D, MW-5D, MW-6, MW-7, MW-9, MW-11 to MW-13 were sampled 9 months post-3DME injections. All these monitoring wells are to be sampled to evaluate the effectiveness of the remedial system.

Groundwater monitoring and sampling will be performed sixty days following the proposed third ISCO injections in the southeastern upgradient vicinity of the Site in the sidewalk on 78th Avenue. All on- and off-site monitoring wells (MW-1, MW-2, MW-3S, MW-3D, MW-5D, MW-6, MW-7, MW-9, MW-11, MW-12, and MW-13) will be sampled to monitor the effectiveness of both this round, and prior injections.

Table 13 provides the schedule and requirements for groundwater monitoring and sampling (see below). Modification to the frequency or monitoring requirements will require approval from the NYSDEC. A visual inspection of the monitoring wells will be conducted during each monitoring event.

Table 13 – Groundwater Monitoring and Sampling Schedule

Monitoring Wells	Monitoring Parameter	Analytical Methods	Monitoring Schedule
MW1, MW-2, MW-3S; MW-3D, MW-5D, MW-6, MW-7, MW-9 and MW-11 to MW-13	Condition, PID Screen, Depth to water	* TCL VOCs via EPA Method 8260 * Perfluorooctanoic acid (PFOA) and other Perfluorinated compounds (PFCs) via Modified EPA Method 537 * 1,4-Dioxine via EPA Method 8270D SIM	Quarterly
MW1, MW-2, MW-3S; MW-3D, MW-5D, MW-6, MW-7, MW-9 and MW-11 to MW-13	Condition, PID Screen, Depth to water	* TCL VOCs via EPA Method 8260	60 days after proposed 3rd ISCO injections

Table 14 summarizes the wells identification number, as well as the purpose, location, depths, diameter and screened intervals of the wells.

Table 14 – Monitoring Well Construction Details

Monitoring Well ID	Well Location	Casing Elevation above mean seal level (ft)	Well diameter (inches)	Installation depth (ft)	
				Riser interval	Screen interval
MW-1	Off-Site - crossgradient	80.71	1	0-25	25-40
MW-2	Off-Site - crossgradient	80.83	1	0-27	27-42
MW-3S	On-Site - downgradient	79.6	1	0-27	27-37
MW-3D		79.54	1	0-37	37-42
MW-5D	On-Site - upgradient	56.1	1	19-31	31-36
MW-6	Off-Site - crossgradient	83.14	1	0-25	25-40
MW-7 (D)	Off-Site - downgradient	79.88	1	0-37	37-42
MW-9	On-Site upgradient	55.8	1	19-25	25-35
MW-11		84.19	1	0-25	25-40
MW-12	Off-Site - upgradient	84.95	1	0-33	33-48
MW-13	Off-Site - crossgradient	83.26	1	0-32	32-47

Monitoring well construction logs are included in Appendix 3 of this document.

If biofouling or silt accumulation occurs in the on-site and/or off-site monitoring wells, the wells will be physically agitated/surged and redeveloped.
Additionally, monitoring wells will be properly decommissioned and replaced, if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance. Groundwater monitoring wells will be incorporated into the final on-site building plan and installed when necessary. Any new or re-installed groundwater monitoring wells will be 2" diameter with a minimum of 2" of sandpack surrounding the well screen.

The NYSDEC will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC.

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

Deliverables for the groundwater monitoring program are specified in Section 7.0 – Reporting Requirements.

4.7 Soil Vapor Sampling

Soil vapor sampling will be performed annually to assess the performance of the interim SVE system and also the final SVE system. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Table 15 below provides the network of off-site soil vapor sampling locations that will be incorporated into the soil vapor sampling program.

Table 15 – Off-Site Soil Vapor Sampling Requirements and Schedule

Sampling Location	Analytical Method	Schedule
Interim SVE System		
Off-site soil vapor points (SV-KG-1, SV-2, SV-3, SV-6 to SV-11)	VOCs (EPA Method TO-15)	30 days after start-up and then Annually
Final SVE System		
On-site vacuum pressure monitoring ports (PT-3 to PT-6) and Off-site soil vapor points (SV-2, SV-3, SV-6 to SV-11, SV-KG-1)	VOCs (EPA Method TO-15)	30 days after start-up and then Annually

On-site and off-site soil vapor samples will be collected from the off-site soil vapors points and on-site vacuum pressure monitoring points in accordance with October 2006 NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York. These samples will be collected for a duration of 6 hours utilizing 6 liter pre-cleaned (as certified by the laboratory), passivated and evacuated whole air Summa® Canister and analyzed for VOCs via EPA Method TO-15. Figure 13 provides the location of SV-KG-1, SV-2, SV-3, SV-6 to SV-11. The revised design for the final SVE in Appendix 8 provides the location of PT-1 to PT-6.

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

Detailed sample collection and analytical procedures and protocols are provided in Appendix 10 – Quality Assurance Project Plan.

5.0 OPERATION AND MAINTENANCE PLAN

5.1 General

This Operation and Maintenance Plan provides a brief description of the measures necessary to operate, monitor and maintain the mechanical components of the remedy selected for the site. This Operation and Maintenance Plan:

- Includes the procedures necessary to allow individuals unfamiliar with the site to operate and maintain the SVE, the off-site SSDS and the ISCO and bioremediation systems;
- Will be updated periodically to reflect changes in site conditions or the manner in which the SVE, the SSDS and the ISCO and bioremediation system are operated and maintained.

Further detail regarding the Operation and Maintenance of the SVE system, the ISCO and bioremediation system is provided in Appendix 8 - Operation and Maintenance Manual of On-Site ECs. Further detail regarding the Operation and Maintenance of the SSDS is provided in Appendix 9 - Operation and Maintenance Manual of Off-Site SSDS. Updated SVE Operations and Maintenance Plans for the final SVE system and the SSDS will be provided in an SMP amendment report. A copy of the complete SMP along with the on- and off-site Operation and Maintenance Manuals is to be maintained at the Site. A copy of the Off-Site SSDS Operation and Maintenance Manual, is to be maintained at Regency Gardens building. These Operation and Maintenance Plans are not to be used as a stand-alone document, but as a component document of this SMP.

5.2 Soil Vapor Extraction System Performance Criteria

An SVE system was installed as an interim measure beneath the southeast-adjacent sidewall to the Site until the final SVE system is installed beneath the new building.

The SVE system installation for this Site is intended to remove chlorinated VOCs from the subsurface and also prevent potentially contaminated soil vapors from entering any new developments on-Site and or adjacent developments. The SVE system is designed with an EN 707 5-HP Rotron blower to extract impacted soil vapor from residual soil and groundwater beneath the Site and these vapors will be treated via GAC drums prior to being discharged into the ambient air. The SVE system will operate continuously. Details of the installed interim SVE system post Site excavation are provided in Figure 10. The Operation and Maintenance Manual of the interim and the final SVE systems are provided in Appendix 8. Details regarding the proposed final SVE system beneath the proposed new building slab are provided in Appendix 8. The as-built drawings of the final SVE system, start-up and testing will be provided in an SMP amendment report.

5.2.1 Operation and Maintenance of Soil Vapor Extraction System

The following sections provide a description of the operations and maintenance of the interim SVE system as well as the final SVE system. Cut sheets of the SVE system along with interim Operations and Maintenance Manual are provided in Appendix 8. Amended Operations and Maintenance Manual of the final SVE system that will be installed beneath the new building will be provided in an SMP amendment report.

5.2.1.1 SVE Start-Up and Testing

Prior to start-up of the SVE system, an inspection will be performed to confirm that all system components are in place. The SVE blower will then be started in accordance with the manufacturer's recommendations and in accordance to the SVE start-up monitoring protocol described in the RAWP. System testing will be performed as follows:

- A vacuum gauge and a port to measure organic vapors will be mounted on the section of the vertical solid riser pipe located between the blower and building slab.

- A vacuum gauge will be mounted on the influent to the blower in order to measure the total negative pressure exercised by the system.
- The alarm indicating blower malfunction will be tested to confirm operation.
- The effluent past the GAC drums will be subject to monitoring for organic. vapors using PID and also for air temperature and air flow from the system using a digital anemometer.
- Activated carbon bed Breakthrough Detectors will be mounted on the GAC drums, which is an indicator that the activated carbon drum needs to be replaced.
- Six (6) vacuum pressure monitoring ports will be utilized. These monitoring points include two existing monitoring ports (PT-1 and PT-2), one additional vacuum monitoring point (PT-7) installed in the south-adjacent sidewalk to the Site, two existing soil vapor points (SV-8, SV-9) also located in the south-adjacent sidewalk and one existing soil vapor point (SV-KG-1) located at Kew Garden Owners, Corp. After startup, the vacuum at each monitoring port will be measured utilizing a TSI Almor EBT730 Manometer (or similar) in order to verify the radius of influence of the SVE system. A minimum vacuum of -0.01 inches H2O should be achieved at all vacuum monitoring points. A poor vacuum communication between the SVE system and any vacuum monitoring points shall be assessed for improvement.
- Monitoring the soil vapor mitigation performance by the SVE system by collecting soil vapor samples as discussed in Section 4.7. In the event the soil vapor sampling indicates a poor performance by the SVE system, an SVE system design modification or additional measures shall be implemented per NYSDEC approval.
- Based on the levels of off-site soil vapor sampling performed post installation and operation of the final SVE system, additional mitigation measures may be warranted at additional buildings at Regency Gardens Apartments, or other previously sampled off-site properties.

The system testing described above will be conducted if, in the course of the SVE system lifetime, the system goes down or significant changes are made to the system and the system must be restarted.

5.2.1.2 SVE Routine Operation and Maintenance

The vacuum blower will operate continuously after completing the startup protocol. All equipment will be operated in accordance with the manufacturer's recommendations. The present general construction contractor as well as the future Site operator or building superintendent will be provided with all manufacturers' product data, manuals, and drawings related to the SVE components including the blower, switches, alarm and pressure gauges. Routine inspections of the SVE system will be performed by the building superintendent to determine whether the blower is found to be non-operational and the audible/visual alarm has not been triggered, or if the blower is operating, but the vacuum readings observed on the vacuum gauge is less than -20 inch H2O. The BCP site owner or owner's representative(s) shall be immediately contacted the determine the appropriate parties to perform these repairs. Any required maintenance, adjustments, or repairs to the blower system will be conducted as per the manufacturer's recommendations. The non-blower components of the system (i.e., gauges) are passive; therefore, maintenance, adjustments, or repairs are not anticipated, but inspection for physical damage will be conducted annually.

The building superintendent must also check during routine inspections of the activated carbon bed Breakthrough Detector for any changes in color from violet into brown or black is an indication that the activated carbon drum needs replacement. In addition, the detection of organic vapors at the SVE effluent in excess of 1 ppm during quarterly SVE monitoring events should also indicate the need to replace the drum prior to the annual inspection.

Routine equipment maintenance (e.g., replacing vent fans), repairs, and/or adjustments will be determined based on the life expectancy and warranty for the specific part as well as visual observations over time. The need for repairs and/or adjustments will be based on comparisons between the ongoing system performance and the performance when system operations were initiated. Routine maintenance activities and minimum schedules are provided in the SVE manual, which can be found in Appendix 12. Routine maintenance of the accessible, non-mechanical SVE system components (i.e., riser) is not anticipated.

Following the balance of SVE, all gauges and flow element settings will be recorded for future comparison purposes if the system is malfunctioning. The manufacturer's recommendations regarding operation of the blower will be followed.

5.2.1.3 SVE Non-Routine Operation and Maintenance

Non-routine maintenance may also be required during the operation of the SVE system, including the following situations:

- The general construction contractor or the building's owner or occupants report that the warning device indicates the system is not operating properly;
- The system becomes damaged; and/or,
- The building undergoes renovations that may reduce the effectiveness of the system.

Activities conducted during non-routine maintenance visits will vary depending upon the reason for the visit. NYSDEC will be informed of any failure of the SVE system within 48-hours. Repairs or adjustments will be made to the system as appropriate and as per manufacturer guidelines within 15 days of the equipment failure, whenever possible (i.e., pending availability of parts). If necessary, the system will be redesigned and restarted.

Operational problems will be noted in the Periodic Review Report to be prepared for that reporting period.

5.2.1.4 SVE Monitoring Devices and Alarms

The SVE system has a warning device consisting of red-light alarm signal and an audio signal that indicate that the system is not operating properly. The alarm will be located away from the blower in an area that can be easily monitored by the Site operator or building superintendent. In the event that warning device is activated, applicable maintenance and repairs will be conducted, as specified in the Operation and Maintenance Plan, and the SVE system will be restarted. Operational problems will be noted in the Periodic Review Report to be prepared for that reporting period.

5.3 Off-site Sub-slab Depressurization System Performance Criteria

An active SSDS will be installed beneath each of the four adjoining residential buildings identified as Regency Gardens Apartment Corp. and located at 141-05, 141-12, 141-18 & 141-24 78th Avenue to prevent potentially contaminated soil vapors from entering the residential buildings. Each system will use a RadonAway GP501 fan to create a negative pressure zone beneath the slab and subsequently conduct the soil vapor away from the building. Soil vapor will be collected into sub-grade piping and vented from a roof-mounted stack. The SSDS will operate continuously or until approved by NYSDEC to be shut down or reconfigured to operate as a passive SSDS.

5.3.1 Operation and Maintenance of Off-site Sub-slab Depressurization System

The following sections provide a description of the operations and maintenance of the SSDS. Cut-sheets for the proposed SSDS are provided in Appendix 9 – SSDS Operations and Maintenance Manual.

5.3.1.1 SSDS Start-Up and Testing

Prior to initial start-up of each SSDS, an inspection will be performed to confirm that all system components are in place. All equipment will then be started in accordance with the manufacturer's recommendations.

System testing will be performed as follows:

- While the system operates, smoke tubes will be used to check for leaks through concrete cracks, floor joints, and at the suction points. Any leaks identified will be properly sealed.
- The alarm indicating fan malfunction will be tested to confirm proper operation.
- Two vacuum pressure monitoring ports will be installed at each of the four buildings. After startup, a vacuum gauge will be used to measure the pressure at each monitoring port to verify that a vacuum extends throughout the entire sub-slab. A minimum vacuum of -0.01 inches H2O should be achieved at the two vacuum monitoring points associated with each SSDS. A poor vacuum communication between the SSDS system and the vacuum monitoring points shall be assessed for improvement by making any necessary repairs to the slab in order to increase the level of sub-slab vacuum communication.
- Monitoring the soil vapor mitigation performance by the SSDS will be performed by collecting indoor air samples in the basements of the four building at Regency Gardens during the heating season as discussed in Section 4.5.2. In the event the indoor air sampling indicates a poor performance by the SSDS system, adjustment to the SSDS design will be made or additional measures shall be implemented per NYSDEC approval.

The system testing described above will be conducted if, in the course of the SSDS lifetime, the system goes down or significant changes are made to the system and the system must be restarted.

5.2.1.2 SSDS Routine Operation and Maintenance

The vacuum fan associated with each SSDS at the each of the four buildings will operate continuously after initial startup. All equipment will be operated in accordance with manufacturer's recommendations. During the course of operation for the active SSDS, especially immediately after start-up, technical difficulties may be encountered and/or the SSDS may not operate within design specifications.

Any required maintenance, adjustments, or repairs to the fan system in each building will be conducted as per the manufacturer's recommendations. The non-fan components of the system (i.e., riser, suction pit, and underground piping) are passive; therefore, maintenance, adjustments, or repairs are not anticipated, but inspection for physical damage will be conducted annually.

Routine inspections of the SSDS will be performed by the building superintendent to determine whether the fan is found to be non-operational and the audible/visual alarm has not been triggered, or if the fan is operating, but the vacuum readings observed on the magnehelic vacuum gauge is less than -1 inch H2O. Any equipment maintenance (e.g., replacing vent fans), repairs, and/or adjustments will be determined based on the life expectancy and warranty for the specific part as well as visual observations over time. The need for repairs and/or adjustments will be based on comparisons between the ongoing system performance and the performance when system operations were initiated. Routine maintenance activities and minimum schedules are provided in the SSDS manual, which can be found in Appendix 9. Routine maintenance of the accessible, non- mechanical SSDS components (i.e., riser) is not anticipated. The building management office shall immediately contact in order to make the necessary contact with appropriate parties to undertake the necessary repairs.

5.2.1.3 SSDS Non-Routine Operation and Maintenance

Non-routine maintenance may also be required during the operation of the SSDS in the event the building's owner or occupants report that the warning device of the SSDS suggests the following;

- The system is not operating properly;
- The system becomes damaged; and/or,
- The building undergoes renovations that may reduce the effectiveness of the system.

Activities conducted during non-routine maintenance visits will vary depending upon the reason for the visit. NYSDEC will be informed of any failure of the SSDS within 48-hours. Repairs or adjustments will be made to the system as appropriate and as per manufacturer guidelines within 15 days of the equipment failure, whenever possible (i.e., pending availability of parts). If necessary, the system will be redesigned and restarted.

Operational problems will be noted in the Periodic Review Report to be prepared for that reporting period.

5.2.1.4 SSDS Monitoring Devices and Alarms

Each SSDS will have a warning device consisting of red-light alarm signal and an audio signal that indicate that the system is not operating properly. The alarm will be located near a hopper window in each basement so that its sounds can be heard by the building superintendent. In the event that the warning device is activated, applicable maintenance and repairs will be conducted, as specified in the Operation and Maintenance Plan, and the SSDS will be restarted. Operational problems will be noted in the Periodic Review Report to be prepared for that reporting period.

6.0 PERIODIC ASSESSMENTS/EVALUATIONS

6.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

This section provides a summary of vulnerability assessments that will be conducted for the site during periodic assessments, and briefly summarizes the vulnerability of the site and/or engineering controls to severe storms/weather events and associated flooding.

The Site is located in the in Kew Garden Hills neighborhood of Flushing Section of the County of Queens. It is located at an elevation of approximately 77 feet above mean sea level. According to the FEMA Flood Map, this site is not located within a flood hazard risk area. The Site is served by the NYC Municipal sewer system and the completed building will meet all NYC building codes for drainage. Therefore, the Site is not considered to be vulnerable to storm events related to climate change.

6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology.

This section of the SMP provides a summary of any green remediation evaluations to be completed for the site during site management, and as reported in the Periodic Review Report (PRR).

6.2.1 Timing of Green Remediation Evaluations

For major remedial system components, green remediation evaluations and corresponding modifications will be undertaken as part of a formal Remedial System Optimization (RSO), or at any time that the Project Manager feels appropriate, e.g. during significant maintenance events or in conjunction with storm recovery activities.

Modifications resulting from green remediation evaluations will be routinely implemented and scheduled to occur during planned/routine operation and maintenance activities. Reporting of these modifications will be presented in the PRR.

6.2.2. Remedial Systems

Remedial systems will be operated properly considering the current site conditions to conserve materials and resources to the greatest extent possible. Consideration will be given to operating rates and use of reagents and consumables. Spent materials consisting of granulated activated carbon for the treatment of soil vapors from the SVE system will be sent for recycling, as appropriate and in accordance with manufacturer's specification.

6.2.3 Building Operations

Structures including buildings and sheds will be operated and maintained to provide for the most efficient operation of the remedy, while minimizing energy, waste generation and water consumption.

Components to be evaluated as part of building operations should include, but are not limited to:

- Heating/cooling systems and temperature set-points;
- Building skin, insulation and building use and occupancy;
- Ventilation;
- Lighting and plug loads; and
- Grounds and property management.

6.2.4 Frequency of System Checks, Sampling and Other Periodic Activities

Transportation to and from the Site and use of consumables in relation to visiting the Site in order to conduct system checks and or collect samples and shipping samples to a laboratory for analyses have direct and/or inherent energy costs. The schedule and/or means of these periodic activities have been prepared so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

As part of this effort, consideration shall be given to:

- Reduced sampling frequencies;
- Reduced site visits and system checks;
- Installation of remote sensing/operations and telemetry;
- Coordination/consolidation of activities to maximize foreman/labor time; and
- Use of mass transit for site visits, where available.

6.2.5 Metrics and Reporting

As discussed in Section 7.0 and as shown in Appendix 11 and Appendix 12 – Management Forms for On-Site ECs and off-site SSDS, information on energy usage, solid waste generation, transportation and shipping, water usage and land use and ecosystems will be recorded to facilitate and document consistent implementation of green remediation during site management and to identify corresponding benefits; a set of metrics has been developed.

6.3 Remedial System Optimization

A Remedial Site Optimization (RSO) study will be conducted any time that the NYSDEC or the remedial party requests in writing that an in-depth evaluation of the remedy is needed. An RSO may be appropriate if any of the following occur:

- The remedial actions have not met or are not expected to meet RAOs in the time frame estimated in the Decision Document;
- The management and operation of the remedial system is exceeding the estimated costs;
- The remedial system is not performing as expected or as designed;
- Previously unidentified source material may be suspected;
- Plume shift has potentially occurred;
- Site conditions change due to development, change of use, change in groundwater use, etc.;
- There is an anticipated transfer of the site management to another remedial party or agency; and
- A new and applicable remedial technology becomes available.

An RSO will provide a critique of a site's conceptual model, give a summary of past performance, document current cleanup practices, summarize progress made toward the site's cleanup goals, gather additional performance or media specific data and information and provide recommendations for improvements to enhance the ability of the present system to reach RAOs or to provide a basis for changing the remedial strategy.

7.0 REPORTING REQUIREMENTS

7.1 Site Management Reports

All site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms provided in Appendix 11 for on-Site ECs including the SVE system, the cover slab and the monitoring wells and in Appendix 12 for off-site SSDS. These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 16 and summarized in the Periodic Review Report.

Table 16: Schedule of Monitoring/Inspection Reports

Task/Report	Reporting Frequency*
Periodic Review Report	Annually, or as otherwise determined by the Department
Inspection Reports	Quarterly

* The frequency of events will be conducted as specified until otherwise required by the NYSDEC.

All interim monitoring/inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);

- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets, and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting maintenance activities;
- Description of maintenance activities performed;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and,
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and

- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS^{TM} database in accordance with the requirements found at this link http://www.dec.ny.gov/chemical/62440.html.

7.1 Periodic Review Report

A Periodic Review Report (PRR) will be submitted to the Department beginning sixteen (16) months after the Certificate of Completion is issued. After submittal of the initial Periodic Review Report, the next PRR shall be submitted to the Department annually, or at another frequency as may be required by the Department. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in Appendix 1 - Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections and severe condition inspections, if applicable.
- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.

- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.
- Results of all analyses, copies of all laboratory data sheet, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS^{TM} database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.
- A site evaluation, which includes the following:
  - The compliance of the remedy with the requirements of the site-specific RAWP, ROD or Decision Document;
  - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
  - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
  - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan; and
  - Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document.
  - The overall performance and effectiveness of the remedy.
- A performance summary for all treatment systems at the site during the calendar year, including information such as:
  - The number of days the system operated for the reporting period;
  - The contaminant mass removed;
  - A description of breakdowns and/or repairs along with an explanation for any significant downtime;
  - A description of the resolution of performance problems;

  - Alarm conditions;
  - Trends in equipment failure;
  - A summary of the performance, effluent and/or effectiveness monitoring; and
- Comments, conclusions, and recommendations based on data evaluation.

7.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a qualified environmental professional or Professional Engineer licensed to practice in New York State will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

"*For each institutional or engineering control identified for the site, I certify that all of the following statements are true:*

- *The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*

- *Use of the site is compliant with the environmental easement;*

- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and generally accepted engineering practices; and*
- *The information presented in this report is accurate and complete.*
- *No new information has come to my attention, including groundwater monitoring data from wells located at the site boundary, if any, to indicate that the assumptions made in the qualitative exposure assessment of off-site contamination are no longer valid; and*
- *The assumptions made in the qualitative exposure assessment remain valid.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner/Remedial Party or Owner's/Remedial Party's Designated Site Representative] (and if the site consists of multiple properties): *[I have been authorized and designated by all site owners/remedial parties to sign this certification] for the site."*

The signed certification will be included in the Periodic Review Report. The Periodic Review Report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located and the NYSDOH Bureau of Environmental Exposure Investigation. The Periodic Review Report may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

7.3 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a Corrective Measures Work Plan will be submitted to the NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC.

7.4 Remedial Site Optimization Report

In the event that an RSO is to be performed (see Section 6.3, upon completion of an RSO, an RSO report must be submitted to the Department for approval. A general outline for the RSO report is provided in Appendix 13. The RSO report will document the research/ investigation and data gathering that was conducted, evaluate the results and facts obtained, present a revised conceptual site model and present recommendations. RSO recommendations are to be implemented upon approval from the NYSDEC. Additional work plans, design documents, HASPs etc., may still be required to implement the recommendations, based upon the actions that need to be taken. A final engineering report and update to the SMP may also be required.

The RSO report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located, Site Control and the NYSDOH Bureau of Environmental Exposure Investigation.

8.0 REFERENCES

- 6NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.
- NYSDEC DER-10 – "Technical Guidance for Site Investigation and Remediation".
- NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).
- HydroTech Environmental, Corp., Final Remedial Investigation Report, 77-57 Vleigh Place, Queens, NY, September 2017.
- HAKS, Remedial Action Work Plan, 77-57 Vleigh Place, Queens, NY, December 2017
- HydroTech Environmental Engineering and Geology, DPC, Sub-slab Vapor, Indoor and Outdoor Air Sampling Results, Steppingstone Day School - 77-40 Vleigh Place, Flushing, NY, March 2018.
- HydroTech Environmental Engineering and Geology, DPC, Sub-slab Vapor, Indoor and Outdoor Air Sampling Results, Regency Gardens Company- 141-05, 141-12, 141-18 & 141-24 78th Avenue, Flushing, NY, April 2018.
- HydroTech Environmental Engineering and Geology, DPC, Sub-slab Vapor, Indoor and Outdoor Air Sampling Results, Kew Gardens Owners. Corp., 141-27 77th Road, 141-23 & 141-25 78th Avenue, Flushing, NY, April2018.
- HydroTech Environmental Engineering and Geology, DPC, Remedial Action Work Plan Addendum, 77-57 Vleigh Place, Queens, NY, October 2018.
- HydroTech Environmental Engineering and Geology, DPC, Sub-slab Vapor, Indoor and Outdoor Air Sampling Results, Regency Gardens Company- 141-05, 141-12, 141-18 & 141-24 78th Avenue, Flushing, NY, February 2019.
- HydroTech Environmental Engineering and Geology, DPC, Sub-slab Depressurization System Design Work Plan, 141-27 77th Road, 141-23 & 141-25 78th Avenue, Flushing, NY, July 2019.

Tables

Table 2
Groundwater Monitoring Results
77-57 Vleigh Place, Flushing NY

Well ID	Casing Elevation	DTP	DTW (March 2018)	DTW (July 2018)	DTW (Dec 2018)	Water Table Elevation (March 2018)	Water Table Elevation (July 2018)	Water Table Elevation (Dec 2018)
MW-1	80.71	ND	30.7	29.45	29.8	50.01	51.26	50.91
MW-2	80.83	ND	30.05	28.95	29	50.78	51.88	51.83
MW-3S	79.6	ND	28.75	28.8	28.55	50.85	50.8	51.05
MW-3D	79.54	ND	28.8	NM	27.8	50.74	NM	51.74
MW-4	70.73	NA	NA	NA	NA	NA	NA	NA
MW-5S	83	ND	31.85	30.1	32.2	51.15	52.9	50.8
MW-5D	82.9	ND	31.73	NM	30.1	51.17	NM	52.8
MW-6	83.14	ND	32.5	31.35	31.6	50.64	51.79	51.54
MW-7D	79.88	ND	29.55	28.4	28.6	50.33	51.48	51.28
MW-8	81.78	ND	30.8	29.7	30	50.98	52.08	51.78
MW-9	82.82	ND	31.5	29.9	30	51.32	52.92	52.82
MW-10	80.9	NA	NA	NA	NA	NA	NA	NA
MW-11	84.19	ND	32.51	30	30.2	51.68	54.19	53.99
MW-12	84.97	ND	NM	30	33.1	NM	54.97	51.87
MW-13	82.36	ND	30.35	29	28.9	52.01	53.36	53.46

All values reported in feet.
DTW…Depth to Water from top of casing
DTP…Depth to Product from top of casing
ND…None Detected
NM…Not Measured
NA…Not Available

Table 3
End Point Samples Analytical Results for VOCs
77-57 Vleigh Place, Queens, NY

Sample ID	EP-1		EP-2		EP-3		EP-3a		EP-4		EP-5		EP-6		EP-7		EP-8		EP-9		EP-10		EP-11		EP-12		EP-13		EP-14		EP-15		EP-16		EP-17		EP-18		EP-19		UUSCOs	RRSCOs
Sampling Date	8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		9/13/2019		8/2/2019		8/2/2019		8/19/2019		9/13/2019		8/2/2019			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q		
Units	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg
1,1,1,2-Tetrachloroethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,1,1-Trichloroethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.68	100
1,1,2,2-Tetrachloroethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,1,2-Trichloro-1,2,2-trifluoroethane (Freo	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,1,2-Trichloroethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,1-Dichloroethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.27	26
1,1-Dichloroethylene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.33	100
1,1-Dichloropropylene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,2,3-Trichlorobenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,2,3-Trichloropropane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,2,4,5-Tetramethylbenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,2,4-Trichlorobenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,2,4-Trimethylbenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	3.6	52
1,2-Dibromo-3-chloropropane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,2-Dibromoethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,2-Dichlorobenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	1.1	100
1,2-Dichloroethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.02	3.1
1,2-Dichloropropane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,3,5-Trimethylbenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	8.4	52
1,3-Dichlorobenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	2.4	49
1,3-Dichloropropane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
1,4-Dichlorobenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	1.8	13
2,2-Dichloropropane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
2-Butanone	0.00300	U	0.00320	U	0.00280	U	0.00210	U	**0.00750**		**0.00990**		**0.00610**	J	**0.0120**	JB	**0.00600**		**0.00440**		**0.00530**		**0.00460**	J	**0.00510**	J	**0.0120**	JB	0.00210	U	0.00230	U	0.00230	U	0.00470	J	0.00230	U	0.00290	U	0.12	100
2-Chlorotoluene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
2-Hexanone	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
4-Chlorotoluene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
4-Methyl-2-pentanone	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Acetone	0.00600	U	0.00650	U	0.00560	U	**0.0320**		0.00730	U	**0.0270**		0.00730	U	**0.0120**	JB	**0.00670**	J	0.00420	U	**0.0140**		0.00590	U	**0.00850**	J	**0.0100**	JB	**0.0130**		**0.0150**		**0.150**		**0.00530**	U	**0.0100**		0.00590	U	0.05	100
Benzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.06	4.8
Bromobenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Bromochloromethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Bromodichloromethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Bromoform	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Bromomethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Carbon disulfide	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Carbon tetrachloride	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.76	2.4
Chlorobenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	1.1	100
Chloroethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Chloroform	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.37	49
Chloromethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
cis-1,2-Dichloroethylene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.25	100
cis-1,3-Dichloropropylene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Dibromochloromethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Dibromomethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Dichlorodifluoromethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Ethyl Benzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	1	41
Hexachlorobutadiene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Isopropylbenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Methyl tert-butyl ether (MTBE)	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.93	100
Methylene chloride	0.00600	U	0.00650	U	0.00560	U	0.00660	J	0.00730	U	0.00690	U	0.00730	U	0.00410	U	0.00500	U	0.00420	U	0.00510	U	0.00590	U	0.00540	U	0.00410	U	0.00420	U	0.00460	U	0.00460	U	0.00530	U	0.00460	U	0.00590	U	0.05	100
Naphthalene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	12	100
n-Butylbenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	12	100
n-Propylbenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	3.9	100
o-Xylene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
p- & m- Xylenes	0.00600	U	0.00650	U	0.00560	U	0.00430	U	0.00730	U	0.00690	U	0.00730	U	0.00410	U	0.00500	U	0.00420	U	0.00510	U	0.00590	U	0.00540	U	0.00410	U	0.00420	U	0.00460	U	0.00460	U	0.00530	U	0.00460	U	0.00590	U	~	~
p-Diethylbenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
p-Ethyltoluene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
p-Isopropyltoluene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
sec-Butylbenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	11	100
Styrene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
tert-Butylbenzene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	5.9	100
Tetrachloroethylene	0.00300	U	0.00320	U	**0.140**		0.00210	U	0.00370	U	**0.00670**	J	0.00680	J	0.00210	U	0.00250	U	0.00210	U	**0.00330**	J	0.00300	U	0.00270	U	0.00200	U	**0.0150**		**0.00250**	J	**0.0370**		0.00260	U	**0.00410**	J	**0.130**		1.3	19
Toluene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	**0.0100**		0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.7	100
trans-1,2-Dichloroethylene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.19	100
trans-1,3-Dichloropropylene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Trichloroethylene	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.47	21
Trichlorofluoromethane	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	~	~
Vinyl Chloride	0.00300	U	0.00320	U	0.00280	U	0.00210	U	0.00370	U	0.00350	U	0.00360	U	0.00210	U	0.00250	U	0.00210	U	0.00250	U	0.00300	U	0.00270	U	0.00200	U	0.00210	U	0.00230	U	0.00230	U	0.00260	U	0.00230	U	0.00290	U	0.02	0.9
Xylenes, Total	0.00900	U	0.00970	U	0.00840	U	0.00640	U	0.0110	U	0.0100	U	0.0110	U	0.00620	U	0.00760	U	0.00640	U	0.00760	U	0.00890	U	0.00800	U	0.00610	U	0.00630	U	0.00700	U	0.00680	U	0.00790	U	0.00690	U	0.00880	U	0.26	100

NOTES:
Q is the Qualifier Column with definitions as follows:
J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated
U=analyte not detected at or above the level indicated
B=analyte found in the analysis batch blank
~=this indicates that no regulatory limit has been established for this analyte
UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives
RRSCOs=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential

Table 3 (Cont.)
End Point Samples Analytical Results for VOCs
77-57 Vleigh Place, Queens, NY

Sample ID	EP-20		EP-21		EP-22		EP-23		EP-24		EP-25		EP-26		EP-27		EP-28		EP-29		EP-30		EP-31		EP-32		EP-33		EP-34		EP-35		EP-36		EP-37		EP-38		EP-39		UUSCOs	RRSCOs
Sampling Date	8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		9/13/2019		9/13/2019		9/13/2019		9/13/2019		9/13/2019		9/13/2019		8/2/2019			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q		
Units	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg
1,1,1,2-Tetrachloroethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,1,1-Trichloroethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.68	100
1,1,2,2-Tetrachloroethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,1,2-Trichloro-1,2,2-trifluoroethane (Freo	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,1,2-Trichloroethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,1-Dichloroethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.27	26
1,1-Dichloroethylene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.33	100
1,1-Dichloropropylene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,2,3-Trichlorobenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,2,3-Trichloropropane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,2,4,5-Tetramethylbenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,2,4-Trichlorobenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,2,4-Trimethylbenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	3.6	52
1,2-Dibromo-3-chloropropane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,2-Dibromoethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,2-Dichlorobenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	1.1	100
1,2-Dichloroethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.02	3.1
1,2-Dichloropropane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,3,5-Trimethylbenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	8.4	52
1,3-Dichlorobenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	2.4	49
1,3-Dichloropropane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
1,4-Dichlorobenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	1.8	13
2,2-Dichloropropane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
2-Butanone	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	**0.0140**		**0.00510**	J	0.00280	U	**0.00370**		**0.0130**	JB	**0.0340**	B	**0.00380**	J	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.12	100
2-Chlorotoluene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
2-Hexanone	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
4-Chlorotoluene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
4-Methyl-2-pentanone	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Acetone	**0.0670**		0.00320	U	0.00330	U	0.00420	U	0.00550	U	0.00500	U	**0.0870**		0.00550	U	0.00550	U	0.00370	U	**0.0210**	B	**0.0360**	B	0.00390	U	**0.0180**	J	**0.0160**		**0.0100**		0.00300	U	**0.0400**		0.00510	U	0.00430	U	0.05	100
Benzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.06	4.8
Bromobenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Bromochloromethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Bromodichloromethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Bromoform	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Bromomethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Carbon disulfide	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Carbon tetrachloride	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.76	2.4
Chlorobenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	1.1	100
Chloroethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Chloroform	0.00250	J	0.00280	J	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.37	49
Chloromethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
cis-1,2-Dichloroethylene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.25	100
cis-1,3-Dichloropropylene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Dibromochloromethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Dibromomethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Dichlorodifluoromethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Ethyl Benzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	1	41
Hexachlorobutadiene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Isopropylbenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Methyl tert-butyl ether (MTBE)	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.93	100
Methylene chloride	0.00340	J	0.00320	U	0.00330	U	0.00420	U	0.00550	U	0.00500	U	0.00580	U	0.00550	U	0.00550	U	0.00370	U	0.00390	U	0.00830	U	0.00390	U	0.0120	U	0.00520	U	0.00460	U	0.00300	U	0.00930	J	0.00510	U	0.00430	U	0.05	100
Naphthalene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	12	100
n-Butylbenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	12	100
n-Propylbenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	3.9	100
o-Xylene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
p- & m- Xylenes	0.00300	U	0.00320	U	0.00330	U	0.00420	U	0.00550	U	0.00500	U	0.00580	U	0.00550	U	0.00550	U	0.00370	U	0.00390	U	0.00830	U	0.00390	U	0.0120	U	0.00520	U	0.00460	U	0.00300	U	0.00630	U	0.00510	U	0.00430	U	~	~
p-Diethylbenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
p-Ethyltoluene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
p-Isopropyltoluene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
sec-Butylbenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	11	100
Styrene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
tert-Butylbenzene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	5.9	100
Tetrachloroethylene	**0.0540**		**0.00720**		0.00160	U	**0.00460**		0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	1.3	19
Toluene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.7	100
trans-1,2-Dichloroethylene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.19	100
trans-1,3-Dichloropropylene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Trichloroethylene	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.47	21
Trichlorofluoromethane	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	~	~
Vinyl Chloride	0.00150	U	0.00160	U	0.00160	U	0.00210	U	0.00280	U	0.00250	U	0.00290	U	0.00270	U	0.00280	U	0.00190	U	0.00200	U	0.00420	U	0.00200	U	0.00620	U	0.00260	U	0.00230	U	0.00150	U	0.00310	U	0.00250	U	0.00210	U	0.02	0.9
Xylenes, Total	0.00440	U	0.00480	U	0.00490	U	0.00630	U	0.00830	U	0.00750	U	0.00880	U	0.00820	U	0.00830	U	0.00560	U	0.00590	U	0.0120	U	0.00590	U	0.0190	U	0.00780	U	0.00690	U	0.00460	U	0.00940	U	0.00760	U	0.00640	U	0.26	100

NOTES:
Q is the Qualifier Column with definitions as follows:
J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated
U=analyte not detected at or above the level indicated
B=analyte found in the analysis batch blank
~=this indicates that no regulatory limit has been established for this analyte
UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives
RRSCOs=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential

Table 3 (Cont.)
End Point Samples Analytical Results for SVOCs
77-57 Vleigh Place, Queens, NY

Sample ID	EP-1		EP-2		EP-3		EP-3a		EP-4		EP-5		EP-6		EP-7		EP-8		EP-9		EP-10		EP-11		EP-12		EP-13		EP-14		EP-15		EP-16		EP-17		EP-18		EP-19		UUSCOs	RRSCOs
Sampling Date	8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		9/13/2019		8/2/2019		8/2/2019		8/19/2019		9/13/2019		8/2/2019			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q		
Units	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg
1,1-Biphenyl	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
1,2,4,5-Tetrachlorobenzene	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
1,2,4-Trichlorobenzene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
1,2-Dichlorobenzene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	1.1	100
1,2-Diphenylhydrazine (as Azobenzene)	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
1,3-Dichlorobenzene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	2.4	49
1,4-Dichlorobenzene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	1.8	13
1-Methylnaphthalene	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
2,3,4,6-Tetrachlorophenol	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
2,4,5-Trichlorophenol	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
2,4,6-Trichlorophenol	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
2,4-Dichlorophenol	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
2,4-Dimethylphenol	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
2,4-Dinitrophenol	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
2,4-Dinitrotoluene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
2,6-Dinitrotoluene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
2-Chloronaphthalene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
2-Chlorophenol	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
2-Methylnaphthalene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
2-Methylphenol	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	0.33	100
2-Nitroaniline	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
2-Nitrophenol	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
3- & 4-Methylphenols	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
3,3-Dichlorobenzidine	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
3-Nitroaniline	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
4,6-Dinitro-2-methylphenol	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
4-Bromophenyl phenyl ether	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
4-Chloro-3-methylphenol	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
4-Chloroaniline	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
4-Chlorophenyl phenyl ether	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
4-Nitroaniline	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
4-Nitrophenol	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
Acenaphthene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	20	100
Acenaphthylene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	100	100
Acetophenone	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Aniline	0.177	U	0.169	U	0.189	U	0.174	U	0.192	U	0.184	U	0.184	U	0.183	U	0.184	U	0.183	U	0.180	U	0.197	U	0.178	U	0.174	U	0.172	U	0.301	U	0.206	U	0.174	U	0.179	U	0.203	U	~	~
Anthracene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	100	100
Atrazine	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Benzaldehyde	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Benzidine	0.177	U	0.169	U	0.189	U	0.174	U	0.192	U	0.184	U	0.184	U	0.183	U	0.184	U	0.183	U	0.180	U	0.197	U	0.178	U	0.174	U	0.172	U	0.301	U	0.206	U	0.174	U	0.179	U	0.203	U	~	~
Benzo(a)anthracene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	1	1
Benzo(a)pyrene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	1	1
Benzo(b)fluoranthene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	1	1
Benzo(g,h,i)perylene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	100	100
Benzo(k)fluoranthene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	0.8	3.9
Benzoic acid	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Benzyl alcohol	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Benzyl butyl phthalate	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Bis(2-chloroethoxy)methane	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Bis(2-chloroethyl)ether	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Bis(2-chloroisopropyl)ether	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Bis(2-ethylhexyl)phthalate	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Caprolactam	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
Carbazole	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Chrysene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	1	3.9
Cresols, total	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
Dibenzo(a,h)anthracene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	0.33	0.33
Dibenzofuran	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	7	59
Diethyl phthalate	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Dimethyl phthalate	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Di-n-butyl phthalate	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Di-n-octyl phthalate	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Diphenylamine	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
Fluoranthene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	100	100
Fluorene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	30	100
Hexachlorobenzene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	0.33	1.2
Hexachlorobutadiene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Hexachlorocyclopentadiene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Hexachloroethane	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Indeno(1,2,3-cd)pyrene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	0.5	0.5
Isophorone	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Naphthalene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	12	100
Nitrobenzene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
N-Nitrosodimethylamine	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
N-nitroso-di-n-propylamine	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
N-Nitrosodiphenylamine	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Parathion	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	~	~
Pentachloronitrobenzene	0.0885	U	0.0842	U	0.0945	U	0.0869	U	0.0960	U	0.0918	U	0.0917	U	0.0913	U	0.0917	U	0.0912	U	0.0898	U	0.0982	U	0.0891	U	0.0867	U	0.0861	U	0.150	U	0.103	U	0.0868	U	0.0895	U	0.102	U	~	~
Pentachlorophenol	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	0.8	6.7
Phenanthrene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	100	100
Phenol	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	0.33	100
Propargite	0.177	U	0.169	U	0.189	U	0.174	U	0.192	U	0.184	U	0.184	U	0.183	U	0.184	U	0.183	U	0.180	U	0.197	U	0.178	U	0.174	U	0.172	U	0.301	U	0.206	U	0.174	U	0.179	U	0.203	U	~	~
Pyrene	0.0444	U	0.0422	U	0.0474	U	0.0436	U	0.0481	U	0.0460	U	0.0459	U	0.0458	U	0.0460	U	0.0457	U	0.0450	U	0.0492	U	0.0446	U	0.0435	U	0.0431	U	0.0753	U	0.0515	U	0.0435	U	0.0449	U	0.0509	U	100	100
Pyridine	0.177	U	0.169	U	0.189	U	0.174	U	0.192	U	0.184	U	0.184	U	0.183	U	0.184	U	0.183	U	0.180	U	0.197	U	0.178	U	0.174	U	0.172	U	0.301	U	0.206	U	0.174	U	0.179	U	0.203	U	~	~
Resorcinol	0.177	U	0.169	U	0.189	U	0.174	U	0.192	U	0.184	U	0.184	U	0.183	U	0.184	U	0.183	U	0.180	U	0.197	U	0.178	U	0.174	U	0.172	U	0.301	U	0.206	U	0.174	U	0.179	U	0.203	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
~=this indicates that no regulatory limit has been established for this analyte
UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives
RRSCOs=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential

Table 3 (Cont.)
End Point Samples Analytical Results for SVOCs
77-57 Vleigh Place, Queens, NY

Sample ID	EP-20		EP-21		EP-22		EP-23		EP-24		EP-25		EP-26		EP-27		EP-28		EP-29		EP-30		EP-31		EP-32		EP-33		EP-34		EP-35		EP-36		EP-37		EP-38		EP-39		UUSCOs	RRSCOs
Sampling Date	8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		9/13/2019		9/13/2019		9/13/2019		9/13/2019		9/13/2019		9/13/2019		8/2/2019			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q		
Units	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg
1,1-Biphenyl	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
1,2,4,5-Tetrachlorobenzene	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
1,2,4-Trichlorobenzene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
1,2-Dichlorobenzene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	1.1	100
1,2-Diphenylhydrazine (as Azobenzene)	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
1,3-Dichlorobenzene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	2.4	49
1,4-Dichlorobenzene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	1.8	13
1-Methylnaphthalene	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
2,3,4,6-Tetrachlorophenol	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
2,4,5-Trichlorophenol	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
2,4,6-Trichlorophenol	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
2,4-Dichlorophenol	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
2,4-Dimethylphenol	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
2,4-Dinitrophenol	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
2,4-Dinitrotoluene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
2,6-Dinitrotoluene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
2-Chloronaphthalene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
2-Chlorophenol	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
2-Methylnaphthalene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
2-Methylphenol	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	0.33	100
2-Nitroaniline	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
2-Nitrophenol	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
3- & 4-Methylphenols	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
3,3-Dichlorobenzidine	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
3-Nitroaniline	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
4,6-Dinitro-2-methylphenol	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
4-Bromophenyl phenyl ether	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
4-Chloro-3-methylphenol	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
4-Chloroaniline	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
4-Chlorophenyl phenyl ether	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
4-Nitroaniline	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
4-Nitrophenol	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
Acenaphthene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	20	100
Acenaphthylene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	100	100
Acetophenone	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	**0.121**	D	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Aniline	0.193	U	0.191	U	0.190	U	0.196	U	0.188	U	0.198	U	0.193	U	0.179	U	0.181	U	0.204	U	0.175	U	0.189	U	0.180	U	0.177	U	0.179	U	0.179	U	0.190	U	0.171	U	0.173	U	0.187	U	~	~
Anthracene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	100	100
Atrazine	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Benzaldehyde	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Benzidine	0.193	U	0.191	U	0.190	U	0.196	U	0.188	U	0.198	U	0.193	U	0.179	U	0.181	U	0.204	U	0.175	U	0.189	U	0.180	U	0.177	U	0.179	U	0.179	U	0.190	U	0.171	U	0.173	U	0.187	U	~	~
Benzo(a)anthracene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	1	1
Benzo(a)pyrene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	1	1
Benzo(b)fluoranthene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	1	1
Benzo(g,h,i)perylene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	100	100
Benzo(k)fluoranthene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	0.8	3.9
Benzoic acid	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Benzyl alcohol	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Benzyl butyl phthalate	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Bis(2-chloroethoxy)methane	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Bis(2-chloroethyl)ether	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Bis(2-chloroisopropyl)ether	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Bis(2-ethylhexyl)phthalate	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Caprolactam	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
Carbazole	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Chrysene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	1	3.9
Cresols, total	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
Dibenzo(a,h)anthracene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	0.33	0.33
Dibenzofuran	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	7	59
Diethyl phthalate	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Dimethyl phthalate	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Di-n-butyl phthalate	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Di-n-octyl phthalate	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Diphenylamine	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
Fluoranthene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	**0.0706**	JD	0.0475	U	0.0428	U	0.0434	U	0.0468	U	100	100
Fluorene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	30	100
Hexachlorobenzene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	0.33	1.2
Hexachlorobutadiene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Hexachlorocyclopentadiene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Hexachloroethane	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Indeno(1,2,3-cd)pyrene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	0.5	0.5
Isophorone	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Naphthalene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	12	100
Nitrobenzene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
N-Nitrosodimethylamine	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
N-nitroso-di-n-propylamine	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
N-Nitrosodiphenylamine	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Parathion	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	~	~
Pentachloronitrobenzene	0.0966	U	0.0955	U	0.0951	U	0.0978	U	0.0939	U	0.0988	U	0.0962	U	0.0895	U	0.0905	U	0.102	U	0.0875	U	0.0945	U	0.0898	U	0.0886	U	0.0896	U	0.0892	U	0.0947	U	0.0854	U	0.0866	U	0.0934	U	~	~
Pentachlorophenol	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	0.8	6.7
Phenanthrene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	100	100
Phenol	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	0.0447	U	0.0475	U	0.0428	U	0.0434	U	0.0468	U	0.33	100
Propargite	0.193	U	0.191	U	0.190	U	0.196	U	0.188	U	0.198	U	0.193	U	0.179	U	0.181	U	0.204	U	0.175	U	0.189	U	0.180	U	0.177	U	0.179	U	0.179	U	0.190	U	0.171	U	0.173	U	0.187	U	~	~
Pyrene	0.0484	U	0.0478	U	0.0477	U	0.0490	U	0.0471	U	0.0495	U	0.0482	U	0.0448	U	0.0453	U	0.0512	U	0.0438	U	0.0473	U	0.0450	U	0.0444	U	0.0449	U	**0.0663**	JD	0.0475	U	0.0428	U	0.0434	U	0.0468	U	100	100
Pyridine	0.193	U	0.191	U	0.190	U	0.196	U	0.188	U	0.198	U	0.193	U	0.179	U	0.181	U	0.204	U	0.175	U	0.189	U	0.180	U	0.177	U	0.179	U	0.179	U	0.190	U	0.171	U	0.173	U	0.187	U	~	~
Resorcinol	0.193	U	0.191	U	0.190	U	0.196	U	0.188	U	0.198	U	0.193	U	0.179	U	0.181	U	0.204	U	0.175	U	0.189	U	0.180	U	0.177	U	0.179	U	0.179	U	0.190	U	0.171	U	0.173	U	0.187	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
~=this indicates that no regulatory limit has been established for this analyte
UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives
RRSCOs=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential

Table 3 (Cont.)
End Point Samples Analytical Results for Pesticides and PCBs
77-57 Vleigh Place, Queens, NY

Sample ID	EP-1		EP-2		EP-3		EP-3a		EP-4		EP-5		EP-6		EP-7		EP-8		EP-9		EP-10		EP-11		EP-12		EP-13		EP-14		EP-15		EP-16		EP-17		EP-18		EP-19		UUSCOs	RRSCOs
Sampling Date	8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		9/13/2019		8/2/2019		8/2/2019		8/19/2019		9/13/2019		8/2/2019			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q		
Units	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg
Pesticides, 8081 target list																																								
4,4'-DDD	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	0.0033	13
4,4'-DDE	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	0.0033	8.9
4,4'-DDT	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	0.0033	7.9
Aldrin	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	0.005	0.097
alpha-BHC	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	0.02	0.48
alpha-Chlordane	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	0.094	4.2
beta-BHC	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	0.036	0.36
Chlordane, total	0.0356	U	0.0339	U	0.0374	U	0.0344	U	0.0383	U	0.0365	U	0.0360	U	0.0358	U	0.0363	U	0.0363	U	0.0357	U	0.0382	U	0.0351	U	0.0345	U	0.0346	U	0.0403	U	0.0408	U	0.0346	U	0.0360	U	0.0402	U	~	~
delta-BHC	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	0.04	100
Dieldrin	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	0.005	0.2
Endosulfan I	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	2.4	24
Endosulfan II	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	2.4	24
Endosulfan sulfate	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	2.4	24
Endrin	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	0.014	11
Endrin aldehyde	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	~	~
Endrin ketone	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	~	~
gamma-BHC (Lindane)	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	0.1	1.3
gamma-Chlordane	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	~	~
Heptachlor	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	0.042	2.1
Heptachlor epoxide	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	~	~
Methoxychlor	0.00178	U	0.00169	U	0.00187	U	0.00172	U	0.00191	U	0.00182	U	0.00180	U	0.00179	U	0.00181	U	0.00182	U	0.00178	U	0.00191	U	0.00176	U	0.00173	U	0.00173	U	0.00201	U	0.00204	U	0.00173	U	0.00180	U	0.00201	U	~	~
Toxaphene	0.178	U	0.169	U	0.187	U	0.172	U	0.191	U	0.182	U	0.180	U	0.179	U	0.181	U	0.182	U	0.178	U	0.191	U	0.176	U	0.173	U	0.173	U	0.201	U	0.204	U	0.173	U	0.180	U	0.201	U	~	~
Polychlorinated Biphenyls (PCB)																																								
Aroclor 1016	0.0180	U	0.0171	U	0.0189	U	0.0174	U	0.0193	U	0.0184	U	0.0182	U	0.0181	U	0.0183	U	0.0183	U	0.0180	U	0.0193	U	0.0177	U	0.0174	U	0.0175	U	0.0203	U	0.0206	U	0.0175	U	0.0182	U	0.0203	U	~	~
Aroclor 1221	0.0180	U	0.0171	U	0.0189	U	0.0174	U	0.0193	U	0.0184	U	0.0182	U	0.0181	U	0.0183	U	0.0183	U	0.0180	U	0.0193	U	0.0177	U	0.0174	U	0.0175	U	0.0203	U	0.0206	U	0.0175	U	0.0182	U	0.0203	U	~	~
Aroclor 1232	0.0180	U	0.0171	U	0.0189	U	0.0174	U	0.0193	U	0.0184	U	0.0182	U	0.0181	U	0.0183	U	0.0183	U	0.0180	U	0.0193	U	0.0177	U	0.0174	U	0.0175	U	0.0203	U	0.0206	U	0.0175	U	0.0182	U	0.0203	U	~	~
Aroclor 1242	0.0180	U	0.0171	U	0.0189	U	0.0174	U	0.0193	U	0.0184	U	0.0182	U	0.0181	U	0.0183	U	0.0183	U	0.0180	U	0.0193	U	0.0177	U	0.0174	U	0.0175	U	0.0203	U	0.0206	U	0.0175	U	0.0182	U	0.0203	U	~	~
Aroclor 1248	0.0180	U	0.0171	U	0.0189	U	0.0174	U	0.0193	U	0.0184	U	0.0182	U	0.0181	U	0.0183	U	0.0183	U	0.0180	U	0.0193	U	0.0177	U	0.0174	U	0.0175	U	0.0203	U	0.0206	U	0.0175	U	0.0182	U	0.0203	U	~	~
Aroclor 1254	0.0180	U	0.0171	U	0.0189	U	0.0174	U	0.0193	U	0.0184	U	0.0182	U	0.0181	U	0.0183	U	0.0183	U	0.0180	U	0.0193	U	0.0177	U	0.0174	U	0.0175	U	0.0203	U	0.0206	U	0.0175	U	0.0182	U	0.0203	U	~	~
Aroclor 1260	0.0180	U	0.0171	U	0.0189	U	0.0174	U	0.0193	U	0.0184	U	0.0182	U	0.0181	U	0.0183	U	0.0183	U	0.0180	U	0.0193	U	0.0177	U	0.0174	U	0.0175	U	0.0203	U	0.0206	U	0.0175	U	0.0182	U	0.0203	U	~	~
Total PCBs	0.0180	U	0.0171	U	0.0189	U	0.0174	U	0.0193	U	0.0184	U	0.0182	U	0.0181	U	0.0183	U	0.0183	U	0.0180	U	0.0193	U	0.0177	U	0.0174	U	0.0175	U	0.0203	U	0.0206	U	0.0175	U	0.0182	U	0.0203	U	0.1	1

NOTES:
Q is the Qualifier Column with definitions as follows:
D=result is from an analysis that required a dilution
U=analyte not detected at or above the level indicated
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
~=this indicates that no regulatory limit has been established for this analyte
UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives
RRSCOs=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential

Table 3 (Cont.)
End Point Samples Analytical Results for Pesticides and PCBs
77-57 Vleigh Place, Queens, NY

Sample ID	EP-20		EP-21		EP-22		EP-23		EP-24		EP-25		EP-26		EP-27		EP-28		EP-29		EP-30		EP-31		EP-32		EP-33		EP-34		EP-35		EP-36		EP-37		EP-38		EP-39		UUSCOs	RRSCOs
Sampling Date	8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		9/13/2019		9/13/2019		9/13/2019		9/13/2019		9/13/2019		9/13/2019		8/2/2019			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q		
Units	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg
Pesticides, 8081 target list																																								
4,4'-DDD	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	0.0033	13
4,4'-DDE	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	0.0033	8.9
4,4'-DDT	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	**0.0112**	D	0.00190	U	0.00173	U	0.00170	U	0.00189	U	0.0033	7.9
Aldrin	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	0.005	0.097
alpha-BHC	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	0.02	0.48
alpha-Chlordane	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	**0.00295**	DP	0.00190	U	0.00173	U	0.00170	U	0.00189	U	0.094	4.2
beta-BHC	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	0.036	0.36
Chlordane, total	0.0387	U	0.0384	U	0.0385	U	0.0390	U	0.0373	U	0.0397	U	0.0382	U	0.0355	U	0.0363	U	0.0401	U	0.0344	U	0.0374	U	0.0354	U	0.0352	U	0.0353	U	0.0349	U	0.0381	U	0.0346	U	0.0340	U	0.0378	U	~	~
delta-BHC	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	0.04	100
Dieldrin	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	0.005	0.2
Endosulfan I	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	2.4	24
Endosulfan II	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	2.4	24
Endosulfan sulfate	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	2.4	24
Endrin	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	0.014	11
Endrin aldehyde	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	~	~
Endrin ketone	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	~	~
gamma-BHC (Lindane)	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	0.1	1.3
gamma-Chlordane	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	**0.00271**	DP	0.00190	U	0.00173	U	0.00170	U	0.00189	U	~	~
Heptachlor	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	0.042	2.1
Heptachlor epoxide	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	~	~
Methoxychlor	0.00194	U	0.00192	U	0.00192	U	0.00195	U	0.00186	U	0.00199	U	0.00191	U	0.00178	U	0.00181	U	0.00201	U	0.00172	U	0.00187	U	0.00177	U	0.00176	U	0.00177	U	0.00175	U	0.00190	U	0.00173	U	0.00170	U	0.00189	U	~	~
Toxaphene	0.194	U	0.192	U	0.192	U	0.195	U	0.186	U	0.199	U	0.191	U	0.178	U	0.181	U	0.201	U	0.172	U	0.187	U	0.177	U	0.176	U	0.177	U	0.175	U	0.190	U	0.173	U	0.170	U	0.189	U	~	~
Polychlorinated Biphenyls (PCB)																																								
Aroclor 1016	0.0196	U	0.0194	U	0.0194	U	0.0197	U	0.0188	U	0.0201	U	0.0193	U	0.0179	U	0.0183	U	0.0203	U	0.0174	U	0.0189	U	0.0179	U	0.0178	U	0.0178	U	0.0176	U	0.0192	U	0.0175	U	0.0172	U	0.0191	U	~	~
Aroclor 1221	0.0196	U	0.0194	U	0.0194	U	0.0197	U	0.0188	U	0.0201	U	0.0193	U	0.0179	U	0.0183	U	0.0203	U	0.0174	U	0.0189	U	0.0179	U	0.0178	U	0.0178	U	0.0176	U	0.0192	U	0.0175	U	0.0172	U	0.0191	U	~	~
Aroclor 1232	0.0196	U	0.0194	U	0.0194	U	0.0197	U	0.0188	U	0.0201	U	0.0193	U	0.0179	U	0.0183	U	0.0203	U	0.0174	U	0.0189	U	0.0179	U	0.0178	U	0.0178	U	0.0176	U	0.0192	U	0.0175	U	0.0172	U	0.0191	U	~	~
Aroclor 1242	0.0196	U	0.0194	U	0.0194	U	0.0197	U	0.0188	U	0.0201	U	0.0193	U	0.0179	U	0.0183	U	0.0203	U	0.0174	U	0.0189	U	0.0179	U	0.0178	U	0.0178	U	0.0176	U	0.0192	U	0.0175	U	0.0172	U	0.0191	U	~	~
Aroclor 1248	0.0196	U	0.0194	U	0.0194	U	0.0197	U	0.0188	U	0.0201	U	0.0193	U	0.0179	U	0.0183	U	0.0203	U	0.0174	U	0.0189	U	0.0179	U	0.0178	U	0.0178	U	0.0176	U	0.0192	U	0.0175	U	0.0172	U	0.0191	U	~	~
Aroclor 1254	0.0196	U	0.0194	U	0.0194	U	0.0197	U	0.0188	U	0.0201	U	0.0193	U	0.0179	U	0.0183	U	0.0203	U	0.0174	U	0.0189	U	0.0179	U	0.0178	U	0.0178	U	0.0176	U	0.0192	U	0.0175	U	0.0172	U	0.0191	U	~	~
Aroclor 1260	0.0196	U	0.0194	U	0.0194	U	0.0197	U	0.0188	U	0.0201	U	0.0193	U	0.0179	U	0.0183	U	0.0203	U	0.0174	U	0.0189	U	0.0179	U	0.0178	U	0.0178	U	0.0176	U	0.0192	U	0.0175	U	0.0172	U	0.0191	U	~	~
Total PCBs	0.0196	U	0.0194	U	0.0194	U	0.0197	U	0.0188	U	0.0201	U	0.0193	U	0.0179	U	0.0183	U	0.0203	U	0.0174	U	0.0189	U	0.0179	U	0.0178	U	0.0178	U	0.0176	U	0.0192	U	0.0175	U	0.0172	U	0.0191	U	0.1	1

NOTES:
Q is the Qualifier Column with definitions as follows:
D=result is from an analysis that required a dilution
U=analyte not detected at or above the level indicated
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
~=this indicates that no regulatory limit has been established for this analyte
UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives
RRSCOs=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential
sample exceeds UUSCOs

Table 3 (Cont.)
End Point Samples Analytical Results for Metals
77-57 Vleigh Place, Queens, NY

Sample ID	EP-1		EP-2		EP-3		EP-3a		EP-4		EP-5		EP-6		EP-7		EP-8		EP-9		EP-10		EP-11		EP-12		EP-13		EP-14		EP-15		EP-16		EP-17		EP-18		EP-19		UUSCOs	RRSCOs
Sampling Date	8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		9/13/2019		8/2/2019		8/2/2019		8/19/2019		9/13/2019		8/2/2019			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q		
Units	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg
Aluminum	**2,240**		**2,270**		**1,730**		**2,160**		**4,300**		**4,280**		**4,320**		**4,350**		**3,650**		**3,750**		**4,330**		**3,670**		**3,030**		**3,280**		**4,270**		**1,410**		**2,390**		**2,350**		**5,320**		**2,370**		~	~
Antimony	2.720	U	2.580	U	2.870	U	2.620	U	2.910	U	2.770	U	2.760	U	2.750	U	2.800	U	2.760	U	2.720	U	2.950	U	2.680	U	2.630	U	2.640	U	3.060	U	3.110	U	2.650	U	2.740	U	3.050	U	~	~
Arsenic	1.630	U	1.550	U	1.720	U	1.570	U	1.740	U	1.660	U	1.650	U	1.650	U	1.680	U	1.660	U	1.630	U	1.770	U	1.610	U	1.580	U	1.580	U	1.840	U	1.870	U	1.590	U	1.640	U	1.830	U	13	16
Barium	**16.8**		**30.4**		**16.7**		**19.0**		**35.2**		**24.7**		**25.8**		**32.9**		**33.1**		**25.0**		**34.0**		**32.6**		**24.7**		**27.5**		**41.1**		**12.9**		**16.1**		**18.4**		**36.7**		**16.7**		350	400
Beryllium	0.0540	U	0.0520	U	0.0570	U	0.0520	U	0.0580	U	0.0550	U	0.0550	U	0.0550	U	0.0560	U	0.0550	U	0.0540	U	0.0590	U	0.0540	U	0.0530	U	0.0530	U	0.0610	U	0.0620	U	0.0530	U	0.0550	U	0.0610	U	7.2	72
Cadmium	0.327	U	0.309	U	0.345	U	0.315	U	0.349	U	0.333	U	0.331	U	0.330	U	0.335	U	0.331	U	0.326	U	0.355	U	0.321	U	0.315	U	0.317	U	0.367	U	0.373	U	0.317	U	0.328	U	0.367	U	2.5	4.3
Calcium	**668**		**1,330**		**475**		**802**		**787**		**632**		**603**		**874**		**737**		**583**		**643**		**687**		**981**		**1,030**		**2,960**	B	**400**		**958**		**870**		**1,150**	B	**816**		~	~
Chromium	**5.4**		**6.3**		**7.2**		**6.3**		**12.6**		**12.3**		**10.5**		**13.2**		**11.3**		**10.5**		**13.8**		**11.8**		**8.8**		**9.1**		**10.3**		**4.6**		**6.0**		**6.2**		**15.2**		**5.4**		~	~
Chromium, Hexavalent	0.545	U	0.515	U	0.574	U	0.525	U	0.582	U	0.554	U	0.551	U	0.549	U	0.559	U	0.552	U	0.544	U	0.591	U	0.536	U	0.525	U	0.528	U	0.612	U	0.622	U	0.529	U	0.547	U	0.611	U	1	110
Chromium, Trivalent	**5.4**		**6.3**		**7.2**		**6.3**		**12.6**		**12.3**		**10.5**		**13.2**		**11.3**		**10.5**		**13.8**		**11.8**		**8.8**		**9.1**		**10.3**		**4.6**		**6.0**		**6.2**		**15.2**		**5.4**		30	180
Cobalt	**2.6**		**4.4**		**3.0**		**3.3**		**6.7**		**5.9**		**5.5**		**6.1**		**5.5**		**5.0**		**6.4**		**5.0**		**4.4**		**4.6**		**6.1**		**2.1**		**3.2**		**3.4**		**6.9**		**2.9**		~	~
Copper	**7.3**		**19.6**		**7.6**		**7.7**		**10.5**		**10.4**		**9.9**		**10.8**		**9.8**		**8.2**		**11.3**		**8.5**		**7.9**		**9.0**		**29.4**		**4.8**		**5.6**		**5.7**		**11.7**		**4.5**		50	270
Iron	**10,300**		**17,200**		**10,800**		**12,200**		**13,000**		**15,800**		**10,300**		**12,200**		**10,900**		**11,500**		**13,100**		**10,900**		**9,110**		**10,300**		**17,100**		**7,790**		**6,910**		**6,080**		**14,600**		**6,340**		~	~
Lead	**1.0**		**5.7**		**1.0**		**1.0**		**3.9**		**3.7**		**2.4**		**3.4**		**3.0**		**3.5**		**3.2**		**2.4**		**2.3**		**2.8**		**4.2**		**0.8**		**1.5**		**2.1**		**3.7**		**1.1**		63	400
Magnesium	**1,070**		**1,130**		**693**		**984**		**1,430**		**1,230**		**1,430**		**1,500**		**1,470**		**1,150**		**1,340**		**1,440**		**1,270**		**1,380**		**2,520**		**610**		**1,150**		**1,170**		**1,850**		**1,150**		~	~
Manganese	**182**		**421**		**193**		**198**		**338**		**250**		**220**		**230**		**375**		**217**		**207**		**232**		**206**		**222**		**298**		**137**		**293**		**180**		**261**		**227**		1600	2000
Mercury	0.0327	U	0.0309	U	0.0345	U	0.0315	U	0.0349	U	0.0333	U	0.0331	U	0.0330	U	0.0335	U	0.0331	U	0.0326	U	0.0355	U	0.0321	U	0.0315	U	0.0317	U	0.0367	U	0.0373	U	0.0317	U	0.0328	U	0.0367	U	0.18	0.81
Nickel	**6.6**		**8.2**		**5.5**		**7.3**		**12.6**		**11.5**		**9.7**		**12.6**		**11.7**		**9.5**		**11.8**		**9.9**		**8.2**		**8.8**		**12.5**		**4.3**		**7.6**		**7.5**		**13.2**		**7.1**		30	310
Potassium	**248**		**435**		**259**		**258**		**792**		**695**		**778**		**793**		**756**		**698**		**754**		**942**		**641**		**675**		**840**		**214**		**392**		**433**		**1,020**		**496**		~	~
Selenium	2.720	U	2.580	U	2.870	U	2.620	U	2.910	U	2.770	U	2.760	U	2.750	U	2.800	U	2.760	U	2.720	U	2.950	U	2.680	U	2.630	U	2.640	U	3.060	U	3.110	U	2.650	U	2.740	U	3.050	U	3.9	180
Silver	0.545	U	0.515	U	0.574	U	0.525	U	0.582	U	0.554	U	0.551	U	0.549	U	0.559	U	0.552	U	0.544	U	0.591	U	0.536	U	0.525	U	0.528	U	0.612	U	0.622	U	0.529	U	0.547	U	0.611	U	2	180
Sodium	**91.8**		**76.0**		**63.9**		**89.8**		**148.0**		**184.0**		**217.0**		**247.0**		**136.0**		**228.0**		**323.0**		**148.0**		**115.0**		**104.0**		**104.0**		**61.2**	**U**	**126.0**		**88.3**		**129.0**		**148.0**		~	~
Thallium	2.720	U	2.580	U	2.870	U	2.620	U	2.910	U	2.770	U	2.760	U	2.750	U	2.800	U	2.760	U	2.720	U	2.950	U	2.680	U	2.630	U	2.640	U	3.060	U	3.110	U	2.650	U	2.740	U	3.050	U	~	~
Vanadium	**8.3**		**12.1**		**9.0**		**9.1**		**16.5**		**18.9**		**12.5**		**17.3**		**15.2**		**15.0**		**17.8**		**15.0**		**12.0**		**16.4**		**20.1**		**6.3**		**10.9**		**8.4**		**23.8**		**7.6**		~	~
Zinc	**9.9**		**16.2**		**10.1**		**12.3**		**24.7**		**21.8**		**17.1**		**20.8**		**21.2**		**19.9**		**20.7**		**17.0**		**13.6**		**16.0**		**22.3**		**6.9**		**10.0**		**10.5**		**23.2**		**11.9**		109	10000

NOTES:

Q is the Qualifier Column with definitions as follows:

U=analyte not detected at or above the level indicated

B=analyte found in the analysis batch blank

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

UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives

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

Table 3 (Cont.)
End Point Samples Analytical Results for Metals
77-57 Vleigh Place, Queens, NY

Sample ID	EP-20		EP-21		EP-22		EP-23		EP-24		EP-25		EP-26		EP-27		EP-28		EP-29		EP-30		EP-31		EP-32		EP-33		EP-34		EP-35		EP-36		EP-37		EP-38		EP-39		UUSCOs	RRSCOs
Sampling Date	8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/2/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		8/19/2019		9/13/2019		9/13/2019		9/13/2019		9/13/2019		9/13/2019		9/13/2019		8/2/2019			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q		
Units	mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg		mg/Kg	mg/Kg
Aluminum	**2,520**		**5,750**		**2,680**		**8,780**		**2,470**		**1,670**		**2,920**		**2,920**		**4,060**		**4,440**		**3,840**		**3,890**		**4,090**		**4,300**		**4,420**		**4,600**		**5,600**		**3,810**		**4,160**		**4,410**		~	~
Antimony	2.940	U	2.930	U	2.930	U	2.960	U	2.850	U	3.030	U	2.920	U	2.740	U	2.770	U	3.070	U	2.630	U	2.840	U	2.700	U	2.670	U	2.690	U	2.680	U	2.910	U	2.640	U	2.600	U	2.870	U	~	~
Arsenic	1.770	U	1.760	U	1.760	U	1.780	U	1.710	U	1.820	U	1.750	U	1.640	U	1.660	U	1.840	U	1.580	U	1.700	U	1.620	U	1.600	U	1.620	U	1.610	U	1.750	U	1.580	U	1.560	U	1.720	U	13	16
Barium	**18.7**		**42.6**		**25.2**		**62.8**		**14.1**		**12.1**		**28.0**		**25.1**		**36.4**		**40.0**		**32.0**		**25.3**		**25.9**		**32.9**		**34.3**		**31.2**		**40.9**		**34.1**		**53.0**		**34.5**		350	400
Beryllium	0.0590	U	0.0590	U	0.0590	U	0.0590	U	0.0570	U	0.0610	U	0.0580	U	0.0550	U	0.0550	U	0.0610	U	0.0530	U	0.0570	U	0.0540	U	0.0530	U	0.0540	U	0.0540	U	0.0580	U	0.0530	U	0.0520	U	0.0570	U	7.2	72
Cadmium	0.353	U	0.351	U	0.351	U	0.355	U	0.342	U	0.364	U	0.351	U	0.328	U	0.332	U	0.368	U	0.316	U	0.341	U	0.324	U	0.321	U	0.323	U	0.322	U	0.350	U	0.316	U	0.312	U	0.345	U	2.5	4.3
Calcium	**933**		**1,320**		**819**		**3,220**		**908**		**903**		**864**		**840**		**774**		**1,540**		**769**		**1,120**		**1,140**		**1,720**	B	**1,260**	B	**2,340**	B	**2,310**	B	**922**	B	**447**	**B**	**1,110**		~	~
Chromium	**6.9**		**14.3**		**7.0**		**12.0**		**4.0**		**4.5**		**10.4**		**8.7**		**12.2**		**14.4**		**12.0**		**10.6**		**11.8**		**14.5**		**12.4**		**13.7**		**16.6**		**12.3**		**13.6**		**12.0**		~	~
Chromium, Hexavalent	0.589	U	0.586	U	0.585	U	0.592	U	0.571	U	0.606	U	0.585	U	0.547	U	0.553	U	0.614	U	0.526	U	0.568	U	0.540	U	0.535	U	0.539	U	0.536	U	0.583	U	0.527	U	0.521	U	0.575	U	1	110
Chromium, Trivalent	**6.9**		**14.3**		**7.0**		**12.0**		**4.0**		**4.5**		**10.4**		**8.7**		**12.2**		**14.4**		**12.0**		**10.6**		**11.8**		**14.5**		**12.4**		**13.7**		**16.6**		**12.3**		**13.6**		**12.0**		30	180
Cobalt	**3.2**		**6.6**		**4.1**		**4.8**		**1.9**		**2.5**		**4.3**		**4.4**		**5.8**		**7.1**		**7.0**		**5.1**		**5.8**		**5.9**		**6.2**		**6.6**		**5.2**		**5.4**		**5.5**		**5.6**		~	~
Copper	**5.1**		**10.4**		**7.5**		**14.4**		**6.8**		**5.2**		**8.2**		**7.4**		**8.7**		**9.1**		**10.6**		**9.4**		**9.3**		**9.3**		**11.6**		**11.1**		**10.2**		**9.3**		**6.9**		**9.6**		50	270
Iron	**7,060**		**12,900**		**8,800**		**13,000**		**6,540**		**8,110**		**9,880**		**9,260**		**10,400**		**12,600**		**13,300**		**12,600**		**13,200**		**13,000**		**13,900**		**12,100**		**10,800**		**10,300**		**13,300**		**11,000**		~	~
Lead	**1.2**		**3.1**		**1.7**		**2.6**		0.6	U	**0.8**		**2.1**		**2.3**		**2.5**		**2.5**		**2.9**		**2.9**		**3.5**		**4.7**		**6.3**		**8.1**		**4.6**		**2.8**		**2.7**		**2.2**		63	400
Magnesium	**1,290**		**2,420**		**1,240**		**2,930**		**948**		**1,030**		**1,480**		**1,260**		**1,650**		**1,920**		**1,420**		**1,330**		**1,340**		**2,060**		**1,800**		**1,490**		**2,310**		**1,830**		**1,520**		**1,540**		~	~
Manganese	**128**		**156**		**150**		**204**		**152**		**116**		**205**		**205**		**251**		**257**		**284**		**259**		**220**		**238**		**277**		**250**		**229**		**232**		**418**		**235**		1600	2000
Mercury	0.0353	U	0.0351	U	0.0351	U	0.0355	U	0.0342	U	0.0364	U	0.0351	U	0.0328	U	0.0332	U	0.0368	U	0.0316	U	0.0341	U	0.0324	U	0.0321	U	0.0323	U	0.0322	U	0.0350	U	0.0316	U	0.0312	U	0.0345	U	0.18	0.81
Nickel	**6.7**		**12.1**		**6.3**		**15.7**		**5.0**		**5.0**		**8.8**		**8.7**		**11.9**		**14.7**		**13.0**		**10.9**		**11.5**		**14.2**		**12.4**		**11.9**		**15.5**		**12.1**		**9.6**		**10.6**		30	310
Potassium	**595**		**1,320**		**735**		**547**		**281**		**293**		**675**		**644**		**911**		**1,240**		**833**		**647**		**738**		**991**		**890**		**905**		**1,120**		**911**		**1,480**		**931**		~	~
Selenium	2.940	U	2.930	U	2.930	U	2.960	U	2.850	U	3.030	U	2.920	U	2.740	U	2.770	U	3.070	U	2.630	U	2.840	U	2.700	U	2.670	U	2.690	U	2.680	U	2.910	U	2.640	U	2.600	U	2.870	U	3.9	180
Silver	0.589	U	0.586	U	0.585	U	0.592	U	0.571	U	0.606	U	0.585	U	0.547	U	0.553	U	0.614	U	0.526	U	0.568	U	0.540	U	0.535	U	0.539	U	0.536	U	0.583	U	0.527	U	0.521	U	0.575	U	2	180
Sodium	**142.0**		**197.0**		**79.1**		**352.0**		**157.0**		**67.1**		**83.0**		**92.3**		**78.6**		**161.0**		**143.0**		**419.0**		**245.0**		**103.0**		**124.0**		**109.0**		**120.0**		**82.5**		**52.1**	**U**	**129.0**		~	~
Thallium	2.940	U	2.930	U	2.930	U	2.960	U	2.850	U	3.030	U	2.920	U	2.740	U	2.770	U	3.070	U	2.630	U	2.840	U	2.700	U	2.670	U	2.690	U	2.680	U	2.910	U	2.640	U	2.600	U	2.870	U	~	~
Vanadium	**8.8**		**19.7**		**12.0**		**18.0**		**6.1**		**8.0**		**12.9**		**12.3**		**15.1**		**14.9**		**15.6**		**14.9**		**17.8**		**22.3**		**20.4**		**18.0**		**16.7**		**20.4**		**18.2**		**16.3**		~	~
Zinc	**11.7**		**24.9**		**17.2**		**24.3**		**8.4**		**9.1**		**14.1**		**13.4**		**20.4**		**18.9**		**30.0**		**19.2**		**21.5**		**21.6**		**24.2**		**23.1**		**24.2**		**18.2**		**18.1**		**18.4**		109	10000

NOTES:
Q is the Qualifier Column with definitions as follows:
U=analyte not detected at or above the level indicated
B=analyte found in the analysis batch blank
~=this indicates that no regulatory limit has been established for this analyte
UUSCOS=NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives
RRSCOs=NYSDEC Part 375 Restricted Use Soil Cleanup Objectives -Restricted Residential

Table 3 (Cont.)
Trip Blanks Analytical Results for VOCs
77-57 Vleigh Place, Queens, NY

Sample ID	Trip Blank		Trip Blank		Trip Blank	
Sampling Date	8/2/2019		8/19/2019		9/13/2019	
Client Matrix	Water		Water		Water	
Compound	Result	Q	Result	Q	Result	Q
1,1,1,2-Tetrachloroethane	0.200	U	0.200	U	0.200	U
1,1,1-Trichloroethane	0.200	U	0.200	U	0.200	U
1,1,2,2-Tetrachloroethane	0.200	U	0.200	U	0.200	U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freo	0.200	U	0.200	U	0.200	U
1,1,2-Trichloroethane	0.200	U	0.200	U	0.200	U
1,1-Dichloroethane	0.200	U	0.200	U	0.200	U
1,1-Dichloroethylene	0.200	U	0.200	U	0.200	U
1,1-Dichloropropylene	0.200	U	0.200	U	0.200	U
1,2,3-Trichlorobenzene	0.200	U	0.200	U	0.200	U
1,2,3-Trichloropropane	0.200	U	0.200	U	0.200	U
1,2,4,5-Tetramethylbenzene	0.200	U	0.200	U	0.200	U
1,2,4-Trichlorobenzene	0.200	U	0.200	U	0.200	U
1,2,4-Trimethylbenzene	0.200	U	0.200	U	0.200	U
1,2-Dibromo-3-chloropropane	0.200	U	0.200	U	0.200	U
1,2-Dibromoethane	0.200	U	0.200	U	0.200	U
1,2-Dichlorobenzene	0.200	U	0.200	U	0.200	U
1,2-Dichloroethane	0.200	U	0.200	U	0.200	U
1,2-Dichloropropane	0.200	U	0.200	U	0.200	U
1,3,5-Trimethylbenzene	0.200	U	0.200	U	0.200	U
1,3-Dichlorobenzene	0.200	U	0.200	U	0.200	U
1,3-Dichloropropane	0.200	U	0.200	U	0.200	U
1,4-Dichlorobenzene	0.200	U	0.200	U	0.200	U
2,2-Dichloropropane	0.200	U	0.200	U	0.200	U
2-Butanone	0.200	U	0.200	U	0.200	U
2-Chlorotoluene	0.200	U	0.200	U	0.200	U
2-Hexanone	0.200	U	0.200	U	0.200	U
4-Chlorotoluene	0.200	U	0.200	U	0.200	U
4-Methyl-2-pentanone	0.200	U	0.200	U	0.200	U
Acetone	1.640	J	1	U	1	U
Benzene	0.200	U	0.200	U	0.200	U
Bromobenzene	0.200	U	0.200	U	0.200	U
Bromochloromethane	0.200	U	0.200	U	0.200	U
Bromodichloromethane	0.200	U	0.200	U	0.200	U
Bromoform	0.200	U	0.200	U	0.200	U
Bromomethane	0.200	U	0.200	U	0.200	U
Carbon disulfide	0.200	U	0.200	U	0.200	U
Carbon tetrachloride	0.200	U	0.200	U	0.200	U
Chlorobenzene	0.200	U	0.200	U	0.200	U
Chloroethane	0.200	U	0.200	U	0.200	U
Chloroform	0.200	U	0.200	U	0.200	U
Chloromethane	0.200	U	0.200	U	0.200	U
cis-1,2-Dichloroethylene	0.200	U	0.200	U	0.200	U
cis-1,3-Dichloropropylene	0.200	U	0.200	U	0.200	U
Dibromochloromethane	0.200	U	0.200	U	0.200	U
Dibromomethane	0.200	U	0.200	U	0.200	U
Dichlorodifluoromethane	0.200	U	0.200	U	0.200	U
Ethyl Benzene	0.200	U	0.200	U	0.200	U
Hexachlorobutadiene	0.200	U	0.200	U	0.200	U
Isopropylbenzene	0.200	U	0.200	U	0.200	U
Methyl tert-butyl ether (MTBE)	0.200	U	0.200	U	0.200	U
Methylene chloride	1	U	1	U	1	U
Naphthalene	1	U	1	U	1	U
n-Butylbenzene	0.200	U	0.200	U	0.200	U
n-Propylbenzene	0.200	U	0.200	U	0.200	U
o-Xylene	0.200	U	0.200	U	0.200	U
p- & m- Xylenes	0.500	U	0.500	U	0.500	U
p-Diethylbenzene	0.200	U	0.200	U	0.200	U
p-Ethyltoluene	0.200	U	0.200	U	0.200	U
p-Isopropyltoluene	0.200	U	0.200	U	0.200	U
sec-Butylbenzene	0.200	U	0.200	U	0.200	U
Styrene	0.200	U	0.200	U	0.200	U
tert-Butylbenzene	0.200	U	0.200	U	0.200	U
Tetrachloroethylene	0.200	U	0.200	U	0.200	U
Toluene	0.200	U	0.200	U	0.200	U
trans-1,2-Dichloroethylene	0.200	U	0.200	U	0.200	U
trans-1,3-Dichloropropylene	0.200	U	0.200	U	0.200	U
Trichloroethylene	0.200	U	0.200	U	0.200	U
Trichlorofluoromethane	0.200	U	0.200	U	0.200	U
Vinyl Chloride	0.200	U	0.200	U	0.200	U
Xylenes, Total	0.600	U	0.600	U	0.600	U

NOTES:
Q is the Qualifier Column with definitions as follows:
U=analyte not detected at or above the level indicated

Table 4
Pre- and Post-Injections Groundwater Samples Analytical Results for VOC's
77-57 Vleigh Place, Flushing NY

Sample ID	MW-1		MW-2		MW-3S		MW-3D		MW-5S		MW-5D		MW-6		MW-7		MW-8		MW-9		MW-11		MW-13		uipment Blank Rins		Trip Blank		NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/18		3/26/18		3/26/18		3/26/18		3/26/18		3/26/18		3/26/18		3/26/18		3/26/18		3/26/18		3/26/18		3/26/18		3/9/18		3/9/18		
Client Matrix	Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		
Compound	Result	Q	Result		Result		Result		Result	Q	Result	Q	Result	Q	Result	Q	Result		Result		Result		Result		Result		Result		
Units	ug/L		matrch	Q	ug/L	Q	ug/L	Q	ug/L		ug/L		ug/L		ug/L		ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q	ug/L
1,1,1,2-Tetrachloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.440**	J	**0.230**	J	0.200	U	0.200	U	0.200	U	5
1,1,1-Trichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2,2-Tetrachloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2-Trichloro-1,2,2-trifluoroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2-Trichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**43**		0.200	U	0.200	U	0.200	U	1
1,1-Dichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1-Dichloroethylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1-Dichloropropylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,3-Trichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,3-Trichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.04
1,2,4,5-Tetramethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.200**	J	0.200	U	~
1,2,4-Trichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,4-Trimethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2-Dibromo-3-chloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.04
1,2-Dibromoethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.0006
1,2-Dichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
1,2-Dichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.490**	J	0.200	U	0.200	U	0.200	U	0.6
1,2-Dichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	1
1,3,5-Trimethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,3-Dichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
1,3-Dichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,4-Dichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
2,2-Dichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
2-Butanone	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**1.300**		**0.210**	J	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
2-Chlorotoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
2-Hexanone	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
4-Chlorotoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
4-Methyl-2-pentanone	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
Acetone	**8.700**	B	**9.100**	B	**1.200**	JB	**9.300**	B	**1**	U	**13**	B	**28**	B	**8.700**	B	**8.700**	B	**1.300**	JB	**7.700**	B	**8.800**	B	**1.600**	J	1	U	50
Benzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.840		0.200	U	0.200	U	**0.310**	J	**0.450**	J	0.200	U	0.200	U	0.200	U	1
Bromobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Bromochloromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.370**	J	0.200	U	0.200	U	0.200	U	5
Bromodichloromethane	0.200	U	**0.720**		0.200	U	**0.400**	J	0.200	U	0.200	U	**0.540**		0.210	J	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
Bromoform	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
Bromomethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Carbon disulfide	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
Carbon tetrachloride	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.360**	J	0.200	U	0.200	U	0.200	U	0.200	U	5
Chloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chloroform	**0.570**		**10**		**4.900**		**8.500**		**0.260**	J	0.200	U	**9**		**19**		**2.400**		**2.300**		**1.900**		0.200	U	0.200	U	0.200	U	7
Chloromethane	0.200	U	0.200	U	0.200	U	0.310	J	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.220	J	0.200	U	**0.290**	J	0.200	U	5
cis-1,2-Dichloroethylene	**1.600**		**1.100**		2.400		**0.740**		**2.200**		**0.470**	J	**9.100**		0.200	U	0.200	U	**0.840**		**2.100**		**0.270**	J	0.200	U	0.200	U	5
cis-1,3-Dichloropropylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.4
Dibromochloromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
Dibromomethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
Dichlorodifluoromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Ethyl Benzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Hexachlorobutadiene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.5
Isopropylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Methyl tert-butyl ether (MTBE)	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.710**		0.200	U	0.200	U	0.200	U	0.200	U	10
Methylene chloride	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	5
Naphthalene	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	10
n-Butylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
n-Propylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
o-Xylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
p- & m- Xylenes	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	5
p-Diethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
p-Ethyltoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
p-Isopropyltoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
sec-Butylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Styrene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
tert-Butylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Tetrachloroethylene	**280**	D	**200**	D	**300**	D	**200**	D	**380**	D	**29**		**110**	D	0.200	U	**330**	D	**33,000**	DE	**21,000**	DE	**0.450**	J	0.200	U	0.200	U	5
Toluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
trans-1,2-Dichloroethylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
trans-1,3-Dichloropropylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.4
Trichloroethylene	**7**		**3.200**		**4.700**		**2.100**		**1**		**0.290**	J	**14**		0.200	U	**0.610**		**29**		**36**		0.200	U	0.200	U	0.200	U	5
Trichlorofluoromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Vinyl Chloride	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2
Total VOCs	**298**		**224**		**313**		**221**		**383**		**43**		**171**		**29**		**342**		**33,035**		**21,092**		**10**		**2**		ND		NS

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
NS=this indicates that no regulatory limit has been established for this analyte
ND=analyte not detected at or above the level indicated
sample exceeds NYSDEC TOGS Standards and Guidance Values - GA

Table 4 (Cont.)
Pre- and Post-Injections Groundwater Samples Analytical Results for VOC's
77-57 Vleigh Place, Flushing NY

York ID	MW-1		MW-2		MW-3S		MW-5S		MW-6		MW-7		MW-8		MW-9		MW-11		MW-12		MW-13		Trip Blank		NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	8/28/18		8/28/18		8/28/18		8/28/18		8/28/18		8/28/18		8/28/18		8/28/18		8/28/18		8/28/18		8/28/18		8/28/18		
Client Matrix	Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
Unit	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L
1,1,1,2-Tetrachloroethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
1,1,1-Trichloroethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
1,1,2,2-Tetrachloroethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
1,1,2-Trichloroethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1
1,1-Dichloroethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
1,1-Dichloroethylene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
1,1-Dichloropropylene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
1,2,3-Trichlorobenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
1,2,3-Trichloropropane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.04
1,2,4,5-Tetramethylbenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	~
1,2,4-Trichlorobenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
1,2,4-Trimethylbenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
1,2-Dibromo-3-chloropropane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.04
1,2-Dibromoethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.0006
1,2-Dichlorobenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	3
1,2-Dichloroethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.6
1,2-Dichloropropane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	1
1,3,5-Trimethylbenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
1,3-Dichlorobenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	3
1,3-Dichloropropane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
1,4-Dichlorobenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	3
2,2-Dichloropropane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
2-Butanone	**18.2**		**15.4**		**16.1**		0.2	U	0.2	U	**14.0**		**1.5**		0.2	U	0.2	U	**18.5**		17.8		0.2	U	50
2-Chlorotoluene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
2-Hexanone	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	50
4-Chlorotoluene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
4-Methyl-2-pentanone	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	~
Acetone	**156**	D	**168**	D	**156**	D	**5.4**		**29.5**		**243**	D	**2.0**	J	**1.2**	J	**4.3**		**185**	D	**219**	D	1.0	U	50
Benzene	0.2	U	0.2	U	0.2	U	0.2	U	**0.5**	J	0.2	U	0.2	U	0.2	U	**0.5**	J	**0.2**	J	0.2	U	0.2	U	1
Bromobenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Bromochloromethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Bromodichloromethane	0.2	U	**0.7**		0.2	U	0.2	U	**0.4**	J	0.2	U	0.2	U	0.2	U	0.2	U	**0.8**		0.2	U	0.2	U	50
Bromoform	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	50
Bromomethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Carbon disulfide	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	~
Carbon tetrachloride	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Chlorobenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Chloroethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Chloroform	**1.2**		**8.8**		**2.9**		**0.2**	J	**8.9**		**20.5**		**0.6**		**1.2**		**1.7**		**12.1**		0.2	U	0.2	U	7
Chloromethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	J	0.4	J	0.2	U	**0.3**	J	**0.2**	J	0.2	U	0.2	U	0.2	U	5
cis-1,2-Dichloroethylene	**1.6**		**1.2**		**0.3**	J	**1.8**		**38.4**		0.2	U	**1.6**		**12.3**		**1.4**		**0.8**		**2.8**		0.2	U	5
cis-1,3-Dichloropropylene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.4
Dibromochloromethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	50
Dibromomethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	~
Dichlorodifluoromethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Ethyl Benzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Hexachlorobutadiene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.5
Isopropylbenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Methyl tert-butyl ether (MTBE)	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.3	J	0.2	U	0.2	U	0.2	U	0.2	U	10
Methylene chloride	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	5
Naphthalene	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	10
n-Butylbenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
n-Propylbenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
o-Xylene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
p- & m- Xylenes	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	5
p-Diethylbenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	~
p-Ethyltoluene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	~
p-Isopropyltoluene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
sec-Butylbenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Styrene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
tert-Butylbenzene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Tetrachloroethylene	**397**	D	**175**	D	**54.6**		**156**	D	**628**	D	0.2	U	**433**	D	**8,880**	D	**7,510**	D	**159**	D	1.7		0.2	U	5
Toluene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	**0.2**	J	0.2	U	0.2	U	0.2	U	5
trans-1,2-Dichloroethylene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
trans-1,3-Dichloropropylene	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.4
Trichloroethylene	**6.3**		**4.4**		**1.2**		**1.0**		**30.7**		0.2	U	**1.2**		**12.7**		**34.4**		**5.1**		0.2	U	0.2	U	5
Trichlorofluoromethane	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Vinyl Chloride	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	5
Total VOCs	**580**		**373**		**231**		**164**		**737**		**278**		**440**		**8,908**		**7,553**		**381**		**241**		ND		NS

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
NS=this indicates that no regulatory limit has been established for this analyte
ND=analyte not detected at or above the level indicated
sample exceeds NYSDEC TOGS Standards and Guidance Values - GA

Table 4 (Cont.)
Pre- and Post-Injections Groundwater Samples Analytical Results for VOC's
77-57 Vleigh Place, Flushing NY

Sample ID	MW-1		MW-2		MW-3S		MW-3D		MW-5S		MW-5D		MW-6		MW-7		MW-8		MW-9		MW-11		MW-12		MW-13		Trip Blank		NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	12/26/18		12/26/18		12/26/18		12/26/18		12/26/18		12/26/18		12/26/18		12/26/18		12/26/18		12/26/18		12/26/18		12/26/18		12/26/18		12/26/18			
Client Matrix	Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water			
Compound	Result	Q	Result		Result		Result		Result	Q	Result	Q	Result	Q	Result	Q	Result		Result		Result		Result		Result		Result			
Units	ug/L		matrch	Q	ug/L	Q	ug/L	Q	ug/L		ug/L		ug/L		ug/L		ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q	ug/L	
1,1,1,2-Tetrachloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.240	J	0.200	U	0.200	U	0.200	U	5
1,1,1-Trichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2,2-Tetrachloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2-Trichloro-1,2,2-trifluoroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2-Trichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	1
1,1-Dichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1-Dichloroethylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1-Dichloropropylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,3-Trichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,3-Trichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.04
1,2,4,5-Tetramethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
1,2,4-Trichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,4-Trimethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2-Dibromo-3-chloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.04
1,2-Dibromoethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.0006
1,2-Dichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
1,2-Dichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.6
1,2-Dichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	1
1,3,5-Trimethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,3-Dichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
1,3-Dichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,4-Dichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
2,2-Dichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
2-Butanone	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
2-Chlorotoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
2-Hexanone	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
4-Chlorotoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
4-Methyl-2-pentanone	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
Acetone	**10**		**11.10**		**10.30**		**9.53**		**10.70**		**10.40**		**9.79**		**9.61**		**9.71**		**10.40**		**21.20**		**9.82**		9.640		1	U	50
Benzene	0.200	U	**0.39**	J	0.200	U	**0.220**	J	0.200	U	0.200	U	0.350	J	0.200	U	0.200	U	0.200	U	0.460	J	**0.76**		0.200	U	0.200	U	1
Bromobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Bromochloromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Bromodichloromethane	0.200	U	**0.31**	J	**1.64**		**0.47**	J	0.200	U	0.200	U	**0.31**	J	0.200	U	0.200	U	0.200	U	0.200	U	**0.39**	J	0.200	U	0.200	U	50
Bromoform	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
Bromomethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Carbon disulfide	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
Carbon tetrachloride	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chloroform	**0.88**		**3.52**		**25.90**		**8.03**		0.200	U	0.200	U	**5.58**		**13.10**		0.200	U	**0.55**		**0.89**		**1.89**		**6.38**		0.200	U	7
Chloromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
cis-1,2-Dichloroethylene	**1.85**		**61.10**		0.200	U	**5.65**		**0.55**		0.200	U	**40.40**		0.200	U	**0.68**		**0.20**	J	**1.77**		**0.77**		0.200	U	0.200	U	5
cis-1,3-Dichloropropylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.4
Dibromochloromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
Dibromomethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
Dichlorodifluoromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Ethyl Benzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Hexachlorobutadiene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.5
Isopropylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Methyl tert-butyl ether (MTBE)	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.29**	J	0.200	U	0.200	U	0.200	U	0.200	U	10
Methylene chloride	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	5
Naphthalene	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	10
n-Butylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
n-Propylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
o-Xylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
p- & m- Xylenes	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	5
p-Diethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
p-Ethyltoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
p-Isopropyltoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
sec-Butylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Styrene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
tert-Butylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Tetrachloroethylene	**222**	D	**8,250**	DE	**52.90**		**2,060**	D	**175**	D	**1,170**	D	**553**	D	0.200	U	**314**	D	**3,220**	D	**6,700**	D	**62.80**	D	0.200	U	0.200	U	5
Toluene	0.200	U	**0.71**		0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
trans-1,2-Dichloroethylene	0.200	U	**0.31**	J	0.200	U	0.200	U	0.200	U	0.200	U	0.220	J	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
trans-1,3-Dichloropropylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.4
Trichloroethylene	**8.43**		**95**	D	**0.49**	J	**12.80**		**0.58**		**1.26**		**31.90**		0.200	U	**0.93**		**6.14**		**37.70**		**2.45**		0.200	U	0.200	U	5
Trichlorofluoromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Vinyl Chloride	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2
Total VOCs	**243**		**8,423**		**91**		**2,097**		**187**		**1,182**		**642**		**23**		**326**		**3,238**		**6,764**		**84**		**10**		**ND**		NS

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
NS=this indicates that no regulatory limit has been established for this analyte
ND=analyte not detected at or above the level indicated
sample exceeds NYSDEC TOGS Standards and Guidance Values - GA

Table 4 (Cont.)
Pre- and Post-Injections Groundwater Samples Analytical Results for VOC's
77-57 Vleigh Place, Flushing NY

Sample ID	MW-1		MW-2		MW-3S		MW-3D		MW-5S		MW-5D		MW-6		MW-7		MW-8		MW-9		MW-11		MW-12		MW-13		Trip Blank		NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	4/8/19		4/8/19		4/8/19		4/8/19		4/8/19		4/8/19		4/8/19		4/8/19		4/8/19		4/8/19		4/8/19		4/8/19		4/8/19		4/8/19			
Client Matrix	Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water			
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q		
Units	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L			
1,1,1,2-Tetrachloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,1-Trichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2,2-Tetrachloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2-Trichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	1
1,1-Dichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1-Dichloroethylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1-Dichloropropylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,3-Trichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,3-Trichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.04
1,2,4,5-Tetramethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	NS
1,2,4-Trichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,4-Trimethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2-Dibromo-3-chloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.04
1,2-Dibromoethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.0006
1,2-Dichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	**0.230**	J	0.200	U	0.200	U	0.200	U	3
1,2-Dichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.6
1,2-Dichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	1
1,3,5-Trimethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,3-Dichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
1,3-Dichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,4-Dichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
2,2-Dichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
2-Butanone	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
2-Chlorotoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
2-Hexanone	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
4-Chlorotoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
4-Methyl-2-pentanone	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	NS
Acetone	**2.23**		**1.85**	J	**1.91**	J	**1.89**	J	**1.82**	J	**1.58**	J	**19.50**	JD	**1.65**	J	**2.48**		**2.04**		**1.70**	J	**1.49**	J	**1.58**	J	1	U	50
Benzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.270	J	0.200	U	0.200	U	1
Bromobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Bromochloromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Bromodichloromethane	0.200	U	0.510		**1.94**		**1.16**		0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.370**	J	0.200	U	0.200	U	50
Bromoform	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
Bromomethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Carbon disulfide	**0.22**	J	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	NS
Carbon tetrachloride	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.20	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chloroform	**1.65**		**6.21**		**23.50**		**12.80**		**0.22**	J	**0.31**	J	**2.60**	JD	**23.20**		0.200	U	**0.37**	J	**0.69**		**5.43**		0.200	U	0.200	U	7
Chloromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
cis-1,2-Dichloroethylene	**6.57**		**2.44**		0.200	U	**3.79**		0.200	U	0.200	U	**22.40**	D	0.200	U	0.200	U	0.200	U	**1.22**		**1.05**		0.200	U	0.200	U	5
cis-1,3-Dichloropropylene	0.200	U	0.200	U	0.200	U	0.20	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.4
Dibromochloromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
Dibromomethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	NS
Dichlorodifluoromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Ethyl Benzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Hexachlorobutadiene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.5
Isopropylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Methyl tert-butyl ether (MTBE)	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	10
Methylene chloride	1	U	1	U	1	U	1	U	1	U	1	U	10	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	5
Naphthalene	1	U	1	U	1	U	1	U	1	U	1	U	10	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	10
n-Butylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
n-Propylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
o-Xylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
p- & m- Xylenes	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	5	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	5
p-Diethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	NS
p-Ethyltoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	NS
p-Isopropyltoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
sec-Butylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Styrene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
tert-Butylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Tetrachloroethylene	**535**	D	**176**	D	**17.30**		**1,410**	D	**21.50**		**856**	D	**336**	D	0.200	U	**5.52**		**668**	D	**1,830**	D	**77.50**		0.200	U	0.200	U	5
Toluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
trans-1,2-Dichloroethylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
trans-1,3-Dichloropropylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.4
Trichloroethylene	**9.40**		**3.17**		0.200	U	**7.14**		0.200	U	**1.23**		**15.60**	D	0.200	U	0.200	U	**0.67**		**4.03**		28.500		0.200	U	0.200	U	5
Trichlorofluoromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Vinyl Chloride	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2
	555.070		190.180		44.650		1,436.780		23.540		859.120		396		24.850		8.000		671.080		1,837.870		114.610		1.580		ND		5

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
NS=this indicates that no regulatory limit has been established for this analyte
ND=analyte not detected at or above the level indicated
sample exceeds NYSDEC TOGS Standards and Guidance Values - GA

Table 4 (Cont.)
Pre- and Post-Injections Groundwater Samples Analytical Results for VOC's
77-57 Vleigh Place, Flushing NY

Sample ID	MW-2(S)		MW-2(D)		MW-3S		MW-3D		MW-7		MW-13(S)		MW-13(D)		MW-12		Trip Blank		NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	7/22/2019		7/22/2019		7/22/2019		7/22/2019		7/22/2019		7/22/2019		7/22/2019		7/22/2019		7/22/2019		
Client Matrix	Water		Water		Water		Water		Water		Water		Water		Water		Water		
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
Units	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		
1,1,1,2-Tetrachloroethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,1-Trichloroethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2,2-Tetrachloroethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2-Trichloro-1,2,2-trifluoroethan	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2-Trichloroethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	1
1,1-Dichloroethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1-Dichloroethylene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1-Dichloropropylene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,3-Trichlorobenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,3-Trichloropropane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.04
1,2,4,5-Tetramethylbenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
1,2,4-Trichlorobenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,4-Trimethylbenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2-Dibromo-3-chloropropane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.04
1,2-Dibromoethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.0006
1,2-Dichlorobenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
1,2-Dichloroethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.6
1,2-Dichloropropane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	1
1,3,5-Trimethylbenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,3-Dichlorobenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
1,3-Dichloropropane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,4-Dichlorobenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
2,2-Dichloropropane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
2-Butanone	**7.16**		**1.70**	D	**5.07**		**6.48**		**5.98**		**6.30**		**6.27**		**6.22**		**1.27**		50
2-Chlorotoluene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
2-Hexanone	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
4-Chlorotoluene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
4-Methyl-2-pentanone	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
Acetone	**60.20**		**18.20**	D	**45.40**		**55.40**		**65.30**		**91.20**		**67.70**		**57.20**		**2.79**		50
Benzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	1
Bromobenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Bromochloromethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Bromodichloromethane	0.250	J	**0.40**	JD	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.48**	J	0.200	U	50
Bromoform	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
Bromomethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Carbon disulfide	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
Carbon tetrachloride	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chlorobenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chloroethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chloroform	**4.42**		**6.44**	D	**1.57**		**26**		**25.70**		0.200	U	0.200	U	**9.62**		0.200	U	7
Chloromethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
cis-1,2-Dichloroethylene	**3.49**		**4.96**	D	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**1.36**		0.200	U	5
cis-1,3-Dichloropropylene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.4
Dibromochloromethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
Dibromomethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
Dichlorodifluoromethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Ethyl Benzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Hexachlorobutadiene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.5
Isopropylbenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Methyl tert-butyl ether (MTBE)	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	10
Methylene chloride	1	U	2	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	5
Naphthalene	1	U	2	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	10
n-Butylbenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
n-Propylbenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
o-Xylene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
p- & m- Xylenes	0.500	U	1	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	5
p-Diethylbenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
p-Ethyltoluene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
p-Isopropyltoluene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
sec-Butylbenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Styrene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
tert-Butylbenzene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Tetrachloroethylene	**264**	D	**874**	D	**25**		**39.90**		0.200	U	0.200	U	0.200	U	**175**	D	0.200	U	5
Toluene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
trans-1,2-Dichloroethylene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
trans-1,3-Dichloropropylene	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.4
Trichloroethylene	**6.790**		**8**	D	0.200	U	**0.38**	J	0.200	U	0.200	U	0.200	U	**23.40**		0.200	U	5
Trichlorofluoromethane	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Vinyl Chloride	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2
Total VOCs	**346.31**		**913.70**		**77.04**		**128.16**		**96.98**		**97.50**		**73.97**		**273.28**		**4.06**		NS

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
NS=this indicates that no regulatory limit has been established for this analyte
ND=analyte not detected at or above the level indicated

sample exceeds NYSDEC TOGS Standards and Guidance Values - GA

Table 4 (Cont.)
Pre- and Post-Injections Groundwater Samples Analytical Results for VOC's
77-57 Vleigh Place, Flushing NY

Sample ID	MW-1		MW-2		MW-3S		MW-3D		MW-5D		MW-6		MW-7		MW-9		MW-11		MW-12		MW-13		Equipment Blank		Equipment Blank		Equipment Blank		Equipment Blank		Trip Blank		NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	10/3/2019		9/30/2019		10/2/2019		10/2/2019		10/2/2019		10/3/2019		9/30/2019		10/2/2019		10/4/2019		10/4/2019		10/1/2019		9/30/2019		10/2/2019		10/3/2019		10/4/2019		10/4/2019		
Client Matrix	Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		Water		DI Water		
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
Units	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		
1,1,1,2-Tetrachloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,1-Trichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2,2-Tetrachloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2-Trichloro-1,2,2-trifluoroethane (Freo	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1,2-Trichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	1
1,1-Dichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1-Dichloroethylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,1-Dichloropropylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,3-Trichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,3-Trichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.200**	U	0.04
1,2,4,5-Tetramethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
1,2,4-Trichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2,4-Trimethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,2-Dibromo-3-chloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.200**	U	0.04
1,2-Dibromoethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.200**	U	0.0006
1,2-Dichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
1,2-Dichloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.6
1,2-Dichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	1
1,3,5-Trimethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,3-Dichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
1,3-Dichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
1,4-Dichlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	3
2,2-Dichloropropane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
2-Butanone	0.200	U	0.200	U	**1.840**		0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	**1.120**		**0.670**		**1.470**		**1.250**		0.200	U	50
2-Chlorotoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
2-Hexanone	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
4-Chlorotoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
4-Methyl-2-pentanone	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
Acetone	1	U	**1.030**	J	**4.670**		1	U	1	U	1	U	1	U	2	U	1	U	1	U	**14.400**		1	U	1.390	J	1.020	J	1	U	**4.380**		50
Benzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	1
Bromobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Bromochloromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Bromodichloromethane	0.220	J	0.240	J	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
Bromoform	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
Bromomethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Carbon disulfide	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
Carbon tetrachloride	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chlorobenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chloroethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Chloroform	**3.040**		**9.59**		**9.69**		**11.20**		**1.060**		**2**		**16**		0.400	U	1.040		**0.730**		0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	7
Chloromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.760		0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	**0.790**		5
cis-1,2-Dichloroethylene	**0.510**		**1.740**		0.220	J	0.200	U	**0.270**	J	**0.740**		0.200	U	**0.680**	JD	**70.90**		**1.700**		0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
cis-1,3-Dichloropropylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.4
Dibromochloromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	50
Dibromomethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
Dichlorodifluoromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Ethyl Benzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Hexachlorobutadiene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.5
Isopropylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Methyl tert-butyl ether (MTBE)	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	10
Methylene chloride	1	U	1	U	1	U	1	U	1	U	1	U	1	U	2	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	5
Naphthalene	1	U	1	U	1	U	1	U	1	U	1	U	1	U	2	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	10
n-Butylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
n-Propylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
o-Xylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
p- & m- Xylenes	**4.300**		**4.310**		**4.310**		0.500	U	0.500	U	**4.290**		**4.310**		1	U	0.500	U	0.500	U	**4.290**		0.500	U	0.500	U	0.500	U	0.500	U	0.500	U	5
p-Diethylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
p-Ethyltoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	~
p-Isopropyltoluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
sec-Butylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Styrene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
tert-Butylbenzene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Tetrachloroethylene	**145**	D	**119**	D	**19.70**		**22.10**		**21.90**		**60.50**	D	**7.08**		**145**	D	**1,640**	D	**104**	D	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Toluene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
trans-1,2-Dichloroethylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	**0.220**	J	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
trans-1,3-Dichloropropylene	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.4
Trichloroethylene	**3.200**		**2.700**		0.370	J	0.270	J	**0.220**	J	**2.460**		0.200	U	0.400	U	**6.76**		**5.90**		0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Trichlorofluoromethane	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	5
Vinyl Chloride	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.400	U	**1.30**		0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	0.200	U	2
Total VOCs	156.27		138.61		40.80		33.57		23.45		69.99		27.39		145.68		1720.98		112.33		18.69		1.12		2.06		2.49		1.25		5.17		

NOTES:
Q is the Qualifier Column with definitions as follows:
D=result is from an analysis that required a dilution
J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated
U=analyte not detected at or above the level indicated
B=analyte found in the analysis batch blank
E=result is estimated and cannot be accurately reported due to levels encountered or interferences
P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis
NT=this indicates the analyte was not a target for this sample
~=this indicates that no regulatory limit has been established for this analyte
sample exceeds NYSDEC TOGS Standards and Guidance Values - GA

Table 4 (Cont.)
Pre- and Post-Injections Groundwater Samples Analytical Results for Emerging Contaminants
77-57 Vleigh Place, Flushing NY

Sample ID	MW-3D		MW-1		MW-6		MW-11		MW-12		Field Blank		Field Blank		NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	12/26/18		12/26/18		12/28/18		12/28/18		12/28/18		12/26/18		12/28/18		
Client Matrix	Water		Water		Water		Water		Water		Water		Water		
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
Units	ng/L		ng/L		ng/L		ng/L		ng/L		ng/L		ng/L		ug/L
Perfluorobutanesulfonic acid (PFBS)	**7.6**		**6.5**		**13**		**89**		**17**		ND		ND		NS
Perfluorohexanoic acid (PFHxA)	**63**		**22**		**42**		**380**		**13**		ND		ND		NS
Perfluoroheptanoic acid (PFHpA)	**40**		**20**		**9**		**480**		**5.4**		ND		ND		NS
Perfluorobutanoic acid (PFBA)	**7.5**		**4.3**		**7.8**		**64**		ND		ND		ND		NS
Perfluorodecanesulfonic acid (PFDS)	ND		ND		ND		ND		ND		ND		ND		NS
Perfluoroheptanesulfonic acid (PFHpS)	**ND**		ND		ND		**9.1**		ND		ND		ND		NS
Perfluorooctanesulfonamide (FOSA)	ND		ND		ND		ND		ND		ND		ND		NS
Perfluoropentanoic acid (PFPeA)	**51**		**26**		**44**		**390**		**18**		ND		ND		NS
6:2 Fluorotelomersulfonate (6:2 FTS)	**33**		**11**		**15**		**18**		**47**		ND		ND		NS
8:2 Fluorotelomersulfonate (8:2 FTS)	ND		ND		ND		ND		ND		ND		ND		NS
Perfluorohexanesulfonic acid (PFHxS)	**4**		**15**		ND		**160**		ND		ND		ND		NS
Perfluorooctanoic acid (PFOA)	**69**		**33**		**20**		**830**		**17**		ND		ND		NS
Perfluorooctanesulfonic acid (PFOS)	**8.2**		**2.5**		**11**		**11**		**56**		ND		ND		NS
Perfluorononanoic acid (PFNA)	**4.7**		ND		ND		**10**		ND		ND		ND		NS
Perfluorodecanoic acid (PFDA)	ND		ND		ND		ND		**6.9**		ND		ND		NS
N-MeFOSAA	ND		ND		ND		ND		ND		ND		ND		NS
Perfluoroundecanoic acid (PFUnA)	ND		ND		ND		ND		ND		ND		ND		NS
N-EtFOSAA	ND		ND		ND		ND		ND		ND		ND		NS
Perfluorododecanoic acid (PFDoA)	ND		ND		ND		ND		ND		ND		ND		NS
Perfluorotridecanoic acid (PFTrDA)	ND		ND		ND		ND		ND		ND		ND		NS
Perfluorotetradecanoic acid (PFTA)	ND		ND		ND		ND		ND		ND		ND		NS
Units	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L
1,4-Dioxane	ND		ND		ND		ND		ND		ND		ND		NS

NOTES:
NS=analyte not detected at or above the level indicated
NT=this indicates the analyte was not a target for this sample
NS=this indicates that no regulatory limit has been established for this analyte

Table 4 (Cont.)
Pre- and Post-Injections Groundwater Samples Analytical Results for Emerging Contaminants
77-57 Vleigh Place, Flushing NY

Sample ID	MW-1		MW-3D		MW-6		MW-11		MW-12		Field Blank		Field Blank		NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	9/7/18		9/7/18		9/7/18		9/7/18		9/7/18		9/7/18		9/7/18		
Client Matrix	Water		Water		Water		Water		Water		Water		Water		
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
Units	ng/L		ng/L		ng/L		ng/L		ng/L		ng/L		ng/L		ug/L
Perfluorobutanesulfonic acid (PFBS)	ND		ND		ND		**61**		ND		ND		ND		NS
Perfluorohexanoic acid (PFHxA)	**23**		**33**		**42**		**240**		ND		ND		ND		NS
Perfluoroheptanoic acid (PFHpA)	ND		ND		ND		**260**		ND		ND		ND		NS
Perfluorobutanoic acid (PFBA)	ND		ND		ND		**22**		ND		ND		ND		NS
Perfluorodecanesulfonic acid (PFDS)	ND		ND		ND		ND		ND		ND		ND		NS
Perfluoroheptanesulfonic acid (PFHpS)	ND		ND		ND		ND		ND		ND		ND		NS
Perfluorooctanesulfonamide (FOSA)	ND		ND		ND		ND		ND		ND		ND		NS
Perfluoropentanoic acid (PFPeA)	**22**		**31**		**41**		**210**		ND		ND		ND		NS
6:2 Fluorotelomersulfonate (6:2 FTS)	ND		ND		**23**		ND		ND		ND		ND		NS
8:2 Fluorotelomersulfonate (8:2 FTS)	ND		ND		ND		ND		ND		ND		ND		NS
Perfluorohexanesulfonic acid (PFHxS)	ND		ND		ND		**130**		ND		ND		ND		NS
Perfluorooctanoic acid (PFOA)	**33**		**57**		**25**		**590**		ND		ND		ND		NS
Perfluorooctanesulfonic acid (PFOS)	ND		ND		ND		ND		**93**		ND		ND		NS
Perfluorononanoic acid (PFNA)	ND		ND		ND		ND		ND		ND		ND		NS
Perfluorodecanoic acid (PFDA)	ND		ND		ND		ND		ND		ND		ND		NS
N-MeFOSAA	ND		ND		ND		ND		ND		ND		ND		NS
Perfluoroundecanoic acid (PFUnA)	ND		ND		ND		ND		ND		ND		ND		NS
N-EtFOSAA	ND		ND		ND		ND		ND		ND		ND		NS
Perfluorododecanoic acid (PFDoA)	ND		ND		ND		ND		ND		ND		ND		NS
Perfluorotridecanoic acid (PFTrDA)	ND		ND		ND		ND		ND		ND		ND		NS
Perfluorotetradecanoic acid (PFTA)	ND		ND		ND		ND		ND		ND		ND		NS
Units	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L				ug/L
1,4-Dioxane	0.21		ND		**0.3**		**0.22**		ND		ND		ND		NS

NOTES:
NS=analyte not detected at or above the level indicated
NT=this indicates the analyte was not a target for this sample
NS=this indicates that no regulatory limit has been established for this analyte

Table 4 (Cont.)
Pre- and Post-Injections Groundwater Samples Analytical Results for Emerging Contaminants
77-57 Vleigh Place, Flushing NY

Sample ID	MW-1		MW-2		MW-3		MW-4		MW-5		Field Blank		NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	4/9/19		4/9/19		4/9/19		4/9/19		4/9/19		4/9/19		
Client Matrix	Water		Water		Water		Water		Water		Water		
Compound	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
Units	ng/L		ng/L		ng/L		ng/L		ng/L		ng/L		ug/L
Perfluorobutanesulfonic acid (PFBS)	**140**		**20**		**23**		**13**		**9.7**		<2.0		NS
Perfluorohexanoic acid (PFHxA)	**470**		**58**		**12**		**27**		**13**		<2.0		NS
Perfluoroheptanoic acid (PFHpA)	**660**		**14**		**10**		**26**		**5.1**		<2.0		NS
Perfluorobutanoic acid (PFBA)	**110**		**9.1**		**11**		**4.8**		<2.0		<2.0		NS
Perfluorodecanesulfonic acid (PFDS)	<2.0		<2.0		<2.0		<2.0		<2.0		<2.0		NS
Perfluoroheptanesulfonic acid (PFHpS)	**210**		<2.0		**4**		**2.1**		<2.0		<2.0		NS
Perfluorooctanesulfonamide (FOSA)	<2.0		<2.0		<2.0		<2.0		<2.0		<2.0		NS
Perfluoropentanoic acid (PFPeA)	**410**		**63**		**26**		**29**		**33**		<2.0		NS
6:2 Fluorotelomersulfonate (6:2 FTS)	**6000**		**13**		**4.1**		<2.0		**2**		<2.0		NS
8:2 Fluorotelomersulfonate (8:2 FTS)	**17**		<2.0		<2.0		<2.0		<2.0		<2.0		NS
Perfluorohexanesulfonic acid (PFHxS)	**310**		**3.8**		**7.2**		**10**		**3.1**		<2.0		NS
Perfluorooctanoic acid (PFOA)	**1100**		**23**		**23**		**81**		**12**		<2.0		NS
Perfluorooctanesulfonic acid (PFOS)	**26**		**20**		**4.6**		**8.4**		**57**		<2.0		NS
Perfluorononanoic acid (PFNA)	**27**		**2.3**		<2.0		**2.7**		<2.0		<2.0		NS
Perfluorodecanoic acid (PFDA)	<2.0		<2.0		<2.0		<2.0		**3**		<2.0		NS
N-MeFOSAA	<2.0		<2.0		<2.0		<2.0		<2.0		<2.0		NS
Perfluoroundecanoic acid (PFUnA)	<2.0		<2.0		<2.0		<2.0		<2.0		<2.0		NS
N-EtFOSAA	<2.0		<2.0		<2.0		<2.0		<2.0		<2.0		NS
Perfluorododecanoic acid (PFDoA)	<2.0		<2.0		<2.0		<2.0		<2.0		<2.0		NS
Perfluorotridecanoic acid (PFTrDA)	**5.7**		<2.0		<2.0		<2.0		<2.0		<2.0		NS
Perfluorotetradecanoic acid (PFTA)	<2.0		<2.0		<2.0		<2.0		<2.0		<2.0		NS
Units	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L
1,4-Dioxane	<0.21		<0.20		<0.19		<0.20		<0.19		<0.20		NS

NOTES:
NS=analyte not detected at or above the level indicated
NT=this indicates the analyte was not a target for this sample
NS=this indicates that no regulatory limit has been established for this analyte

Table 4 (Conbt.)
Pre- and Post-Injections Groundwater Samples Analytical Results for Emerging Contaminants
77-57 Vleigh Place, Flushing NY

Sample ID	MW-2	MW-3S	MW-7	MW-3D	MW-12	MW-13	Field Blank	Field Blank	Field Blank	Equipment Blank	Field Blank	Equipment Blank	NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	7/25/19	7/24/19	7/23/19	7/24/19	7/22/19	7/25/19	7/22/19	7/23/19	7/24/19	7/24/19	7/25/19	7/25/19	
Client Matrix	Water	Water	Water	Water	Water	Water	DI Water	DI Water	DI Water	DI Water	DI Water	DI Water	
Compound	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	
Units	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Perfluorobutanoic acid (PFBA)	**5.5**	**3.3**	**2.2**	<2.0	**4.9**	**4.3**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorobutanesulfonic acid (PFBS)	**2.8**	**2.2**	**3.2**	<2.0	**8.7**	**9.1**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluoropentanoic acid (PFPeA)	**23**	**2.8**	**8.7**	**4.9**	**22**	**9.3**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorohexanoic acid (PFHxA)	**43**	**7.4**	**13**	**3.2**	**20**	**13**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorohexanesulfonic acid (PFHxS)	4.7	<2.0	<2.0	<2.0	**2.9**	14	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluoroheptanoic acid (PFHpA)	**31**	**4.4**	<2.0	**2**	**8**	**9.3**	<2.0	<2.0	3.5	<2.0	<2.0	<2.0	NS
Perfluoroheptanesulfonic acid (PFHpS)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorooctanoic acid (PFOA)	**89**	**14**	**7.5**	**19**	**24**	**70**	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	NS
Perfluorooctanesulfonic acid (PFOS)	**5.6**	**5.8**	**4.9**	**8**	**32**	**6.7**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorooctanesulfonamide (FOSA)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
6:2 Fluorotelomersulfonate (6:2 FTS A)	**4.7**	**260**	**7.5**	**6.5**	**95**	**8.4**	<2.0	<2.0	**47**	<2.0	<2.0	<2.0	NS
Perfluorononanoic acid (PFNA)	**10**	**2.6**	<2.0	**3.4**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorodecanoic acid (PFDA)	**4.3**	<2.0	<2.0	<2.0	**3.7**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorodecanesulfonic acid (PFDS)	<2.0	**3.3**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
N-EtFOSAA	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
8:2 Fluorotelomersulfonate (8:2 FTS A)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluoroundecanoic acid (PFUnA)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
N-MeFOSAA	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorododecanoic acid (PFDoA)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorotridecanoic acid (PFTrDA)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorotetradecanoic acid (PFTA)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,4-Dioxane	<0.20	<0.20	<0.20	<0.19	<0.19	<0.19	NT	NT	NT	<0.25	NT	<0.22	NS

NOTES:
NS=analyte not detected at or above the level indicated
NT=this indicates the analyte was not a target for this sample
NS=this indicates that no regulatory limit has been established for this analyte

Table 4 (Cont.)

Pre- and Post-Injections Groundwater Samples Analytical Results for Emerging Contaminants

77-57 Vleigh Place, Flushing NY

Sample ID	MW-1	MW-3D	MW-6	MW-11	MW-12	Field Blank	Field Blank	Field Blank	Equipment Blank	Equipment Blank	NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	10/3/19	10/2/19	10/3/19	10/4/19	10/4/19	10/2/19	10/3/19	10/4/19	10/3/19	10/4/19	
Client Matrix	Water	Water	Water	Water	Water	DI Water	DI Water	DI Water	DI Water	DI Water	
Compound	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	
Units	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Perfluorobutanoic acid (PFBA)	<2.0	<2.0	**25**	**12**	**11**	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorobutanesulfonic acid (PFBS)	**8.3**	<2.0	**20**	**32**	**14**	<2.0	<2.0	<2.0	**3**	**3.4**	NS
Perfluoropentanoic acid (PFPeA)	**28**	<2.0	**78**	**18**	**18**	<2.0	<2.0	<2.0	**2.6**	**4.6**	NS
Perfluorohexanoic acid (PFHxA)	**49**	2.2	**120**	**18**	**20**	<2.0	<2.0	<2.0	**2.6**	**10**	NS
Perfluorohexanesulfonic acid (PFHxS)	**13**	2.7	**15**	**4.6**	**11**	2.2	7.5	<2.0	**4.2**	**40**	NS
Perfluoroheptanoic acid (PFHpA)	**44**	<2.0	**120**	**11**	**16**	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluoroheptanesulfonic acid (PFHpS)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**4.2**	NS
Perfluorooctanoic acid (PFOA)	**68**	**6.7**	**150**	**26**	**50**	<2.0	<2.0	<2.0	<2.0	**4.4**	NS
Perfluorooctanesulfonic acid (PFOS)	**3.9**	**5.4**	**25**	**26**	**22**	<2.0	<2.0	<2.0	<2.0	**18**	NS
Perfluorooctanesulfonamide (FOSA)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
6:2 Fluorotelomersulfonate (6:2 FTS A)	**750**	**70**	**49**	**5**	**13**	<2.0	2.7	<2.0	**2.2**	**24**	NS
Perfluorononanoic acid (PFNA)	**2**	**2.7**	**14**	**3.1**	**2.1**	<2.0	<2.0	<2.0	<2.0	**8.5**	NS
Perfluorodecanoic acid (PFDA)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorodecanesulfonic acid (PFDS)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
N-EtFOSAA	<2.0	<2.0	2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**3**	NS
8:2 Fluorotelomersulfonate (8:2 FTS A)	**8**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.6	NS
Perfluoroundecanoic acid (PFUnA)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
N-MeFOSAA	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorododecanoic acid (PFDoA)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorotridecanoic acid (PFTrDA)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Perfluorotetradecanoic acid (PFTA)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,4-Dioxane	<0.19	<0.20	<0.19	<0.20	<0.19	NT	NT	NT	<0.20	<0.21	NS

NOTES:

NS=analyte not detected at or above the level indicated

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

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

Table 5
Off-site Soil Vapor Analytical Results Over time
77-57 Vleigh Place, Flushing, New York

Sample ID	SV-KG-1		SV-KG-1		SV-KG-1		SV-2		SV-2		SV-2		SV-3		SV-3		SV-3	
Sampling Date	4/4/2017		11/15/2018		10/9/2019		11/23/2014		11/15/2018		10/9/2019		11/23/2014		11/15/2018		10/9/2019	
Client Matrix	Air		Air		Air		Soil Vapor		Air		Air		Soil Vapor		Air		Air	
Compound	Result		Result		Result		Result		Result		Result		Result		Result		Result	
Volatile Organics, EPA TO15 Full Lis	ug/m3	RL	ug/m3	RL	ug/m3	RL	ug/m^3	Q	ug/m3	RL	ug/m3	RL	ug/m^3	Q	ug/m3	RL	ug/m3	RL
1,1,1,2-Tetrachloroethane	17.0	U	1.3	U	14	U	NT		1.1	U	2	U	NT		1.1	U	1.200	U
1,1,1-Trichloroethane	13.00	U	1.0	U	11	U	1.10	U	0.9	U	1.600	U	1.10	U	0.9	U	0.980	U
1,1,2,2-Tetrachloroethane	17	U	1.3	U	14	U	1.40	U	1.1	U	2	U	1.40	U	1.1	U	1.200	U
1,1,2-Trichloro-1,2,2-trifluoroethane (	19	U	1.5	U	16	U	1.60	U	1.2	U	2.300	U	1.50	U	1.2	U	1.400	U
1,1,2-Trichloroethane	13	U	1.0	U	11	U	1.10	U	0.9	U	1.600	U	1.10	U	0.9	U	0.980	U
1,1-Dichloroethane	10	U	0.8	U	8.400	U	0.83	U	0.6	U	1.200	U	0.80	U	0.6	U	0.730	U
1,1-Dichloroethylene	9.7	U	0.2	U	2.100	U	0.82	U	0.2	U	0.290	U	0.78	U	0.2	U	0.180	U
1,2,4-Trichlorobenzene	18	U	1.4	U	15	U	1.50	U	1.2	U	2.200	U	1.50	U	1.2	U	1.300	U
1,2,4-Trimethylbenzene	12	U	**54.1**	D	**11**	D	**6.50**	D	**54.1**	D	**3.8**	D	**9.60**	D	**2.2**	D	0.890	U
1,2-Dibromoethane	19	U	1.5	U	16	U	1.60	U	1.2	U	2.300	U	1.50	U	1.2	U	1.400	U
1,2-Dichlorobenzene	15	U	1.1	U	13	U	1.20	U	1.0	U	1.800	U	1.20	U	1.0	U	1.100	U
1,2-Dichloroethane	10	U	0.8	U	8.400	U	0.83	U	0.6	U	1.200	U	0.80	U	0.6	U	0.730	U
1,2-Dichloropropane	11	U	0.9	U	9.600	U	0.95	U	0.7	U	1.400	U	0.91	U	0.7	U	0.830	U
1,2-Dichlorotetrafluoroethane	17	U	1.3	U	15	U	1.40	U	1.1	U	2.100	U	1.40	U	1.1	U	1.300	U
1,3,5-Trimethylbenzene	12	U	**17.2**	D	10	U	**2.10**	D	**15.7**	D	**1.5**	D	**2.70**	D	**0.9**	D	0.890	U
1,3-Butadiene	16	U	**8.0**	D	14	U	0.89	U	1.1	U	2	U	0.86	U	1.1	U	1.200	U
1,3-Dichlorobenzene	15	U	1.1	U	13	U	1.20	U	1.0	U	1.800	U	1.20	U	1.0	U	1.100	U
1,3-Dichloropropane	11	U	0.9	U	9.600	U	NT		0.7	U	1.400	U	NT		0.7	U	0.830	U
1,4-Dichlorobenzene	15	U	1.1	U	13	U	1.20	U	1.0	U	1.800	U	1.20	U	1.0	U	1.100	U
1,4-Dioxane	18	U	1.4	U	15	U	0.74	U	1.2	U	2.100	U	0.71	U	1.2	U	1.300	U
2-Butanone	7.3	U	**32.4**	D	6.100	U	**1.70**	D	**8.3**	D	100	D	**5.20**	D	**5.9**	D	**1.2**	D
2-Hexanone	20	U	**2.9**	D	17	U	1.70	U	1.3	U	**14**	D	1.60	U	1.4	U	1.500	U
3-Chloropropene	38	U	3.0	U	33	U	NT		2.5	U	4.600	U	NT		2.6	U	2.800	U
4-Methyl-2-pentanone	10	U	0.8	U	8.500	U	0.84	U	0.7	U	1.200	U	0.81	U	**0.9**	D	0.740	U
Acetone	**29**	D	**71.2**	D	9.900	U	**29**	D	**23.7**	D	**19**	D	**39**	D	**23.7**	D	**7**	D
Acrylonitrile	5.3	U	0.4	U	4.500	U	NT		0.3	U	0.640	U	NT		0.3	U	0.390	U
Benzene	**13**	D	**25.5**	D	6.700	U	**2.40**	D	**5.7**	D	0.940	U	**5.10**	D	**3.8**	D	0.580	U
Benzyl chloride	13	U	1.0	U	11	U	1.10	U	0.8	U	1.500	U	1	U	0.8	U	0.930	U
Bromodichloromethane	16	U	1.3	U	14	U	1.30	U	1.1	U	2	U	1.20	U	1.1	U	**3**	D
Bromoform	25	U	2.0	U	22	U	2.10	U	1.7	U	3.100	U	2	U	1.7	U	1.900	U
Bromomethane	9.5	U	0.7	U	8.100	U	0.80	U	0.6	U	1.100	U	0.77	U	0.6	U	0.700	U
Carbon disulfide	7.7	U	**12.1**	D	**140**	D	**0.90**	D	**3.4**	D	**3**	D	**3**	D	**5.6**	D	**2**	D
Carbon tetrachloride	3.9	U	0.3	U	3.300	U	0.32	U	0.3	U	0.460	U	0.31	U	0.3	U	**0.9**	D
Chlorobenzene	11	U	0.9	U	9.600	U	0.95	U	0.7	U	1.400	U	0.91	U	0.7	U	0.830	U
Chloroethane	6.5	U	0.5	U	5.500	U	0.54	U	0.4	U	0.780	U	0.52	U	0.4	U	0.480	U
Chloroform	12	U	0.9	U	10	U	**3.80**	D	**20.5**	D	**95**	D	**4.30**	D	**19.5**	D	**260**	D
Chloromethane	5.1	U	0.4	U	4.300	U	0.42	U	0.3	U	0.610	U	**1**	D	0.3	U	0.370	U
cis-1,2-Dichloroethylene	9.7	U	0.2	U	2.100	U	0.82	U	0.2	U	0.290	U	0.78	U	0.2	U	0.180	U
cis-1,3-Dichloropropylene	11	U	0.9	U	9.500	U	0.93	U	0.7	U	1.300	U	0.90	U	0.7	U	0.820	U
Cyclohexane	8.5	U	**25.8**	D	7.200	U	**1.30**	D	**8.9**	D	1	U	**3.40**	D	**15.5**	D	**0.9**	D
Dibromochloromethane	21	U	1.6	U	18	U	1.70	U	1.4	U	2.500	U	1.60	U	1.4	U	1.500	U
Dichlorodifluoromethane	12	U	**1.8**	D	10	U	**2.50**	D	**2.1**	D	**2.5**	D	**2.20**	D	**1.9**	D	**2.3**	D
Ethyl acetate	18	U	1.4	U	15	U	1.50	U	1.2	U	2.100	U	1.40	U	1.2	U	1.300	U
Ethyl Benzene	11	U	**69.4**	D	9	U	**8.70**	D	**38.2**	D	**2.2**	D	**8.70**	D	**6.1**	D	0.780	U
Hexachlorobutadiene	26	U	2.0	U	22	U	2.20	U	1.7	U	3.200	U	2.10	U	1.7	U	1.900	U
Isopropanol	12	U	1.0	U	10	U	**9.10**	D	**2.7**	D	1.500	U	**82**	D	**11.3**	D	**1.2**	D
Methyl Methacrylate	10	U	0.8	U	8.500	U	0.84	U	**1.4**	D	**9.7**	D	0.81	U	**0.7**	D	**6.7**	D
Methyl tert-butyl ether (MTBE)	8.9	U	0.7	U	7.500	U	0.74	U	0.6	U	1.100	U	0.71	U	0.6	U	0.650	U
Methylene chloride	17	U	1.4	U	14	U	**22**	B(1)D	**16.0**	D	**55**	D	**6.70**	B(1)D	1.1	U	**21**	D
n-Heptane	10	U	**45.1**	D	8.500	U	**4.30**	D	**16.8**	D	**4.1**	D	**6.50**	D	**9.8**	D	0.740	U
n-Hexane	**13**	D	0.7	U	7.300	U	**4.30**	D	**10.9**	D	1	U	**13**	D	**11.3**	D	0.640	U
o-Xylene	11	U	**95.5**	D	9	U	**11**	D	**69.4**	D	**3.3**	D	**11**	D	**7.8**	D	0.780	U
p- & m- Xylenes	**30**	D	**251.7**	D	18	U	**32**	D	**143.2**	D	**6.5**	D	**33**	D	**17.8**	D	1.600	U
p-Ethyltoluene	12	U	**68.8**	D	10	U	**8.10**	D	**54.1**	D	**3**	D	**9.40**	D	**3.3**	D	0.890	U
Propylene	**61**	D	**74.0**	D	3.600	U	0.35	U	**1.0**	D	0.510	U	0.34	U	**2.4**	D	0.310	U
Styrene	10	U	**0.8**	U	8.900	U	0.88	U	0.7	U	**2.8**	D	0.84	U	0.7	U	0.770	U
Tetrachloroethylene	**13,000**	D	**10,169**	D	**66,000**	D	**370**	B(2)D	**5,085**	D	**1,400**	D	**10**	B(2)D	**2.8**	D	**18**	D
Tetrahydrofuran	15	U	**20.3**	D	12	U	**0.61**	U	**11.2**	D	**7.4**	D	**5.20**	D	**5.0**	D	1.100	U
Toluene	**35**	D	218.5	D	7.800	U	**31**	D	**109.2**	D	**3.1**	D	**41**	D	**35.8**	D	**0.7**	D
trans-1,2-Dichloroethylene	9.7	U	0.8	U	8.300	U	0.82	U	0.6	U	1.200	U	0.78	U	0.6	U	0.720	U
trans-1,3-Dichloropropylene	11	U	0.9	U	9.500	U	0.93	U	0.7	U	1.300	U	0.90	U	0.7	U	0.820	U
Trichloroethylene	**13**	D	15.0	D	**45**	D	**17**	D	**59.1**	D	**21**	D	**0.64**	D	**1.0**	D	**5.1**	D
Trichlorofluoromethane (Freon 11)	14	U	1.1	U	12	U	**1.60**	D	**1.1**	D	**1.7**	D	**3.10**	D	**1.2**	D	**1.6**	D
Vinyl acetate	8.7	U	0.7	U	7.300	U	0.72	U	0.6	U	1	U	0.70	U	0.6	U	0.640	U
Vinyl bromide	11	U	0.8	U	9.100	U	NT		0.7	U	1.300	U	NT		0.7	U	0.790	U
Vinyl Chloride	6.3	U	0.1	U	1.300	U	0.13	U	0.1	U	0.190	U	0.13	U	0.1	U	0.120	U

Sample ID	SV-6		SV-6		SV-6		SV-7		SV-7		SV-7		SV-8		SV-8		SV-8	
Sampling Date	12/3/2015		11/15/2018		10/9/2019		12/3/2015		11/15/2018		10/9/2019		10/17/2016		11/15/2018		10/9/2019	
Client Matrix	Soil Vapor		Air		Air		Soil Vapor		Air		Air		Soil Vapor		Air		Air	
Compound	Result		Result		Result		Result		Result		Result		ug/m3		Result		Result	
Volatile Organics, EPA TO15 Full Lis	ug/m3	Q	ug/m3	RL	ug/m3	RL	ug/m3	Q	ug/m3	RL	ug/m3	RL			ug/m3	RL	ug/m3	RL
1,1,1,2-Tetrachloroethane	<7.9	U	4.6	U	1.200	U	<2	U	1.4	U	1.200	U	16	U	1.0	U	4.600	U
1,1,1-Trichloroethane	<6.2	U	3.7	U	0.960	U	<1.6	U	1.1	U	0.920	U	13	U	0.8	U	3.700	U
1,1,2,2-Tetrachloroethane	<7.9	U	4.6	U	1.200	U	<2	U	1.4	U	1.200	U	16	U	1.0	U	4.600	U
1,1,2-Trichloro-1,2,2-trifluoroethane (	<8.8	U	5.1	U	1.300	U	<2.3	U	1.6	U	1.300	U	18	U	1.1	U	5.200	U
1,1,2-Trichloroethane	<6.2	U	3.7	U	0.960	U	<1.6	U	1.1	U	0.920	U	13	U	0.8	U	3.700	U
1,1-Dichloroethane	<4.6	U	2.7	U	0.710	U	<1.2	U	0.8	U	0.690	U	9.70	U	0.6	U	2.700	U
1,1-Dichloroethylene	<4.5	U	0.7	U	0.170	U	<1.2	U	0.2	U	0.170	U	9.50	U	0.1	U	0.670	U
1,2,4-Trichlorobenzene	<8.5	U	5.0	U	1.300	U	<2.2	U	1.6	U	1.300	U	**20**	D	1.0	U	5	U
1,2,4-Trimethylbenzene	<5.6	U	3.3	U	**3.7**	D	**2.80**	D	**12.8**	D	**1.4**	D	12	U	**0.8**	D	3.300	U
1,2-Dibromoethane	<8.8	U	5.1	U	1.300	U	<2.3	U	1.6	U	1.300	U	18	U	1.1	U	5.200	U
1,2-Dichlorobenzene	<6.9	U	4.0	U	1.100	U	<1.8	U	1.3	U	1	U	14	U	0.8	U	4	U
1,2-Dichloroethane	<4.6	U	2.7	U	0.710	U	<1.2	U	0.8	U	0.690	U	9.70	U	0.6	U	2.700	U
1,2-Dichloropropane	<5.3	U	3.1	U	0.810	U	<1.4	U	1.0	U	0.780	U	11	U	0.6	U	3.100	U
1,2-Dichlorotetrafluoroethane	<8	U	4.7	U	1.200	U	<2.1	U	1.5	U	1.200	U	17	U	1.0	U	4.700	U
1,3,5-Trimethylbenzene	<5.6	U	3.3	U	**0.9**	D	<1.5	U	**5.4**	D	0.830	U	12	U	0.7	U	3.300	U
1,3-Butadiene	<15	U	4.4	U	1.200	U	<3.8	U	1.4	U	1.100	U	16	U	1.0	U	4.500	U
1,3-Dichlorobenzene	<6.9	U	4.0	U	1.100	U	<1.8	U	1.3	U	1	U	14	U	0.8	U	4	U
1,3-Dichloropropane	<5.3	U	3.1	U	0.810	U	<1.4	U	1.0	U	0.780	U	11	U	0.6	U	3.100	U
1,4-Dichlorobenzene	<6.9	U	4.0	U	1.100	U	<1.8	U	1.3	U	1	U	14	U	0.8	U	4	U
1,4-Dioxane	<8.3	U	4.7	U	1.300	U	<2.1	U	1.5	U	1.200	U	17	U	1.0	U	4.900	U
2-Butanone	<3.4	U	**4.7**	D	**5.1**	D	**1.30**	D	**15.3**	D	**6.8**	D	**7.80**	D	**2.0**	D	**100**	D
2-Hexanone	<9.4	U	5.3	U	1.400	U	<2.4	U	1.7	U	1.400	U	20	U	1.2	U	5.500	U
3-Chloropropene	<18	U	10.6	U	2.700	U	<4.6	U	3.4	U	2.600	U	38	U	2.3	U	11	U
4-Methyl-2-pentanone	<4.7	U	2.7	U	0.720	U	<1.2	U	0.9	U	0.690	U	9.80	U	**0.8**	D	2.800	U
Acetone	**16**	D	**16.9**	D	**8.5**	D	**23**	D	**106.9**	D	**7.3**	D	**59**	D	**19.9**	D	**16**	D
Acrylonitrile	<2.5	U	1.5	U	0.380	U	<0.64	U	0.5	U	0.370	U	5.20	U	0.3	U	1.500	U
Benzene	<3.7	U	**4.2**	D	**0.7**	D	**1.10**	D	**7.0**	D	**1.4**	D	7.70	U	**0.9**	D	2.200	U
Benzyl chloride	<5.9	U	3.5	U	0.910	U	<1.5	U	1.1	U	0.880	U	12	U	0.7	U	3.500	U
Bromodichloromethane	<7.1	U	4.5	U	1.200	U	<1.8	U	1.4	U	1.100	U	**16**	D	0.9	U	4.500	U
Bromoform	<12	U	6.9	U	1.800	U	<3.1	U	2.2	U	1.700	U	25	U	1.4	U	7	U
Bromomethane	<4.4	U	2.6	U	0.680	U	<1.1	U	0.8	U	0.660	U	9.30	U	0.5	U	2.600	U
Carbon disulfide	**7.10**	D	**3.1**	D	**0.7**	D	**11**	D	**26.8**	D	**0.7**	D	7.50	U	0.4	U	**4.2**	D
Carbon tetrachloride	<1.8	U	1.1	U	**0.6**	D	<0.47	U	0.3	U	0.270	U	3.80	U	0.2	U	1.100	U
Chlorobenzene	<5.3	U	3.1	U	0.810	U	<1.4	U	1.0	U	0.780	U	11	U	0.6	U	3.100	U
Chloroethane	<3	U	1.8	U	0.460	U	<0.78	U	0.6	U	0.450	U	6.30	U	0.4	U	1.800	U
Chloroform	**320**	D	**385.6**	D	**1.8**	D	**220**	D	**3.3**	D	**12**	D	**430**	D	**3.1**	D	**58**	D
Chloromethane	<2.4	U	1.4	U	**1**	D	<0.61	U	0.4	U	**0.5**	D	5	U	0.3	U	1.400	U
cis-1,2-Dichloroethylene	<4.5	U	0.7	U	0.170	U	<1.2	U	**15.5**	D	**14**	D	**7,400**	D	**22.2**	D	**1200.0**	D
cis-1,3-Dichloropropylene	<5.2	U	3.0	U	0.800	U	<1.3	U	1.0	U	0.770	U	11	U	0.6	U	3.100	U
Cyclohexane	<3.9	U	**6.9**	D	0.600	U	<1	U	**34.4**	D	**0.6**	D	8.30	U	**0.5**	D	2.300	U
Dibromochloromethane	<9.2	U	5.7	U	1.500	U	<2.4	U	1.8	U	1.400	U	20	U	1.2	U	5.700	U
Dichlorodifluoromethane	<5.7	U	3.3	U	**2.2**	D	**4.50**	D	**1.9**	D	**1.8**	D	**25**	D	**2.0**	D	**3.7**	D
Ethyl acetate	<8.3	U	4.7	U	1.300	U	<2.1	U	**1.6**	D	1.200	U	17	U	**4.3**	D	4.900	U
Ethyl Benzene	<5	U	**14.8**	D	**0.8**	D	**4.20**	D	**22.1**	D	**0.8**	D	10	U	**1.6**	D	2.900	U
Hexachlorobutadiene	<12	U	7.1	U	1.900	U	<3.2	U	2.2	U	1.800	U	**31**	D	1.5	U	7.200	U
Isopropanol	<5.6	U	3.2	U	**1.9**	D	**4.50**	D	**7.1**	D	0.830	U	12	U	**18.9**	D	3.300	U
Methyl Methacrylate	<4.7	U	2.7	U	**9.8**	D	<1.2	U	0.9	U	**1.7**	D	9.80	U	**2.3**	D	2.800	U
Methyl tert-butyl ether (MTBE)	<4.1	U	2.4	U	0.630	U	<1.1	U	0.8	U	0.610	U	8.70	U	0.5	U	2.400	U
Methylene chloride	<8	U	4.5	U	**72**	D	<2.1	U	**8.0**	D	**8.3**	D	17	U	**10.4**	D	4.700	U
n-Heptane	<4.7	U	**12.7**	D	0.720	U	<1.2	U	**24.6**	D	0.690	U	9.80	U	0.6	U	2.800	U
n-Hexane	<4	U	**9.5**	D	**1.1**	D	<1	U	**88.1**	D	**1.2**	D	8.50	U	**1.4**	D	2.400	U
o-Xylene	<5	U	**16.1**	D	**1.4**	D	**3.60**	D	**34.7**	D	**1.3**	D	10	U	**1.4**	D	2.900	U
p- & m- Xylenes	<9.9	U	**35.6**	D	**2.5**	D	**24**	D	**69.4**	D	**2.6**	D	21	U	**4.8**	D	5.800	U
p-Ethyltoluene	<5.6	U	**4.3**	D	**1.8**	D	**3.10**	D	**15.2**	D	**1**	D	12	U	**0.8**	D	3.300	U
Propylene	<2	U	**2.9**	D	0.300	U	<0.51	U	**55.1**	D	0.290	U	4.10	U	**0.8**	D	1.200	U
Styrene	<4.9	U	2.9	U	**1**	D	<1.3	U	0.9	U	0.720	U	10	U	0.6	U	2.900	U
Tetrachloroethylene	**130**	D	**41.4**	D	**1.1**	D	**72**	D	**35.9**	D	**110**	D	**37,000**	D	**813.6**	D	**320**	D
Tetrahydrofuran	<6.8	U	**5.6**	D	**31**	D	<1.7	U	**8.8**	D	**47**	D	14	U	0.9	U	**23**	D
Toluene	**17**	D	**67.8**	D	**1.8**	D	**80**	D	**94.2**	D	**1.9**	D	9	U	**10.5**	D	**3.6**	D
trans-1,2-Dichloroethylene	<4.5	U	2.7	U	0.700	U	<1.2	U	**14.3**	D	**13**	D	**21**	D	0.6	U	**15**	D
trans-1,3-Dichloropropylene	<5.2	U	3.0	U	0.800	U	<1.3	U	1.0	U	0.770	U	11	U	0.6	U	3.100	U
Trichloroethylene	<1.5	U	0.9	U	0.240	U	**4.10**	D	**8.6**	D	**68**	D	**6,000**	D	**41.4**	D	**320**	D
Trichlorofluoromethane (Freon 11)	<6.4	U	3.8	U	**1.5**	D	**2.70**	D	1.2	U	**1.6**	D	13	U	**1.3**	D	3.800	U
Vinyl acetate	<4	U	2.4	U	0.620	U	<1	U	0.7	U	0.600	U	8.50	U	0.5	U	2.400	U
Vinyl bromide	<5	U	2.9	U	0.770	U	<1.3	U	0.9	U	0.740	U	10	U	0.6	U	2.900	U
Vinyl Chloride	<2.9	U	0.4	U	0.110	U	<0.76	U	0.1	U	0.110	U	**50**	D	0.1	U	**1.9**	D

Sample ID	SV-9		SV-9		SV-9		SV-10		SV-10		SV-10		SV-11		SV-11		SV-11	
Sampling Date	10/17/2016		11/15/2018		10/9/2019		10/17/2016		11/15/2018		10/9/2019		10/17/2016		11/15/2018		10/9/2019	
Client Matrix	Soil Vapor		Air		Air		Soil Vapor		Air		Air		Soil Vapor		Air		Air	
Compound	ug/m3		Result		Result		ug/m3		Result		Result		ug/m3		Result		Result	
Volatile Organics, EPA TO15 Full Lis			ug/m3	RL	ug/m3	RL			ug/m3	RL	ug/m3	RL			ug/m3	RL	ug/m3	RL
1,1,1,2-Tetrachloroethane	17	U	1.2	U	10	U	16	U	0.9	U	1.100	U	15	U	0.9	U	1.200	U
1,1,1-Trichloroethane	14	U	0.9	U	8	U	13	U	0.7	U	0.850	U	12	U	0.7	U	0.950	U
1,1,2,2-Tetrachloroethane	17	U	1.2	U	10	U	16	U	0.9	U	1.100	U	15	U	0.9	U	1.200	U
1,1,2-Trichloro-1,2,2-trifluoroethane (	19	U	1.3	U	11	U	18	U	1.0	U	1.200	U	17	U	1.0	U	1.300	U
1,1,2-Trichloroethane	14	U	0.9	U	8	U	13	U	0.7	U	0.850	U	12	U	0.7	U	0.950	U
1,1-Dichloroethane	10	U	0.7	U	5.900	U	9.60	U	0.5	U	0.630	U	8.80	U	0.5	U	0.710	U
1,1-Dichloroethylene	10	U	0.2	U	1.500	U	9.40	U	0.1	U	0.150	U	8.60	U	0.1	U	0.170	U
1,2,4-Trichlorobenzene	19	U	1.3	U	11	U	18	U	1.0	U	1.200	U	16	U	1.0	U	1.300	U
1,2,4-Trimethylbenzene	12	U	0.8	U	7.200	U	12	U	**20.1**	D	**39**	D	11	U	**0.9**	D	**4.5**	D
1,2-Dibromoethane	19	U	1.3	U	11	U	18	U	1.0	U	1.200	U	17	U	1.0	U	1.300	U
1,2-Dichlorobenzene	15	U	1.0	U	8.800	U	14	U	0.8	U	0.940	U	13	U	0.8	U	1	U
1,2-Dichloroethane	10	U	0.7	U	5.900	U	9.60	U	0.5	U	**1.6**	D	8.80	U	0.5	U	0.710	U
1,2-Dichloropropane	12	U	0.8	U	6.800	U	11	U	0.6	U	0.720	U	10	U	0.6	U	0.810	U
1,2-Dichlorotetrafluoroethane	18	U	1.2	U	10	U	17	U	0.9	U	1.100	U	15	U	0.9	U	1.200	U
1,3,5-Trimethylbenzene	12	U	0.8	U	7.200	U	12	U	**5.4**	D	**12**	D	11	U	0.6	U	**1.5**	D
1,3-Butadiene	17	U	1.1	U	9.700	U	16	U	0.9	U	1	U	14	U	0.9	U	1.200	U
1,3-Dichlorobenzene	15	U	1.0	U	8.800	U	14	U	0.8	U	0.940	U	13	U	0.8	U	1	U
1,3-Dichloropropane	12	U	0.8	U	6.800	U	11	U	0.6	U	0.720	U	10	U	0.6	U	0.810	U
1,4-Dichlorobenzene	15	U	1.0	U	8.800	U	14	U	0.8	U	0.940	U	13	U	0.8	U	1	U
1,4-Dioxane	18	U	1.2	U	11	U	17	U	1.0	U	1.100	U	16	U	0.9	U	1.300	U
2-Butanone	7.40	U	**1.0**	D	4.300	U	7	U	**6.2**	D	**0.8**	D	6.40	U	**2.4**	D	**130**	D
2-Hexanone	21	U	1.4	U	12	U	19	U	1.1	U	1.300	U	18	U	1.1	U	**29**	D
3-Chloropropene	39	U	2.6	U	23	U	37	U	2.1	U	2.400	U	34	U	2.0	U	2.700	U
4-Methyl-2-pentanone	10	U	0.7	U	6	U	9.70	U	0.5	U	**1.1**	D	8.90	U	**1.0**	D	0.710	U
Acetone	**37**	D	**6.4**	D	7	U	**16**	D	**22.1**	D	**36**	D	**27**	D	**23.7**	D	**21**	D
Acrylonitrile	5.50	U	0.4	U	3.200	U	5.20	U	0.3	U	0.340	U	4.70	U	0.3	U	0.380	U
Benzene	8.10	U	**0.9**	D	4.700	U	7.60	U	**4.2**	D	**1.9**	D	6.90	U	**0.8**	D	**1.4**	D
Benzyl chloride	13	U	0.9	U	7.600	U	12	U	0.7	U	0.810	U	11	U	0.7	U	0.900	U
Bromodichloromethane	17	U	1.1	U	9.800	U	16	U	0.9	U	1	U	15	U	0.9	U	1.200	U
Bromoform	26	U	1.8	U	15	U	25	U	1.3	U	1.600	U	22	U	1.3	U	1.800	U
Bromomethane	9.80	U	0.7	U	5.700	U	9.20	U	0.5	U	0.600	U	8.40	U	0.5	U	0.680	U
Carbon disulfide	7.80	U	0.5	U	**62**	D	7.40	U	**9.0**	D	**100**	D	6.80	U	0.4	U	**4.4**	D
Carbon tetrachloride	4	U	0.3	U	2.300	U	3.70	U	0.2	U	**0.3**	D	3.40	U	0.2	U	**0.7**	D
Chlorobenzene	12	U	0.8	U	6.800	U	11	U	0.6	U	0.720	U	10	U	0.6	U	0.800	U
Chloroethane	6.60	U	0.4	U	3.900	U	6.30	U	0.3	U	0.410	U	5.70	U	0.3	U	0.460	U
Chloroform	**23**	D	0.8	U	7.200	U	12	U	**3.9**	D	**0.8**	D	**32**	D	**0.9**	D	**26**	D
Chloromethane	5.20	U	0.4	U	3	U	4.90	U	0.3	U	0.320	U	4.50	U	0.3	U	**0.4**	D
cis-1,2-Dichloroethylene	**29**	D	0.2	U	1.500	U	9.40	U	0.1	U	0.150	U	8.60	U	0.1	U	0.170	U
cis-1,3-Dichloropropylene	11	U	0.8	U	6.700	U	11	U	0.6	U	0.710	U	9.90	U	0.6	U	0.790	U
Cyclohexane	8.70	U	0.6	U	5	U	8.20	U	**9.3**	D	**0.8**	D	7.50	U	**0.4**	D	**0.8**	D
Dibromochloromethane	21	U	1.4	U	12	U	20	U	1.1	U	1.300	U	19	U	1.1	U	1.500	U
Dichlorodifluoromethane	12	U	**2.1**	D	7.300	U	12	U	**1.9**	D	**1.8**	D	11	U	**2.0**	D	**2.2**	D
Ethyl acetate	18	U	1.2	U	11	U	17	U	1.0	U	1.100	U	16	U	**6.5**	D	1.300	U
Ethyl Benzene	11	U	0.7	U	6.400	U	10	U	**20.4**	D	**6.8**	D	9.40	U	**2.0**	D	**3.3**	D
Hexachlorobutadiene	27	U	1.8	U	16	U	25	U	1.4	U	1.700	U	23	U	1.4	U	1.900	U
Isopropanol	12	U	0.8	U	7.200	U	12	U	0.7	U	0.760	U	11	U	**16.5**	D	**1.9**	D
Methyl Methacrylate	10	U	0.7	U	6	U	9.70	U	0.5	U	**5.9**	D	8.90	U	**1.8**	D	0.710	U
Methyl tert-butyl ether (MTBE)	9.10	U	0.6	U	5.300	U	8.60	U	0.5	U	0.560	U	7.80	U	0.5	U	0.630	U
Methylene chloride	18	U	1.2	U	**35**	D	17	U	0.9	U	**68**	D	15	U	**21.9**	D	**2.1**	D
n-Heptane	10	U	0.7	U	6	U	9.70	U	**11.9**	D	**2.4**	D	8.90	U	0.5	U	**4.1**	D
n-Hexane	8.90	U	**0.8**	D	5.200	U	8.40	U	**8.8**	D	**0.8**	D	7.70	U	**1.9**	D	**1.4**	D
o-Xylene	11	U	0.7	U	6.400	U	10	U	**27.3**	D	**16**	D	9.40	U	**1.8**	D	**5.1**	D
p- & m- Xylenes	22	U	**1.5**	D	13	U	21	U	**69.4**	D	**33**	D	19	U	**6.1**	D	**11**	D
p-Ethyltoluene	12	U	0.8	U	7.200	U	12	U	**18.7**	D	**21**	D	11	U	**0.9**	D	**3.9**	D
Propylene	4.30	U	**1.0**	D	2.500	U	4.10	U	**8.4**	D	0.270	U	3.70	U	**0.9**	D	0.300	U
Styrene	11	U	0.7	U	6.200	U	10	U	0.6	U	**1.4**	D	9.30	U	0.6	U	**2.4**	D
Tetrachloroethylene	**280,000**	D	**3.5**	D	**160,000**	D	**4,400**	D	**21.0**	D	**280**	D	**2,100**	D	**5.2**	D	**220**	D
Tetrahydrofuran	15	U	1.0	U	8.700	U	14	U	**6.5**	D	0.920	U	13	U	0.8	U	**3**	D
Toluene	9.50	U	**7.9**	D	5.500	U	9	U	**71.6**	D	**14**	D	8.20	U	**15.1**	D	**7.4**	D
trans-1,2-Dichloroethylene	10	U	0.7	U	5.800	U	9.40	U	0.5	U	0.620	U	8.60	U	0.5	U	0.690	U
trans-1,3-Dichloropropylene	11	U	0.8	U	6.700	U	11	U	0.6	U	0.710	U	9.90	U	0.6	U	0.790	U
Trichloroethylene	**900**	D	0.2	U	**61**	D	**13**	D	0.2	U	**1.5**	D	2.90	U	0.2	U	**2.2**	D
Trichlorofluoromethane (Freon 11)	14	U	1.0	U	8.200	U	13	U	**1.0**	D	**1.4**	D	12	U	**1.3**	D	**2.3**	D
Vinyl acetate	8.90	U	0.6	U	5.200	U	8.40	U	0.5	U	0.550	U	7.60	U	0.5	U	0.610	U
Vinyl bromide	11	U	0.7	U	6.400	U	10	U	0.6	U	0.680	U	9.50	U	0.6	U	0.760	U
Vinyl Chloride	6.40	U	0.1	U	0.940	U	6.10	U	0.1	U	0.0990	U	5.60	U	0.1	U	0.110	U

Sample ID	SV-12		SV-12		SV-13		SV-13	
Sampling Date	10/17/2016		10/9/2019		10/17/2016		10/9/2019	
Client Matrix	Soil Vapor		Air		Soil Vapor		Air	
Compound	ug/m3		Result		ug/m3		Result	
Volatile Organics, EPA TO15 Full Lis			ug/m3	RL			ug/m3	RL
1,1,1,2-Tetrachloroethane	16	U	1.200	U	18	U	1.200	U
1,1,1-Trichloroethane	13	U	6.500	D	14	U	**2.4**	D
1,1,2,2-Tetrachloroethane	16	U	1.200	U	18	U	1.200	U
1,1,2-Trichloro-1,2,2-trifluoroethane (	18	U	1.300	U	20	U	1.400	U
1,1,2-Trichloroethane	13	U	0.940	U	14	U	0.980	U
1,1-Dichloroethane	9.40	U	0.690	U	11	U	0.730	U
1,1-Dichloroethylene	9.20	U	0.170	U	11	U	0.180	U
1,2,4-Trichlorobenzene	17	U	1.300	U	20	U	1.300	U
1,2,4-Trimethylbenzene	11	U	0.840	U	13	U	0.880	U
1,2-Dibromoethane	18	U	1.300	U	20	U	1.400	U
1,2-Dichlorobenzene	14	U	1	U	16	U	1.100	U
1,2-Dichloroethane	9.40	U	0.690	U	11	U	0.730	U
1,2-Dichloropropane	11	U	0.790	U	12	U	0.830	U
1,2-Dichlorotetrafluoroethane	16	U	1.200	U	19	U	1.300	U
1,3,5-Trimethylbenzene	11	U	0.840	U	13	U	0.880	U
1,3-Butadiene	15	U	1.100	U	18	U	1.200	U
1,3-Dichlorobenzene	14	U	1	U	16	U	1.100	U
1,3-Dichloropropane	11	U	0.790	U	12	U	0.830	U
1,4-Dichlorobenzene	14	U	1	U	16	U	1.100	U
1,4-Dioxane	17	U	1.200	U	19	U	1.300	U
2-Butanone	6.90	U	0.510	U	7.80	U	0.530	U
2-Hexanone	19	U	1.400	U	22	U	1.500	U
3-Chloropropene	37	U	2.700	U	42	U	2.800	U
4-Methyl-2-pentanone	9.60	U	0.700	U	11	U	0.740	U
Acetone	**47**	D	**1.3**	D	**30**	D	**3.1**	D
Acrylonitrile	5.10	U	0.370	U	5.80	U	0.390	U
Benzene	7.50	U	0.550	U	8.50	U	0.570	U
Benzyl chloride	12	U	0.890	U	14	U	0.930	U
Bromodichloromethane	16	U	1.100	U	18	U	1.200	U
Bromoform	24	U	1.800	U	27	U	1.900	U
Bromomethane	9.10	U	0.670	U	10	U	0.700	U
Carbon disulfide	7.30	U	0.530	U	8.30	U	**0.9**	D
Carbon tetrachloride	3.70	U	0.270	U	4.20	U	0.280	U
Chlorobenzene	11	U	0.790	U	12	U	0.830	U
Chloroethane	6.20	U	0.450	U	7	U	0.470	U
Chloroform	11	U	**0.9**	D	13	U	**1.4**	D
Chloromethane	4.80	U	0.350	U	5.50	U	0.370	U
cis-1,2-Dichloroethylene	9.20	U	0.170	U	11	U	0.180	U
cis-1,3-Dichloropropylene	11	U	0.780	U	12	U	0.820	U
Cyclohexane	8	U	0.590	U	9.10	U	0.620	U
Dibromochloromethane	20	U	1.500	U	23	U	1.500	U
Dichlorodifluoromethane	12	U	**1.9**	D	13	U	**1.4**	D
Ethyl acetate	17	U	1.200	U	19	U	1.300	U
Ethyl Benzene	10	U	0.740	U	12	U	0.780	U
Hexachlorobutadiene	25	U	1.800	U	28	U	1.900	U
Isopropanol	11	U	0.840	U	13	U	**1.1**	D
Methyl Methacrylate	9.60	U	**3.4**	D	11	U	**16**	D
Methyl tert-butyl ether (MTBE)	8.40	U	0.620	U	9.60	U	0.650	U
Methylene chloride	16	U	**11**	D	18	U	**180**	D
n-Heptane	9.60	U	0.700	U	11	U	0.740	U
n-Hexane	8.20	U	0.600	U	9.40	U	0.630	U
o-Xylene	10	U	0.740	U	12	U	0.780	U
p- & m- Xylenes	20	U	1.500	U	23	U	1.600	U
p-Ethyltoluene	11	U	0.840	U	13	U	0.880	U
Propylene	4	U	0.300	U	4.60	U	0.310	U
Styrene	9.90	U	0.730	U	11	U	0.770	U
Tetrachloroethylene	**14**	D	**9.7**	D	**9**	D	**3.9**	D
Tetrahydrofuran	14	U	1	U	16	U	1.100	U
Toluene	8.80	U	0.650	U	10	U	0.680	U
trans-1,2-Dichloroethylene	9.20	U	0.680	U	11	U	0.710	U
trans-1,3-Dichloropropylene	11	U	0.780	U	12	U	0.820	U
Trichloroethylene	3.10	U	0.230	U	3.60	U	0.240	U
Trichlorofluoromethane (Freon 11)	13	U	**1.5**	D	15	U	**1.4**	D
Vinyl acetate	8.20	U	0.600	U	9.30	U	0.630	U
Vinyl bromide	10	U	0.750	U	12	U	0.790	U
Vinyl Chloride	6	U	0.110	U	6.80	U	0.110	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
(1) Compound detected in laboratory quality control batch blank at a concentration of 0.73 ug/m^3
(2) Compound detected in laboratory quality batch control blank at a concentration of 0.54 ug/m^3

Table 6
Indoor Air Assessement Analytical Results At Steppingstone Day School
77-40 Vleigh Place, Flushing, NY

Sample ID	SSB-1		SSB-1a		IA-1		IA-1a		SSB-2		SSB-2a		IA-2		IA-2a		SSB-3		SSB-3a		IA-3		IA-3a		IA-4		IA-4a		IA-5		IA-5a		IA-6		IA-6a		IA-7		IA-7a		OA-1		OA-1a	
Sampling Date	4/2/16		2/22/19		4/2/16		2/22/19		4/2/16		2/22/19		4/2/16		2/22/19		4/2/16		2/22/19		4/2/16		2/22/19		4/2/16		2/22/19		4/2/16		2/22/19		4/2/16		2/22/19		4/2/16		2/22/19		4/2/16		2/22/19	
Client Matrix	Soil Vapor		Soil Vapor		Air		Air		Soil Vapor		Soil Vapor		Air		Air		Soil Vapor		Soil Vapor		Air		Air		Air		Air		Air		Air		Air		Air		Air		Air		Air	
Compound	Result		Result	Q	Result		Result	Q	Result		Result	Q	Result		Result	Q	Result		Result	Q	Result		Result	Q	Result		Result	Q	Result		Result	Q	Result		Result	Q	Result		Result	Q	Result	Q
Volatile Organics, EPA TO15 Full List	ug/m3	Q	ug/m3		ug/m3	Q	ug/m3		ug/m3	Q	ug/m3		ug/m3	Q	ug/m3		ug/m3	Q	ug/m3		ug/m3	Q	ug/m3		ug/m3	Q	ug/m3		ug/m3	Q	ug/m3		ug/m3	Q	ug/m3		ug/m3	Q	ug/m3		ug/m3	Q	ug/m3	
1,1,1,2-Tetrachloroethane	< 1.00	U	2.200	U	< 1.00	U	0.600	U	< 1.00	U	1.900	U	< 1.00	U	0.610	U	< 1.00	U	2.500	U	< 1.00	U	0.630	U	< 1.00	U	0.590	U	< 1.00	U	0.630	U	< 1.00	U	0.600	U	< 1.00	U	0.640	U	< 1.00	U	0.600	U
1,1,1-Trichloroethane	**1.83**		1.700	U	< 1.00	U	0.480	U	**4.19**		1.500	U	< 1.00	U	0.490	U	< 1.00	U	**4.7**	**D**	< 1.00	U	0.500	U	< 1.00	U	0.470	U	< 1.00	U	0.500	U	< 1.00	U	0.480	U	< 1.00	U	0.510	U	< 1.00	U	0.470	U
1,1,2,2-Tetrachloroethane	< 1.00	U	2.200	U	< 1.00	U	0.600	U	< 1.00	U	1.900	U	< 1.00	U	0.610	U	< 1.00	U	2.500	U	< 1.00	U	0.630	U	< 1.00	U	0.590	U	< 1.00	U	0.630	U	< 1.00	U	0.600	U	< 1.00	U	0.640	U	< 1.00	U	0.600	U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NT		2.400	U	NT		0.670	U	NT		2.100	U	NT		0.680	U	NT		2.800	U	NT		0.710	U	NT		0.650	U	NT		0.700	U	NT		0.670	U	NT		0.720	U	NT		0.670	U
1,1,2-Trichloroethane	< 1.00	U	1.700	U	< 1.00	U	0.480	U	< 1.00	U	1.500	U	< 1.00	U	0.490	U	< 1.00	U	2	U	< 1.00	U	0.500	U	< 1.00	U	0.470	U	< 1.00	U	0.500	U	< 1.00	U	0.480	U	< 1.00	U	0.510	U	< 1.00	U	0.470	U
1,1-Dichloroethane	< 1.00	U	1.300	U	< 1.00	U	0.350	U	< 1.00	U	1.100	U	< 1.00	U	0.360	U	< 1.00	U	1.500	U	< 1.00	U	0.370	U	< 1.00	U	0.350	U	< 1.00	U	0.370	U	< 1.00	U	0.350	U	< 1.00	U	0.380	U	< 1.00	U	0.350	U
1,1-Dichloroethene	< 1.00	U	0.320	U	< 1.00	U	0.0870	U	< 1.00	U	0.270	U	< 1.00	U	0.0880	U	< 1.00	U	0.360	U	< 1.00	U	0.0920	U	< 1.00	U	0.0850	U	< 1.00	U	0.0900	U	< 1.00	U	0.0870	U	< 1.00	U	0.0930	U	< 1.00	U	0.0860	U
1,2,4-Trichlorobenzene	< 1.00	U	2.400	U	< 1.00	U	0.650	U	< 1.00	U	2	U	< 1.00	U	0.660	U	< 1.00	U	2.700	U	< 1.00	U	0.690	U	< 1.00	U	0.630	U	< 1.00	U	0.680	U	< 1.00	U	0.650	U	< 1.00	U	0.690	U	< 1.00	U	0.640	U
1,2,4-Trimethylbenzene	**13.7**		**9.6**	**D**	**9.33**		**23**	**D**	**24.5**		**23**	**D**	**5.6**		**35**	**D**	**33.9**		**48**	**D**	**7.91**		**49**	**D**	**9.63**		**12**	**D**	**6.14**		**58**	**D**	**4.51**		**31**	**D**	**4.51**		**32**	**D**	< 1.00	U	**9.3**	**D**
1,2-Dibromoethane(EDB)	< 1.00	U	2.500	U	< 1.00	U	0.670	U	< 1.00	U	2.100	U	< 1.00	U	0.680	U	< 1.00	U	2.800	U	< 1.00	U	0.710	U	< 1.00	U	0.660	U	< 1.00	U	0.700	U	< 1.00	U	0.670	U	< 1.00	U	0.720	U	< 1.00	U	0.670	U
1,2-Dichlorobenzene	< 1.00	U	1.900	U	< 1.00	U	0.530	U	< 1.00	U	1.600	U	< 1.00	U	0.540	U	< 1.00	U	2.200	U	< 1.00	U	0.560	U	< 1.00	U	0.510	U	< 1.00	U	0.550	U	< 1.00	U	0.530	U	< 1.00	U	0.560	U	< 1.00	U	0.520	U
1,2-Dichloroethane	< 1.00	U	1.300	U	< 1.00	U	0.350	U	< 1.00	U	1.100	U	< 1.00	U	0.360	U	< 1.00	U	1.500	U	< 1.00	U	0.370	U	< 1.00	U	0.350	U	< 1.00	U	0.370	U	< 1.00	U	0.350	U	< 1.00	U	0.380	U	< 1.00	U	0.350	U
1,2-dichloropropane	< 1.00	U	1.500	U	< 1.00	U	0.400	U	< 1.00	U	1.300	U	< 1.00	U	0.410	U	< 1.00	U	1.700	U	< 1.00	U	0.430	U	< 1.00	U	0.390	U	< 1.00	U	0.420	U	< 1.00	U	0.400	U	< 1.00	U	0.430	U	< 1.00	U	0.400	U
1,2-Dichlorotetrafluoroethane	< 1.00	U	2.200	U	< 1.00	U	0.610	U	< 1.00	U	1.900	U	< 1.00	U	0.620	U	< 1.00	U	2.500	U	< 1.00	U	0.650	U	< 1.00	U	0.600	U	< 1.00	U	0.640	U	< 1.00	U	0.610	U	< 1.00	U	0.650	U	< 1.00	U	0.610	U
1,3,5-Trimethylbenzene	**2.76**		**2.2**	**D**	**3.91**		**5.8**	**D**	**4.28**		**5.6**	**D**	**1.55**		**8.8**	**D**	**5.65**		**10**	**D**	**2.05**		**11**	**D**	**2.69**		**4.1**	**D**	**2.03**		**14**	**D**	**1.21**		**6.8**	**D**	**1.23**		**8**	**D**	< 1.00	U	**2.1**	**D**
1,3-Butadiene	< 1.00	U	2.100	U	< 1.00	U	0.580	U	< 1.00	U	1.800	U	< 1.00	U	0.590	U	< 1.00	U	2.400	U	< 1.00	U	0.610	U	< 1.00	U	0.570	U	< 1.00	U	0.610	U	< 1.00	U	0.580	U	< 1.00	U	0.620	U	< 1.00	U	0.580	U
1,3-Dichlorobenzene	< 1.00	U	1.900	U	< 1.00	U	0.530	U	< 1.00	U	1.600	U	< 1.00	U	0.540	U	< 1.00	U	2.200	U	< 1.00	U	0.560	U	< 1.00	U	0.510	U	< 1.00	U	0.550	U	< 1.00	U	0.530	U	< 1.00	U	0.560	U	< 1.00	U	0.520	U
1,3-Dichloropropane	NT		1.500	U	NT		0.400	U	NT		1.300	U	NT		0.410	U	NT		1.700	U	NT		0.430	U	NT		0.390	U	NT		0.420	U	NT		0.400	U	NT		0.430	U	NT		0.400	U
1,4-Dichlorobenzene	< 1.00	U	1.900	U	< 1.00	U	0.530	U	< 1.00	U	1.600	U	< 1.00	U	0.540	U	< 1.00	U	2.200	U	< 1.00	U	0.560	U	< 1.00	U	0.510	U	< 1.00	U	0.550	U	< 1.00	U	0.530	U	< 1.00	U	0.560	U	< 1.00	U	0.520	U
1,4-Dioxane	< 1.00	U	2.300	U	< 1.00	U	0.630	U	< 1.00	U	2	U	< 1.00	U	0.640	U	< 1.00	U	2.600	U	< 1.00	U	0.670	U	< 1.00	U	0.620	U	< 1.00	U	0.660	U	< 1.00	U	0.630	U	< 1.00	U	0.670	U	< 1.00	U	0.630	U
2-Butanone	**1.52**		**17**	**D**	**1.27**		**17**	**D**	**1.13**		**26**	**D**	**2.81**		**13**	**D**	**2.65**		**48**	**D**	**7.37**		**18**	**D**	**3.65**		**25**	**D**	**3.3**		**29**	**D**	**2.2**		**28**	**D**	**2.22**		**21**	**D**	< 1.00	U	**13**	**D**
2-Hexanone(MBK)	< 1.00	U	2.600	U	< 1.00	U	0.720	U	< 1.00	U	2.200	U	< 1.00	U	0.730	U	< 1.00	U	2.900	U	< 1.00	U	0.760	U	< 1.00	U	0.700	U	< 1.00	U	0.750	U	< 1.00	U	0.720	U	< 1.00	U	0.770	U	< 1.00	U	0.710	U
3-Chloropropene	NT		5	U	NT		1.400	U	NT		4.300	U	NT		1.400	U	NT		5.600	U	NT		1.400	U	NT		1.300	U	NT		1.400	U	NT		1.400	U	NT		1.500	U	NT		1.400	U
4-Methyl-2-pentanone(MIBK)	< 1.00	U	**8.1**	**D**	< 1.00	U	0.360	U	< 1.00	U	**6.2**	**D**	< 1.00	U	**0.5**	**D**	**1.02**		**24**	**D**	< 1.00	U	0.380	U	< 1.00	U	**1.2**	**D**	< 1.00	U	0.370	U	< 1.00	U	**0.8**	**D**	< 1.00	U	0.380	U	< 1.00	U	0.360	U
Acetone	**23.2**		**430**	**D**	**16.2**		**51**	**D**	**52.5**		**800**	**D**	**34.7**		**30**	**D**	**38.7**		**1000**	**D**	**42.5**		24	D	**51.5**		**46**	**D**	**35.8**		**71**	**D**	**21.8**		**76**	**D**	**27.1**		**56**	**D**	**5.75**	**S**	**44**	**D**
Acrylonitrile	< 1.00	U	0.690	U	< 1.00	U	0.190	U	< 1.00	U	**0.7**	**D**	< 1.00	U	0.190	U	< 1.00	U	0.780	U	< 1.00	U	0.200	U	< 1.00	U	0.190	U	< 1.00	U	0.200	U	< 1.00	U	0.190	U	< 1.00	U	0.200	U	< 1.00	U	0.190	U
Benzene	**1.57**		3.500	D	**1.16**		**5.8**	**D**	**1.08**		**2.9**	**D**	**2.79**		**5**	**D**	**2.85**		**6.5**	**D**	**4.21**		**5.7**	**D**	**5.01**		**8.8**	**D**	**2.31**		**10**	**D**	**2.27**		**11**	**D**	**2.61**		**7.8**	**D**	< 1.00	U	**4.6**	**D**
Benzyl chloride	< 1.00	U	1.700	U	< 1.00	U	0.450	U	< 1.00	U	1.400	U	< 1.00	U	0.460	U	< 1.00	U	1.900	U	< 1.00	U	0.480	U	< 1.00	U	0.440	U	< 1.00	U	0.470	U	< 1.00	U	0.450	U	< 1.00	U	0.480	U	< 1.00	U	0.450	U
Bromodichloromethane	< 1.00	U	2.100	U	< 1.00	U	0.590	U	< 1.00	U	1.800	U	< 1.00	U	0.600	U	< 1.00	U	2.400	U	< 1.00	U	0.620	U	< 1.00	U	0.570	U	< 1.00	U	0.610	U	< 1.00	U	0.590	U	< 1.00	U	0.630	U	< 1.00	U	0.580	U
Bromoform	< 1.00	U	3.300	U	< 1.00	U	0.900	U	< 1.00	U	2.800	U	< 1.00	U	0.920	U	< 1.00	U	3.700	U	< 1.00	U	0.960	U	< 1.00	U	0.880	U	< 1.00	U	0.940	U	< 1.00	U	0.900	U	< 1.00	U	0.970	U	< 1.00	U	0.900	U
Bromomethane	< 1.00	U	1.200	U	< 1.00	U	0.340	U	< 1.00	U	1.100	U	< 1.00	U	0.350	U	< 1.00	U	1.400	U	< 1.00	U	0.360	U	< 1.00	U	0.330	U	< 1.00	U	0.350	U	< 1.00	U	0.340	U	< 1.00	U	0.360	U	< 1.00	U	0.340	U
Carbon Disulfide	**21.9**		**3.7**	**D**	< 1.00	U	0.270	U	**1.1**		**7.1**	**D**	< 1.00	U	0.280	U	**11**		**18**	**D**	< 1.00	U	0.290	U	< 1.00	U	0.270	U	< 1.00	U	0.290	U	< 1.00	U	0.270	U	< 1.00	U	0.290	U	< 1.00	U	0.270	U
Carbon Tetrachloride	**0.38**		0.500	U	**0.52**		**0.6**	**D**	**0.48**		0.430	U	**1.09**		**0.560**	**D**	**0.32**		**1.1**	**D**	**0.49**		**0.5**	**D**	**0.55**		**0.5**	**D**	**0.55**		0.140	U	**0.41**		0.140	U	**0.58**		**0.5**	**D**	**0.5**		**0.5**	**D**
Chlorobenzene	< 1.00	U	1.500	U	< 1.00	U	0.400	U	< 1.00	U	1.300	U	< 1.00	U	0.410	U	< 1.00	U	1.700	U	< 1.00	U	0.430	U	< 1.00	U	0.390	U	< 1.00	U	0.420	U	< 1.00	U	0.400	U	< 1.00	U	0.430	U	< 1.00	U	0.400	U
Chloroethane	< 1.00	U	0.840	U	< 1.00	U	0.230	U	< 1.00	U	0.720	U	< 1.00	U	0.230	U	< 1.00	U	**1.6**	**D**	< 1.00	U	0.240	U	< 1.00	U	0.230	U	< 1.00	U	0.240	U	< 1.00	U	0.230	U	< 1.00	U	0.250	U	< 1.00	U	0.230	U
Chloroform	**3.7**		1.600	U	< 1.00	U	0.430	U	**1.86**		1.300	U	**1.28**		0.430	U	< 1.00	U	1.800	U	< 1.00	U	0.450	U	< 1.00	U	**0.5**	**D**	< 1.00	U	**3.2**	**D**	< 1.00	U	**0.5**	**D**	< 1.00	U	0.460	U	< 1.00	U	0.420	U
Chloromethane	< 1.00	U	**2.5**	**D**	**1.16**		**1.2**	**D**	< 1.00	U	0.560	U	**1.42**		**1.3**	**D**	< 1.00	U	0.740	U	**1.45**		**1.2**	**D**	**1.24**		**1.2**	**D**	**1.26**		**1.4**	**D**	< 1.00	U	**1.3**	**D**	**1.28**		**1.1**	**D**	**1.14**		**1.2**	**D**
Cis-1,2-Dichloroethene	< 1.00	U	0.320	U	< 1.00	U	0.0870	U	< 1.00	U	0.270	U	< 1.00	U	0.0880	U	< 1.00	U	0.360	U	< 1.00	U	0.0920	U	< 1.00	U	0.0850	U	< 1.00	U	0.0900	U	< 1.00	U	0.0870	U	< 1.00	U	0.0930	U	< 1.00	U	0.0860	U
cis-1,3-Dichloropropene	< 1.00	U	1.400	U	< 1.00	U	0.400	U	< 1.00	U	1.200	U	< 1.00	U	0.400	U	< 1.00	U	1.600	U	< 1.00	U	0.420	U	< 1.00	U	0.390	U	< 1.00	U	0.410	U	< 1.00	U	0.400	U	< 1.00	U	0.420	U	< 1.00	U	0.390	U
Cyclohexane	**7.74**		**13**	**D**	< 1.00	U	**2.8**	**D**	**2.79**		**7**	**D**	**1.87**		**2.3**	**D**	**28.9**		**51**	**D**	**2.43**		**2.9**	**D**	**3.42**		**4.8**	**D**	**1.51**		**5.4**	**D**	**1.69**		**5.5**	**D**	**1.55**		**4**	**D**	< 1.00	U	**1.9**	**D**
Dibromochloromethane	< 1.00	U	2.700	U	< 1.00	U	0.750	U	< 1.00	U	2.300	U	< 1.00	U	0.760	U	< 1.00	U	3.100	U	< 1.00	U	0.790	U	< 1.00	U	0.730	U	< 1.00	U	0.780	U	< 1.00	U	0.750	U	< 1.00	U	0.800	U	< 1.00	U	0.740	U
Dichlorodifluoromethane	**3.16**		**3.2**	**D**	**1.86**		**1.6**	**D**	**2.12**		**2.6**	**D**	**1.67**		**2**	**D**	**2.8**		**3.9**	**D**	**2.08**		**1.9**	**D**	**2.05**		**1.9**	**D**	**2.38**		**2**	**D**	**1.55**		**1.9**	**D**	**2.04**		**1.6**	**D**	**2.05**		**1.8**	**D**
Ethyl acetate	< 1.00	U	**52**	**D**	< 1.00	U	**1.0**	**D**	< 1.00	U	**67**	**D**	**1.27**		**1.6**	**D**	< 1.00	U	**130**	**D**	**1.67**		**1.2**	**D**	**1.95**		**2.4**	**D**	< 1.00	U	**2.3**	**D**	< 1.00	U	**2**	**D**	**1.04**		**1.3**	**D**	< 1.00	U	0.630	U
Ethylbenzene	**7.68**		**7.6**	**D**	< 1.00	U	**21**	**D**	**5.08**		**16**	**D**	**3.21**		**24**	**D**	**10.1**		**28**	**D**	**4.14**		**32**	**D**	**4.95**		**24**	**D**	**2.5**		**38**	**D**	**2.37**		**34**	**D**	**2.27**		**30**	**D**	< 1.00	U	**17**	**D**
Hexachlorobutadiene	< 1.00	U	3.400	U	< 1.00	U	0.930	U	< 1.00	U	2.900	U	< 1.00	U	0.950	U	< 1.00	U	3.800	U	< 1.00	U	0.990	U	< 1.00	U	0.910	U	< 1.00	U	0.970	U	< 1.00	U	0.930	U	< 1.00	U	1	U	< 1.00	U	0.930	U
Isopropylalcohol	< 1.00	U	**48**	**D**	**33.4**		**73**	**D**	**10.7**		**13**	**D**	**135**	**E**	**84**	**D**	**8.99**	**S**	**27**	**D**	**123**	**E**	**78**	**D**	**142**	**E**	**74**	**D**	**51.6**		94	D	**56**		NT		**98**		**100**	**D**	**1.86**	**S**	**3.2**	**D**
Methyl Methacrylate	NT		1.300	U	NT		0.360	U	NT		1.100	U	NT		0.360	U	NT		1.500	U	NT		0.380	U	NT		0.350	U	NT		0.370	U	NT		0.360	U	NT		0.380	U	NT		0.360	U
Methyl tert-butyl ether(MTBE)	< 1.00	U	1.200	U	< 1.00	U	0.320	U	< 1.00	U	0.980	U	< 1.00	U	0.320	U	< 1.00	U	1.300	U	< 1.00	U	0.330	U	< 1.00	U	0.310	U	< 1.00	U	0.330	U	< 1.00	U	0.320	U	< 1.00	U	0.340	U	< 1.00	U	0.310	U
Methylene Chloride	**2.76**	**S**	**3.5**	**D**	< 1.00	U	**2.5**	**D**	< 1.00	U	**2.2**	**D**	**1.14**	**S**	**9.4**	**D**	< 1.00	U	2.500	U	**1.22**	**S**	**1.6**	**D**	**1.14**	**S**	**4.3**	**D**	**1.43**	**S**	0.630	U	< 1.00	U	**3.5**	**D**	**4.83**	**S**	**2.2**	**D**	< 1.00	U	0.600	U
n-Heptane	**2.59**		**24**	**D**	**1**		**17**	**D**	**1.33**		**21**	**D**	**3.58**		**15**	**D**	**2.88**		**35**	**D**	**4.1**		**19**	**D**	**5.77**		**27**	**D**	**2.79**		**35**	**D**	**2.72**		**33**	**D**	**2.92**		**25**	**D**	< 1.00	U	**11**	**D**
Hexane	**4.37**	**S**	**13**	**D**	**1.85**	**S**	**13**	**D**	**1.57**	**S**	**7.6**	**D**	**7.96**	**S**	**11**	**D**	**4.23**	**S**	**13**	**D**	**10.3**		**13**	**D**	**12.1**		**22**	**D**	**6.16**	**S**	**24**	**D**	**6.13**	**S**	**25**	**D**	**7.19**	**S**	**18**	**D**	< 1.00	U	**9.3**	**D**
o-Xylene	**8.85**		**11**	**D**	**1.49**		**29**	**D**	**7.38**		**24**	**D**	**3.96**		**38**	**D**	**12.5**		**44**	**D**	**5.64**		**50**	**D**	**6.6**		**31**	**D**	**3.42**		**59**	**D**	**3.14**		**44**	**D**	**3.17**		**42**	**D**	< 1.00	U	**21**	**D**
m,p-Xylene	**35**		**33**	**D**	**3.02**		**83**	**D**	**25.9**		**71**	**D**	**10.9**		**110**	**D**	**48.2**		**130**	**D**	**14.8**		**150**	**D**	**18.4**		**88**	**D**	**9.42**		**160**	**D**	**9.11**		**130**	**D**	**8.59**		**120**	**D**	< 1.00	U	**66**	**D**
4-Ethyltoluene	**5.65**		**10**	**D**	**1.54**		**24**	**D**	**7.66**		**24**	**D**	**1.34**		**37**	**D**	**12**		**49**	**D**	**1.82**		**53**	**D**	**1.79**		**21**	**D**	**1.36**		**53**	**D**	**1.11**		**36**	**D**	**1.02**		**34**	**D**	< 1.00	U	**14**	**D**
Propylene	< 1.00	U	**51**	**D**	< 1.00	U	0.150	U	< 1.00	U	**3.9**	**D**	< 1.00	U	**0.2**	**U**	**38.7**		**27**	**D**	< 1.00	U	0.160	U	< 1.00	U	0.150	U	< 1.00	U	0.160	U	< 1.00	U	0.150	U	< 1.00	U	0.160	U	< 1.00	U	0.150	U
Styrene	< 1.00	U	1.400	U	< 1.00	U	0.370	U	< 1.00	U	1.200	U	**1.29**		0.380	U	< 1.00	U	1.500	U	< 1.00	U	0.390	U	< 1.00	U	0.360	U	< 1.00	U	0.390	U	< 1.00	U	0.370	U	< 1.00	U	0.400	U	< 1.00	U	0.370	U
Tetrachloroethene	< 0.25	U	0.540	U	**0.64**		**0.6**	**D**	**0.38**		0.460	U	**1.07**		0.150	U	**0.29**		**2.4**	**D**	**0.53**		**0.6**	**D**	**0.34**		**1.3**	**D**	**0.73**		**9.3**	**D**	**0.6**		**0.9**	**D**	**0.41**		**2.9**	**D**	**0.92**		**2.2**	**D**
Tetrahydrofuran	< 1.00	U	**60**	**D**	< 1.00	U	**37**	**D**	< 1.00	U	**90**	**D**	< 1.00	U	**30**	**D**	< 1.00	U	**120**	**D**	**3.71**		**37**	**D**	< 1.00	U	**61**	**D**	< 1.00	U	**70**	**D**	< 1.00	U	**69**	**D**	< 1.00	U	**50**	**D**	< 1.00	U	**26**	**D**
Toluene	**20.5**		**30**	**D**	**3.88**		**81**	**D**	**9.68**		**48**	**D**	**14.2**		**78**	**D**	**23.2**		**81**	**D**	**15.3**		**100**	**D**	**20.3**		**110**	**D**	**12.5**		**140**	**D**	**11.1**		**140**	**D**	**11**		**110**	**D**	**1.36**		**68**	**D**
Trans-1,2-Dichloroethene	< 1.00	U	1.300	U	< 1.00	U	0.350	U	< 1.00	U	1.100	U	< 1.00	U	0.350	U	< 1.00	U	1.400	U	< 1.00	U	0.370	U	< 1.00	U	0.340	U	< 1.00	U	0.360	U	< 1.00	U	0.350	U	< 1.00	U	0.370	U	< 1.00	U	0.340	U
trans-1,3-Dichloropropene	< 1.00	U	1.400	U	< 1.00	U	0.400	U	< 1.00	U	1.200	U	< 1.00	U	0.400	U	< 1.00	U	1.600	U	< 1.00	U	0.420	U	< 1.00	U	0.390	U	< 1.00	U	0.410	U	< 1.00	U	0.400	U	< 1.00	U	0.420	U	< 1.00	U	0.390	U
Trichloroethene	< 0.25	U	0.430	U	< 0.25	U	0.120	U	< 0.25	U	0.370	U	< 0.25	U	0.120	U	**0.32**		0.480	U	< 0.25	U	0.120	U	< 0.25	U	0.110	U	< 0.25	U	0.120	U	< 0.25	U	0.120	U	< 0.25	U	0.130	U	< 0.25	U	0.120	U
Trichlorofluoromethane	**1.33**		1.800	U	**1.5**		**1.5**	**D**	**1.06**		1.500	U	**1.45**		**1.5**	**D**	< 1.00	U	**2.2**	**D**	**1.47**		**1.3**	**D**	**1.5**		**1.5**	**D**	**1.43**		**1.5**	**D**	< 1.00	U	**1.6**	**D**	**1.4**		**1.3**	**D**	**1.44**		**1.3**	**D**
Vinyl acetate	NT		1.100	U	NT		0.310	U	NT		0.960	U	NT		0.310	U	NT		**240**	**D**	NT		**0.9**	**D**	NT		0.300	U	NT		0.320	U	NT		0.310	U	NT		0.330	U	NT		0.310	U
Vinyl bromide	NT		1.400	U	NT		0.380	U	NT		1.200	U	NT		0.390	U	NT		1.600	U	NT		0.400	U	NT		0.370	U	NT		0.400	U	NT		0.380	U	NT		0.410	U	NT		0.380	U
Vinyl Chloride	< 0.25	U	0.200	U	< 0.25	U	0.0560	U	< 0.25	U	0.170	U	< 0.25	U	0.0570	U	< 0.25	U	0.230	U	< 0.25	U	0.0590	U	< 0.25	U	0.0550	U	< 0.25	U	0.0580	U	< 0.25	U	0.0560	U	< 0.25	U	0.0600	U	< 0.25	U	0.0550	U

NOTES:
Q is the Qualifier Column with definitions as follows:
U=analyte not detected at or above the level indicated
S=This compound is a solvent that is used in the laboratory. Laboratory contamination is suspected if concentration is less than five times the reporting level.
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

Table 7
Indoor Air Assessment Analytical Results at Kew Garden Owners, Corp.
141-27 77th Road, 141-23 & 141-25 78th Avenue, Flushing, NY

Sample ID	SV-KG-1		SV-KG-1		CS-KG-1		IA-KG-1		CS-KG-2		IA-KG-2		CS-KG-3		IA-KG-3		OA-KG-1	
Sampling Date	2/28/18		11/15/18		2/28/18		2/28/18		2/28/18		2/28/18		2/28/18		2/28/18		2/28/18	
Client Matrix	Soil Vapor		Air		Crawl Air		Indoor Air		Crawl Air		Indoor Air		Crawl Air		Indoor Air		Outdoor Air	
Compound	Result		Result		Result		Result		Result		Result		Crawl Air		Result		Result	
Units	ug/m3	Q	ug/m3	Q	ug/m3	Q	ug/m3	Q	ug/m3	Q	Result	Q	ug/m3	Q	ug/m3	Q	ug/m3	Q
1,1,1,2-Tetrachloroethane	1.1	U	1.3	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
1,1,1-Trichloroethane	0.9	U	1.0	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
1,1,2,2-Tetrachloroethane	1.1	U	1.3	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113	1.2	U	1.5	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
1,1,2-Trichloroethane	0.9	U	1.0	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
1,1-Dichloroethane	0.6	U	0.8	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1-Dichloroethylene	0.2	U	0.2	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
1,2,4-Trichlorobenzene	1.2	U	1.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
1,2,4-Trimethylbenzene	**5.7**	D	**54.1**	D	**2.4**	D	**1.2**	D	**0.8**	D	**0.8**	D	**1.2**	D	**0.5**	D	**0.3**	D
1,2-Dibromoethane	1.2	U	1.5	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
1,2-Dichlorobenzene	1.0	U	1.1	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
1,2-Dichloroethane	0.6	U	0.8	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,2-Dichloropropane	0.7	U	0.9	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
1,2-Dichlorotetrafluoroethane	1.1	U	1.3	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
1,3,5-Trimethylbenzene	**1.7**	D	**17.2**	D	**0.6**	D	**0.3**	D	0.3	U	**0.3**	D	**0.4**	D	0.3	U	0.3	U
1,3-Butadiene	1	U	**8.0**	D	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
1,3-Dichlorobenzene	1.0	U	1.1	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
1,3-Dichloropropane	0.7	U	0.9	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
1,4-Dichlorobenzene	1.0	U	1.1	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
1,4-Dioxane	1.1	U	1.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
2-Butanone	**6.4**	D	**32.4**	D	**2.3**	D	**1.3**	D	**1.0**	D	**1.9**	D	**0.7**	D	**0.7**	D	**0.5**	D
2-Hexanone	**4**	D	**2.9**	D	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
3-Chloropropene	2.5	U	3.0	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
4-Methyl-2-pentanone	0.7	U	0.8	U	0.2	U	**0.5**	D	**0.3**	D	0.2	U	**1.0**	D	**0.3**	D	0.2	U
Acetone	**57**	D	**71.2**	D	**11**	D	**9.6**	D	**5.9**	D	**11.0**	D	**6.4**	D	**7.4**	D	**2.7**	D
Acrylonitrile	0.3	U	0.4	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Benzene	**15**	D	**25.5**	D	**1.4**	D	**0.9**	D	**0.9**	D	**2.5**	D	**1.1**	D	**0.6**	D	**0.5**	D
Benzyl chloride	0.8	U	1.0	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
Bromodichloromethane	1.1	U	1.3	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Bromoform	1.6	U	2.0	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U
Bromomethane	0.6	U	0.7	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Carbon disulfide	**6.4**	D	**12.1**	D	**0.2**	D	0.2	U	**0.2**	D	**0.3**	D	0.2	U	**0.2**	D	0.2	U
Carbon tetrachloride	**0.3**	D	0.3	U	**0.4**	D	**0.4**	D	**0.3**	D	**0.4**	D	**0.3**	D	**0.2**	D	**0.4**	D
Chlorobenzene	0.7	U	0.9	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U
Chloroethane	0.4	U	0.5	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Chloroform	0.8	U	0.9	U	0.3	U	**0.5**	D	0.3	U	**0.9**	D	0.3	U	0.3	U	0.3	U
Chloromethane	**1.2**	D	0.4	U	**0.8**	D	**0.8**	D	**0.7**	D	**0.9**	D	**0.6**	D	**0.6**	D	**0.8**	D
cis-1,2-Dichloroethylene	0.2	U	0.2	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.2	D
cis-1,3-Dichloropropylene	0.7	U	0.9	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Cyclohexane	**12**	D	**25.8**	D	**0.9**	D	**0.4**	D	**0.4**	D	**0.8**	D	**1.3**	D	**0.2**	D	0.2	U
Dibromochloromethane	1.3	U	1.6	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Dichlorodifluoromethane	**1.7**	D	**1.8**	D	**2.4**	D	**1.9**	D	**1.4**	D	**2.0**	D	**1.1**	D	**1.0**	D	**1.3**	D
Ethyl acetate	1.1	U	1.4	U	**3.8**	D	**2.7**	D	**1.3**	D	**3.8**	D	**1.2**	D	**1.4**	D	**0.9**	D
Ethyl Benzene	**10**	D	**69.4**	D	**1.7**	D	**0.8**	D	**0.6**	D	**1.3**	D	**1.4**	D	**0.4**	D	**0.2**	D
Hexachlorobutadiene	1.7	U	2.0	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U
Isopropanol	**2.3**	D	1.0	U	**13**	D	**11**	D	**11**	D	**29**	D	**5.2**	D	**8.8**	D	**1.7**	D
Methyl Methacrylate	0.7	U	0.8	U	0.2	U	**0.7**	D	0.2	U	0.2	U	0.2	U	**0.7**	D	**0.2**	D
Methyl tert-butyl ether (MTBE)	0.6	U	0.7	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Methylene chloride	1.1	U	1.4	U	**5.6**	D	**2.4**	D	**2.8**	D	**8.4**	D	**2**	D	**5.5**	D	**0.7**	D
n-Heptane	**31**	D	**45.1**	D	**2.0**	D	**0.9**	D	**0.8**	D	**1.7**	D	**2.3**	D	**0.6**	D	0.2	U
n-Hexane	**33**	D	0.7	U	**2.9**	D	**1.3**	D	**1.1**	D	**2.4**	D	**2.7**	D	**2.8**	D	**0.3**	D
o-Xylene	**9.2**	D	**95.5**	D	**2.1**	D	**1.0**	D	**0.8**	D	**1.5**	D	**1.8**	D	**0.5**	D	**0.3**	D
p- & m- Xylenes	**28**	D	**251.7**	D	**6.0**	D	**2.9**	D	**2.1**	D	**4.4**	D	**5.0**	D	**1.4**	D	**0.7**	D
p-Ethyltoluene	**7**	D	**68.8**	D	**1.9**	D	**1.0**	D	**0.7**	D	**1.2**	D	**1.2**	D	**0.5**	D	**0.3**	D
Propylene	**72**	D	**74.0**	D	**1.0**	D	**1.6**	D	**0.5**	D	**0.9**	D	**0.9**	D	**0.5**	D	**0.3**	D
Styrene	0.7	U	**0.8**	U	**0.5**	D	**0.3**	D	0.2	U	**0.5**	D	0.2	U	0.2	U	0.2	U
Tetrachloroethylene	**20,000**	DE	**10,169**	D	**9**	D	**4**	D	**1.2**	D	**1.1**	D	**3.3**	D	**0.7**	D	**1.0**	D
Tetrahydrofuran	0.9	U	**20.3**	D	**2.4**	D	**1**	D	**0.7**	D	**2.1**	D	0.3	U	**0.4**	D	0.3	U
Toluene	**51**	D	218.5	D	**6.7**	D	**3.6**	D	**2.7**	D	**4.9**	D	**6.7**	D	**2**	D	**1.1**	D
trans-1,2-Dichloroethylene	0.6	U	0.8	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
trans-1,3-Dichloropropylene	0.7	U	0.9	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Trichloroethylene	**17**	D	15.0	D	0.1	D	**0.1**	D	0.1	U	**0.1**	D	0.1	U	**0.1**	D	0.1	U
Trichlorofluoromethane (Freon 11)	**1.2**	D	1.1	U	2.2	D	**1.3**	D	**1.1**	D	**2**	D	**0.8**	D	**0.8**	D	**0.9**	D
Vinyl acetate	0.6	U	0.7	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Vinyl bromide	0.7	U	0.8	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Vinyl Chloride	0.1	U	0.1	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	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
E=result is estimated and cannot be accurately reported due to levels encountered or interferences

Table 8

Soil Vapor Analytical Results Over time at Regency Garden Company

141-05, 141-12, 141-18 & 141-24 78th Avenue, Flushing, NY

Sample ID	SSB-RG-1		SSB-RG-1		IA-RG-1		IA-RG-1		SSB-RG-2		SSB-RG-2		IA-RG-2		IA-RG-2		SSB-RG-3		SSB-RG-3		IA-RG-3		IA-RG-3		SSB-RG-4		SSB-RG-4		IA-RG-4		IA-RG-4		OA-RG-1		OA-RG-1	
Sampling Date	3/1/2018		1/9/2019		3/1/2018		1/9/2019		3/1/2018		1/9/2019		3/1/2018		1/9/2019		3/1/2018		1/9/2019		3/1/2018		1/9/2019		3/1/2018		1/9/2019		3/1/2018		1/9/2019		3/1/2018		1/9/2019	
Client Matrix	Sub-slab vapor		Sub-slab vapor		Indoor Air		Indoor Air		Sub-slab vapor		Sub-slab vapor		Indoor Air		Indoor Air		Sub-slab vapor		Sub-slab vapor		Indoor Air		Indoor Air		Sub-slab vapor		Sub-slab vapor		Indoor Air		Indoor Air		Outdoor Air		Outdoor Air	
Compound	Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result	
Volatile Organics, EPA TO15 Full Li	Result	RL	Result	RL	ug/m3	RL	ug/m3	RL	ug/m3	RL	ug/m3	RL	ug/m3	RL	ug/m3	RL	Result	RL	Result	RL	ug/m3	RL	ug/m3	RL	ug/m3	RL	ug/m3	RL	Result	RL	Result	RL	ug/m3	RL	ug/m3	RL
1,1,1,2-Tetrachloroethane	1.2	U	1.7	U	0.4	U	0.7	U	3.1	U	1.2	U	0.4	U	0.7	U	1.4	U	11	U	0.4	U	0.7	U	1.2	U	12	U	0.4	U	0.7	U	0.4	U	0.6	U
1,1,1-Trichloroethane	0.9	U	1.4	U	0.3	U	0.5	U	2.5	U	1	U	0.3	U	0.5	U	1.1	U	9.1	U	0.3	U	0.5	U	1.0	U	9.5	U	0.3	U	0.5	U	0.3	U	0.5	U
1,1,2,2-Tetrachloroethane	1.2	U	1.7	U	0.4	U	0.7	U	3.1	U	1.2	U	0.4	U	0.7	U	1.4	U	11	U	0.4	U	0.7	U	1.2	U	12	U	0.4	U	0.7	U	0.4	U	0.6	U
1,1,2-Trichloro-1,2,2-trifluoroethane	1.3	U	**1.9**	D	0.4	U	0.7	U	3.5	U	1.3	U	0.4	U	**0.7**	D	1.6	U	13	U	0.4	U	0.8	U	1.3	U	13	U	0.4	U	0.8	U	0.4	U	**0.7**	D
1,1,2-Trichloroethane	0.9	U	1.4	U	0.3	U	0.5	U	2.5	U	1	U	0.3	U	0.5	U	1.1	U	9.1	U	0.3	U	0.5	U	1.0	U	9.5	U	0.3	U	0.5	U	0.3	U	0.5	U
1,1-Dichloroethane	0.7	U	1	U	0.2	U	0.4	U	1.9	U	0.7	U	0.2	U	0.4	U	0.9	U	6.8	U	0.2	U	0.4	U	0.7	U	7.0	U	0.2	U	0.4	U	0.2	U	0.4	U
1,1-Dichloroethylene	0.2	U	0.3	U	0.1	U	0.1	U	0.5	U	0.2	U	0.1	U	0.1	U	0.2	U	1.7	U	0.1	U	0.1	U	0.2	U	1.7	U	0.1	U	0.1	U	0.1	U	0.1	U
1,2,4-Trichlorobenzene	1.3	U	1.9	U	0.4	U	0.7	U	3.4	U	1.3	U	0.4	U	0.7	U	1.6	U	12	U	0.4	U	0.7	U	1.3	U	13	U	0.4	U	0.7	U	0.4	U	0.7	U
1,2,4-Trimethylbenzene	**5.7**	D	**24**	D	**5**	D	**27**	D	**5.4**	D	**25**	D	**4.6**	D	**34**	D	**11**	D	**9.8**	D	**4.6**	D	**13**	D	**4.2**	D	**21**	D	**0.5**	D	**19**	D	**0.5**	D	**23**	D
1,2-Dibromoethane	1.3	U	1.9	U	0.4	U	0.7	U	3.5	U	1.3	U	0.4	U	0.7	U	1.6	U	13	U	0.4	U	0.8	U	1.3	U	13	U	0.4	U	0.8	U	0.4	U	0.7	U
1,2-Dichlorobenzene	1.0	U	1.5	U	0.3	U	0.6	U	2.8	U	1.1	U	0.3	U	0.6	U	1.3	U	10	U	0.3	U	0.6	U	1.0	U	10	U	0.3	U	0.6	U	0.3	U	0.5	U
1,2-Dichloroethane	0.7	U	1	U	**0.5**	D	**0.8**	D	1.9	U	0.7	U	0.2	U	0.4	U	0.9	U	6.8	U	0.2	U	0.4	U	0.7	U	7	U	0.2	U	0.4	U	0.2	U	0.4	U
1,2-Dichloropropane	0.8	U	1.2	U	0.3	U	0.4	U	2.1	U	0.8	U	0.3	U	0.4	U	1.0	U	7.7	U	0.3	U	0.5	U	0.8	U	8	U	0.3	U	0.5	U	0.3	U	0.4	U
1,2-Dichlorotetrafluoroethane	1.2	U	**1.8**	D	0.4	U	0.7	U	3.2	U	1.2	U	0.4	U	0.7	U	1.5	U	12	U	0.4	U	0.7	U	1.2	U	12	U	0.4	U	0.7	U	0.4	U	0.6	U
1,3,5-Trimethylbenzene	**1.4**	D	**7.2**	D	**1.3**	D	**7.6**	D	2.2	U	**7**	D	**1.3**	D	**9.4**	D	**3.3**	D	8.2	U	**1.2**	D	**3.7**	D	**1.1**	D	8.6	U	0.3	U	**5.3**	D	0.3	U	**6.3**	D
1,3-Butadiene	1.1	U	1.7	U	0.4	U	0.6	U	3	U	**14**	D	0.4	U	0.6	U	1.4	U	11	U	0.4	U	0.7	U	1.2	U	12	U	0.4	U	0.7	U	0.4	U	0.6	U
1,3-Dichlorobenzene	1.0	U	1.5	U	0.3	U	0.6	U	2.8	U	1.1	U	0.3	U	0.6	U	1.3	U	10	U	0.3	U	0.6	U	1.0	U	10	U	0.3	U	0.6	U	0.3	U	0.5	U
1,3-Dichloropropane	0.8	U	1.2	U	0.3	U	0.4	U	2.1	U	0.8	U	0.3	U	0.4	U	1.0	U	7.7	U	0.3	U	0.5	U	0.8	U	8	U	0.3	U	0.5	U	0.3	U	0.4	U
1,4-Dichlorobenzene	**9.0**	D	1.5	U	0.3	U	0.6	U	2.8	U	1.1	U	0.3	U	0.6	U	1.3	U	10	U	0.3	U	0.6	U	1.0	U	10	U	0.3	U	0.6	U	0.3	U	0.5	U
1,4-Dioxane	1.2	U	1.8	U	0.4	U	0.7	U	3.3	U	1.3	U	0.4	U	0.7	U	1.5	U	12	U	0.4	U	0.7	U	1.2	U	13	U	0.4	U	0.7	U	0.4	U	0.6	U
2-Butanone	**1.6**	D	**1.9**	D	**2.1**	D	**2**	D	**4.6**	D	**14**	D	**2.8**	D	**2.2**	D	**3.0**	D	**9.3**	D	**1.5**	D	**2.1**	D	**1.7**	D	5.1	U	**0.8**	D	**1.5**	D	**1.0**	D	**3.5**	D
2-Hexanone	1.4	U	2.1	U	0.4	U	0.8	U	3.7	U	1.4	U	0.4	U	0.8	U	1.7	U	14	U	0.4	U	0.8	U	1.4	U	14	U	0.4	U	0.8	U	0.4	U	0.7	U
3-Chloropropene	2.7	U	4	U	0.8	U	1.5	U	7.2	U	2.7	U	0.8	U	1.5	U	3.3	U	26	U	0.8	U	1.6	U	2.7	U	27	U	0.8	U	1.6	U	0.8	U	1.4	U
4-Methyl-2-pentanone	0.7	U	**1.1**	D	0.2	U	0.4	U	**1.9**	D	0.7	U	**1.2**	D	0.4	U	0.9	U	6.8	U	0.2	U	0.4	U	**0.9**	D	7.1	U	**0.3**	D	0.4	U	**0.3**	D	0.4	U
Acetone	**5**	D	**5.2**	D	**16**	D	**11**	D	**17**	D	**62**	D	**14**	D	**20**	D	**12**	D	**29**	D	**9.9**	D	**6.6**	D	**8.6**	D	**9.1**	D	**5**	D	**3.6**	D	**4.1**	D	**7.2**	D
Acrylonitrile	0.4	U	0.6	U	0.1	U	0.2	U	1.0	U	0.4	U	0.1	U	0.2	U	0.5	U	3.6	U	0.1	U	0.2	U	0.4	U	3.8	U	0.1	U	0.2	U	0.1	U	0.2	U
Benzene	**0.9**	D	**1.8**	D	**1.8**	D	**1.8**	D	**3.8**	D	**5.9**	D	**1.9**	D	**2.2**	D	**2.4**	D	5.3	U	**1.4**	D	**1.5**	D	**1.9**	D	5.6	U	**0.7**	D	**1.6**	D	**0.8**	D	**4.3**	D
Benzyl chloride	0.9	U	1.3	U	0.3	U	0.5	U	2.4	U	0.9	U	0.3	U	0.5	U	1.1	U	8.6	U	0.3	U	0.5	U	0.9	U	9.0	U	0.3	U	0.5	U	0.3	U	0.5	U
Bromodichloromethane	1.2	U	1.7	U	0.4	U	0.6	U	3.1	U	1.2	U	**0.4**	D	0.6	U	1.4	U	11	U	0.4	U	0.7	U	1.2	U	12	U	0.4	U	0.7	U	0.4	U	0.6	U
Bromoform	1.8	U	2.6	U	0.6	U	1	U	4.7	U	1.8	U	0.6	U	1	U	2.2	U	17	U	0.6	U	1	U	1.8	U	18	U	0.6	U	1	U	0.6	U	0.9	U
Bromomethane	0.7	U	1.0	U	0.2	U	0.4	U	1.8	U	0.7	U	0.2	U	0.4	U	0.8	U	6.5	U	0.2	U	0.4	U	0.7	U	6.8	U	0.2	U	0.4	U	0.2	U	0.3	U
Carbon disulfide	0.5	U	**1.3**	D	0.2	U	**0.3**	D	**2.3**	D	**5.8**	D	**0.3**	D	0.3	U	**3.9**	D	5.2	U	0.2	U	0.3	U	**0.5**	D	5.4	U	**0.3**	D	0.3	U	0.2	U	0.3	U
Carbon tetrachloride	**0.4**	D	0.4	U	**0.3**	D	**0.6**	D	0.7	U	**0.6**	D	**0.3**	D	**0.6**	D	**0.8**	D	2.6	U	**0.3**	D	**0.6**	D	**0.6**	D	2.7	U	**0.3**	D	**0.5**	D	**0.3**	D	**0.6**	D
Chlorobenzene	0.8	U	1.2	U	0.3	U	0.4	U	2.1	U	0.8	U	0.3	U	0.4	U	1.0	U	7.7	U	0.3	U	0.5	U	0.8	U	8	U	0.3	U	0.5	U	0.3	U	0.4	U
Chloroethane	0.5	U	0.7	U	0.1	U	0.3	U	1.2	U	**4.2**	D	0.1	U	0.3	U	0.6	U	4.4	U	0.1	U	0.3	U	0.5	U	4.6	U	0.1	U	0.3	U	0.1	U	0.2	U
Chloroform	**1**	D	**1.2**	D	**0.4**	D	0.5	U	**9.6**	D	**46**	D	**3.9**	D	**3.1**	D	**21**	D	**8.1**	D	0.3	U	0.5	U	**5.6**	D	8.5	U	0.3	U	0.5	U	0.3	U	0.4	U
Chloromethane	0.4	U	**1**	D	**0.7**	D	**2.5**	D	**1.1**	D	**1.5**	D	**0.8**	D	**2.3**	D	**0.5**	D	3.4	U	**0.6**	D	**2.3**	D	**0.4**	D	3.6	U	**0.7**	D	**1.8**	D	**0.6**	D	**2.4**	D
cis-1,2-Dichloroethylene	0.2	U	**0.7**	D	0.1	U	0.1	U	0.5	U	0.2	U	0.1	U	0.1	U	**0.4**	D	1.7	U	0.1	U	0.1	U	0.2	U	1.7	U	**0.1**	D	0.1	U	0.1	U	0.1	U
cis-1,3-Dichloropropylene	0.8	U	1.1	U	0.2	U	0.4	U	2.1	U	0.8	U	0.2	U	0.4	U	1.0	U	7.6	U	0.2	U	0.5	U	0.8	U	7.9	U	0.2	U	0.5	U	0.2	U	0.4	U
Cyclohexane	0.6	U	**1.9**	D	**0.8**	D	**1.9**	D	**2.8**	D	**11**	D	**0.9**	D	**2.5**	D	**4.6**	D	5.7	U	**0.5**	D	**1.4**	D	**1.6**	D	6	U	**0.2**	D	**2**	D	**0.4**	D	**4.2**	D
Dibromochloromethane	1.5	U	2.2	U	0.5	U	0.8	U	3.9	U	1.5	U	0.5	U	0.8	U	1.8	U	14	U	0.5	U	0.9	U	1.5	U	15	U	0.5	U	0.9	U	0.5	U	0.8	U
Dichlorodifluoromethane	**1.7**	D	**3.1**	D	**1.1**	D	**2.1**	D	**2.3**	D	**2.3**	D	**2.5**	D	**2.0**	D	**1.8**	D	8.2	U	**1**	D	**2.2**	D	**2.1**	D	8.6	U	**1**	D	**1.8**	D	**1.0**	D	**2.2**	D
Ethyl acetate	1.2	U	1.8	U	**1.2**	D	**2.2**	D	3.3	U	**1.3**	D	**3.8**	D	**2.2**	D	1.5	U	12.0	U	0.4	U	**1.5**	D	**1.6**	D	13.0	U	**0.5**	D	**1.0**	D	**0.5**	D	0.6	U
Ethyl Benzene	**3.2**	D	**6.9**	D	**3.5**	D	**8.8**	D	**5.0**	D	**5.7**	D	**3.6**	D	**13**	D	**4.4**	D	7.2	U	**3.4**	D	**5.4**	D	**2**	D	7.6	U	**0.4**	D	**6.4**	D	**0.4**	D	**10**	D
Hexachlorobutadiene	1.8	U	2.7	U	0.6	U	1	U	4.9	U	1.9	U	0.6	U	1	U	2.2	U	18	U	0.6	U	1.1	U	1.8	U	19	U	0.6	U	1.1	U	0.6	U	0.9	U
Isopropanol	0.9	U	**1.4**	D	**20**	D	**310**	DE	**47**	D	**2**	D	**21**	D	**10**	D	**3.9**	D	8.2	U	**7.3**	D	**5**	D	**29**	D	8.6	U	**3.5**	D	**2.4**	D	**6.2**	D	**2.4**	D
Methyl Methacrylate	0.7	U	1.0	U	**1.5**	D	0.4	U	**6.4**	D	0.7	U	**1.8**	D	0.4	U	**6.8**	D	6.8	U	0.2	U	0.4	U	**2.6**	D	7.1	U	0.2	U	0.4	U	0.2	U	0.4	U
Methyl tert-butyl ether (MTBE)	0.6	U	0.9	U	0.2	U	0.4	U	1.6	U	0.6	U	0.2	U	0.3	U	0.8	U	6.0	U	0.2	U	0.4	U	0.6	U	6.3	U	0.2	U	0.4	U	0.2	U	0.3	U
Methylene chloride	1.2	U	**4.6**	BD	**3.9**	D	**9.9**	BD	**19**	D	**1.8**	BD	**2.8**	D	**6**	BD	1.5	U	**13**	BD	**0.4**	D	**3.5**	BD	**11**	D	**15**	BD	**2.4**	D	**1.7**	BD	**2.4**	D	**2.6**	BD
n-Heptane	**1.1**	D	**5.7**	D	**2.5**	D	**7.8**	D	**5.4**	D	**7.2**	D	**2.8**	D	**10**	D	**3.5**	D	6.8	U	**1.9**	D	**5.4**	D	**2.1**	D	7.1	U	**0.4**	D	**7.1**	D	**0.6**	D	**15**	D
n-Hexane	**0.8**	D	**3.8**	D	**4.1**	D	**5.1**	D	**10**	D	**6.3**	D	**3.2**	D	**7**	D	**1.9**	D	5.9	U	**1.6**	D	**4.1**	D	**6.0**	D	6.1	U	**0.9**	D	**5**	D	**1.3**	D	**11**	D
o-Xylene	**4.6**	D	**14**	D	**4.5**	D	**17**	D	**6.4**	D	**13**	D	**4.4**	D	**24**	D	**7.4**	D	7.2	U	**4.4**	D	**10**	D	**2.8**	D	**12**	D	**0.6**	D	**13**	D	**0.4**	D	**19**	D
p- & m- Xylenes	**13.0**	D	**31**	D	**13.0**	D	**40**	D	**18**	D	**27**	D	**13**	D	**56**	D	**19**	D	14	U	**13**	D	**23**	D	**7.8**	D	**29**	D	**1.4**	D	**29**	D	**1.2**	D	**43**	D
p-Ethyltoluene	**6.1**	D	**19**	D	**4.6**	D	**22**	D	**5.6**	D	**19**	D	**4.3**	D	**29**	D	**8.4**	D	8.2	U	**4.4**	D	**11**	D	**3.7**	D	**16**	D	**0.5**	D	**15**	D	**0.5**	D	**19**	D
Propylene	**0.7**	D	**1.3**	D	**1.1**	D	1.3	D	**4.1**	D	**130**	D	**0.9**	D	**1.1**	D	**2.2**	D	2.9	U	**3.6**	D	**1.0**	D	**1.0**	D	**3.6**	D	**0.7**	D	0.8	D	**0.6**	D	**0.8**	D
Styrene	**1.5**	D	**1.5**	D	0.2	U	0.4	U	1.9	U	0.7	U	**0.9**	D	**1.5**	D	**1.2**	D	7.1	U	0.2	U	0.4	U	0.7	U	7.4	U	0.2	U	0.4	U	0.2	U	0.4	U
Tetrachloroethylene	**2,200**	D	**720**	D	**1.6**	D	**2.4**	D	**44**	D	**110**	D	**2.3**	D	**4.5**	D	**5,200**	D	**2,700**	D	**2.1**	D	**2.1**	D	**5,800**	D	**5,200**	D	**14**	D	**3**	D	**0.7**	D	**3.1**	D
Tetrahydrofuran	**1.3**	D	1.5	U	**2.1**	D	0.6	U	**5.7**	D	1	U	**2.3**	D	0.6	U	**1.4**	D	**10**	D	**1.7**	D	0.6	U	**2.4**	D	10.0	U	0.3	U	0.6	U	0.3	U	**3.4**	D
Toluene	**7.2**	D	**10**	D	**11**	D	**15**	D	**18**	D	**11**	D	**11**	D	**22**	D	**7.7**	D	6.3	U	**9.4**	D	**12**	D	**6.1**	D	**7.9**	D	**1.7**	D	11	D	**1.9**	D	**23**	D
trans-1,2-Dichloroethylene	0.7	U	1	U	0.2	U	0.4	U	1.8	U	0.7	U	0.2	U	0.4	U	0.8	U	6.6	U	0.2	U	0.4	U	0.7	U	6.9	U	0.2	U	0.4	U	0.2	U	0.4	U
trans-1,3-Dichloropropylene	0.8	U	1.1	U	0.2	U	0.4	U	2.1	U	0.8	U	0.2	U	0.4	U	1.0	U	7.6	U	0.2	U	0.5	U	0.8	U	7.9	U	0.2	U	0.5	U	0.2	U	0.4	U
Trichloroethylene	**4.4**	D	**1.2**	D	**0.1**	D	0.1	U	0.6	U	0.2	U	**1**	D	**0.4**	D	**25**	D	**6.3**	D	**0.1**	D	0.1	U	**5.8**	D	**5.6**	D	**0.2**	D	0.1	U	**0.1**	D	**0.3**	D
Trichlorofluoromethane (Freon 11)	**1.3**	D	**2.6**	D	**1**	D	**1.7**	D	2.6	U	**1.6**	D	**1.2**	D	**1.8**	D	**1.3**	D	9.4	U	**0.8**	D	**1.8**	D	**2.1**	D	9.8	U	**0.7**	D	**1.3**	D	**0.8**	D	**1.6**	D
Vinyl acetate	0.6	U	**2.4**	D	0.2	U	**0.8**	D	1.6	U	**130**	D	0.2	U	0.3	U	0.7	U	5.9	U	0.2	U	0.4	U	0.6	U	6.1	U	0.2	U	0.4	U	0.2	U	0.3	U
Vinyl bromide	0.8	U	1.1	U	0.2	U	0.4	U	2.0	U	0.8	U	0.2	U	0.4	U	0.9	U	7.3	U	0.2	U	0.4	U	0.8	U	7.6	U	0.2	U	0.4	U	0.2	U	0.4	U
Vinyl Chloride	0.1	U	**0.8**	D	0.0	U	0.1	U	0.3	U	0.1	U	0.0	U	0.1	U	0.1	U	1.1	U	0.0	U	0.1	U	0.1	U	1.1	U	0.0	U	0.1	U	0.0	U	0.1	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

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

Figures

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

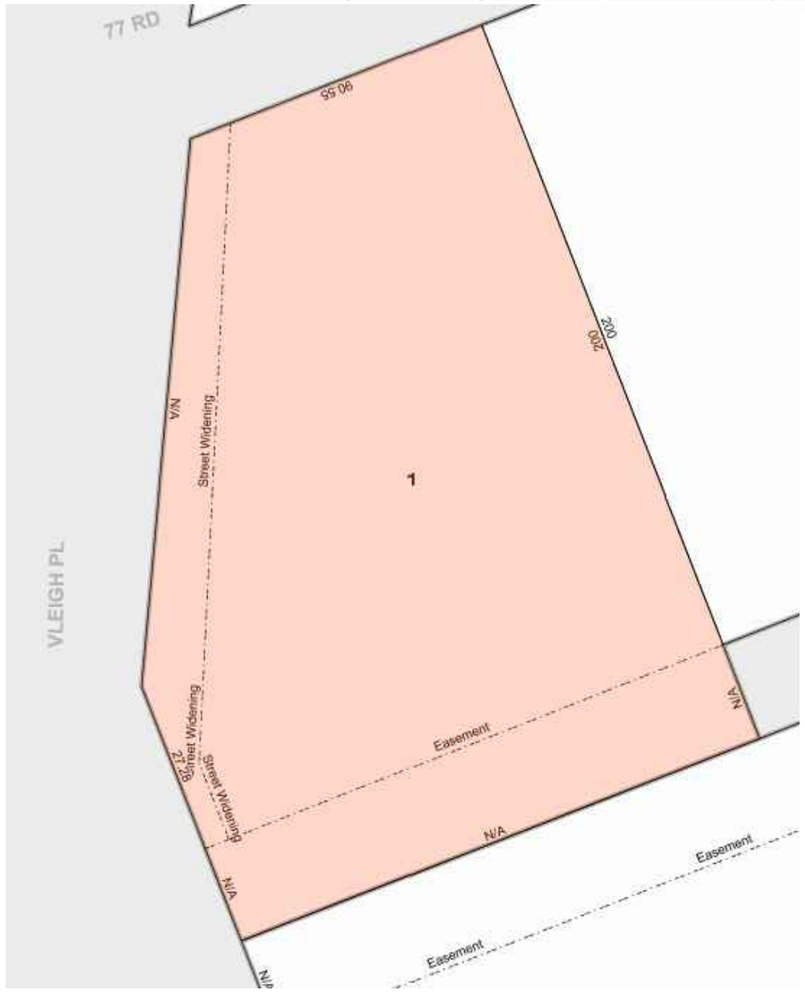
PROJECT NAME AND ADDRESS

PROJECT FIGURE

FIGURE 1: SITE LOCATION MAP

PROJECT NO.	DATE
180120	08/05/2019
DRAWN BY G.T.	REVIEWED BY P.M.
SCALE (11X17) AS NOTED	APPROVED BY P.M.

77-57 Vleigh Place - Digital Tax Map - New York City Dept. of Finance (5/31/2019)



Borough Boundary		Condo Flag/Condo Nunber	C50
Tax Block Boundary		Air Right Flag/Lot Number	A50
Tax Block Number	50	Subterranean Right Flag/Lot Number	S50
Tax Lot Boundary		REUC Flag	R
Tax Lot Number	50	Under Water Tax Lot Boundary	
Condo FKA Tax Lot Number	~~50~~	Other Boundary	
Tax Lot Dimension	50.5	Possession Hook	1
Approximate Tax Lot Dimension	+/-5.5	Miscelaneous Text	Misc
Condo Units Range Label	1500 - 1550	Small Tax Lot Dimension	
Building Footprint		Surface Water	

N

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

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77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

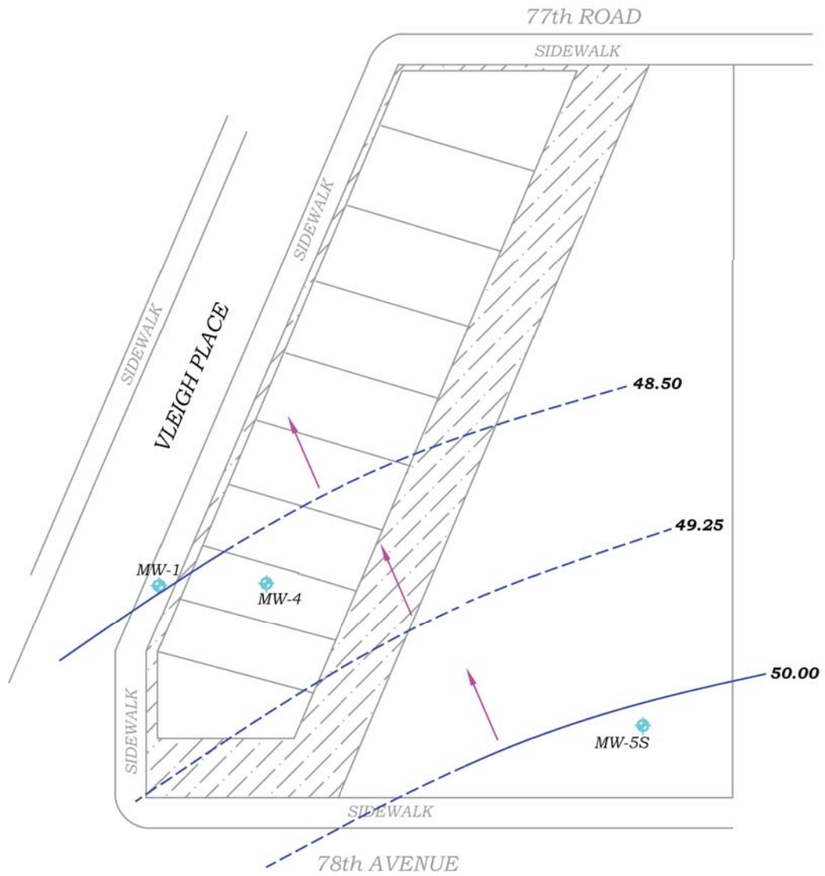
BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

PROJECT FIGURE

FIGURE 2: SITE LAYOUT MAP

PROJECT NO. 180120	DATE 08/05/2019
DRAWN BY G.T.	REVIEWED BY P.M.
SCALE (11X17) AS NOTED	APPROVED BY P.M.



LEGEND:

- *MONITORING WELL LOCATIONS (MW)*
- *C.I. CONTOUR INTERVAL*
- *GROUNDWATER FLOW DIRECTION*
- *GROUNDWATER CONTOUR LINE*
- *DASHED WHERE INFERRED CONTOUR LINE*

C.I. = 0.75 FEET	
Monitoring Well ID	*Groundwater Elevation*
MW-1	*48.51*
MW-4	*49.08*
MW-5S	*50.28*

0' 20' 40' 60'

SCALE IN FEET (FT.)

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

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HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

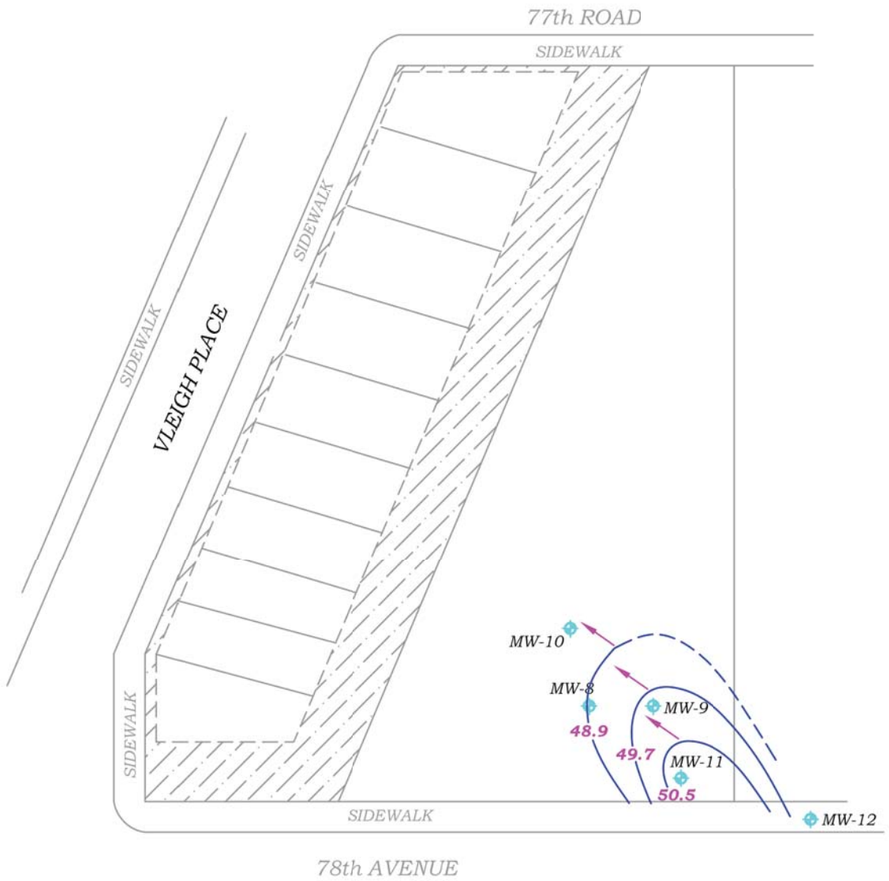
BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

PROJECT FIGURE

FIGURE 3A: GROUNDWATER FLOW CONTOUR MAP - DECEMBER 2015

PROJECT NO.	DATE
180120	08/05/2019
DRAWN BY: G.T.	REVIEWED BY: P.M.
SCALE (11X17): AS NOTED	APPROVED BY: P.M.



LEGEND:

- *MONITORING WELL LOCATIONS (MW)*
- *C.I. CONTOUR INTERVAL*
- *GROUNDWATER FLOW DIRECTION*
- *GROUNDWATER CONTOUR LINE*
- *DASHED WHERE INFERRED CONTOUR LINE*

C.I. = 0.8 FEET	
Monitoring Well ID	*Groundwater Elevation*
MW-8	*48.98*
MW-9	*50.27*
MW-10	*48.58*
MW-11	*50.62*
MW-12	*48.95*

0' 20' 40' 60'
SCALE IN FEET (FT.)

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

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HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

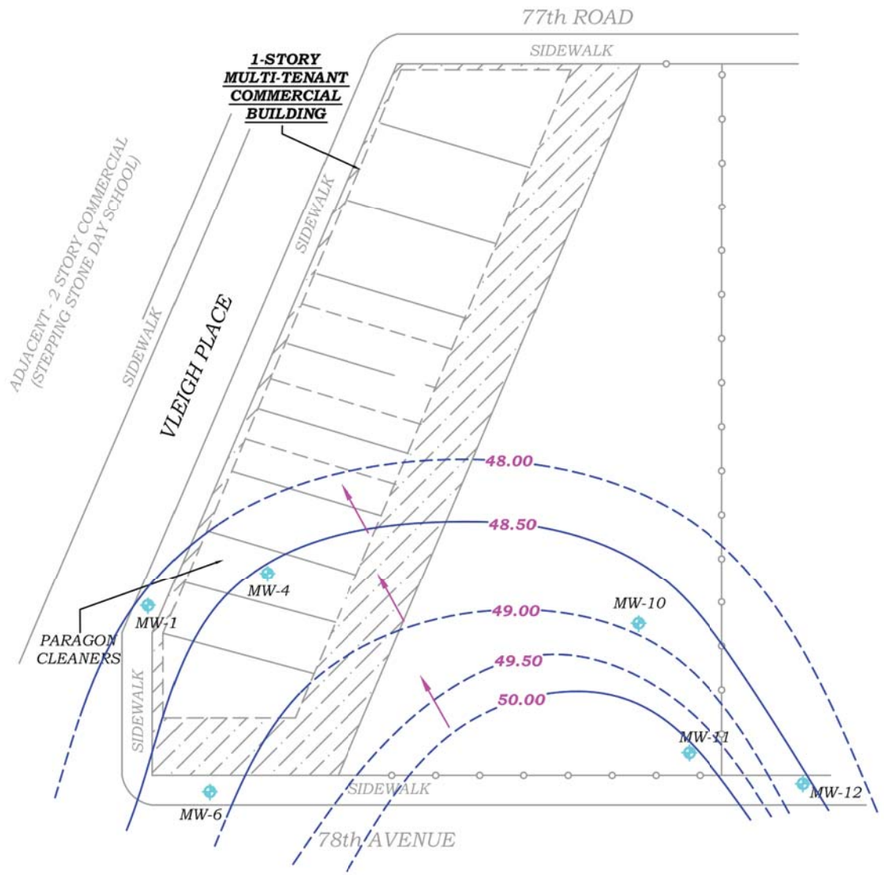
BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

PROJECT FIGURE

FIGURE 3B: GROUNDWATER FLOW CONTOUR MAP - MARCH 2016

PROJECT NO.	DATE
180120	08/05/2019
DRAWN BY: G.T.	REVIEWED BY: P.M.
SCALE (11X17): AS NOTED	APPROVED BY: P.M.



LEGEND:

- *MONITORING WELL LOCATIONS (MW)*
- *C.I. CONTOUR INTERVAL*
- *GROUNDWATER FLOW DIRECTION*
- *GROUNDWATER CONTOUR LINE*
- *DASHED WHERE INFERRED CONTOUR LINE*

C.I. = 0.5 FEET	
Monitoring Well ID	*Groundwater Elevation*
MW-1	*48.05*
MW-4	*48.53*
MW-6	*48.59*
MW-10	*48.57*
MW-11	*50.44*
MW-12	*48.67*

0' 20' 40' 60'
SCALE IN FEET (FT.)

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

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086611
LICENSED PROFESSIONAL ENGINEER

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HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

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HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

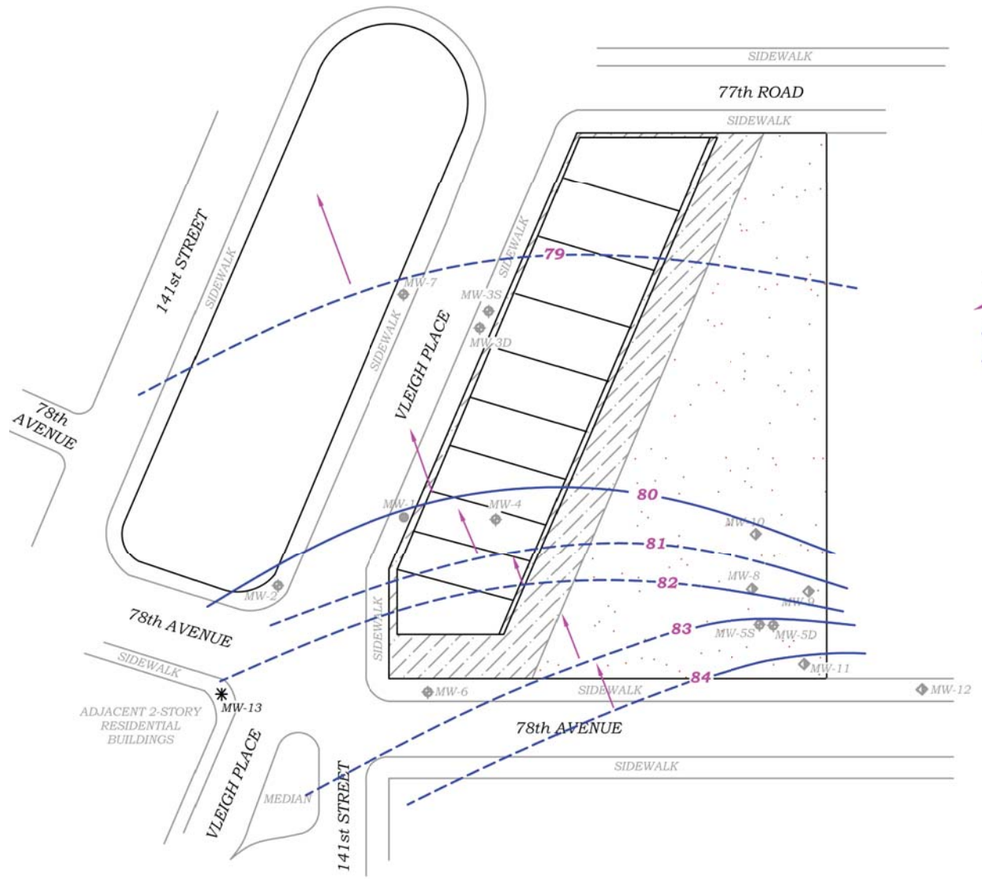
BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

PROJECT FIGURE

FIGURE 3C: GROUNDWATER FLOW CONTOUR MAP - MAY 2016

PROJECT NO.	DATE
180120	08/05/2019
DRAWN BY G.T.	REVIEWED BY P.M.
SCALE (11X17) AS NOTED	APPROVED BY P.M.



LEGEND:

- *MONITORING WELL LOCATION (MW) - INSTALLED DURING JANUARY 2014*
- *MONITORING WELL LOCATIONS (MW) - INSTALLED DURING DECEMBER 2015*
- *MONITORING WELL LOCATIONS (MW) - INSTALLED DURING MARCH 2016*
- *MONITORING WELL LOCATIONS (MW) - INSTALLED DURING OCTOBER 2016*
- *C.I. CONTOUR INTERVAL*
- *GROUNDWATER FLOW DIRECTION*
- *GROUNDWATER CONTOUR LINE*
- *DASHED WHERE INFERRED CONTOUR LINE*

C.I. = 1 FOOT	
Monitoring Well ID	*Groundwater Elevation*
MW-1	*80.71*
MW-2	*80.83*
MW-3S	*79.6*
MW-4	*80.71*
MW-5S	*83.04*
MW-6	*83.14*
MW-7	*79.88*
MW-8	*81.76*
MW-9	*82.8*
MW-10	*80.88*
MW-11	*84.18*
MW-12	*84.95*
MW-13	*82.36*

0' 20' 40' 60'
SCALE IN FEET (FT.)

DATE	DESCRIPTION	CHK

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TAREK ZAKI KHOURI
LICENSED PROFESSIONAL ENGINEER
086611

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HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

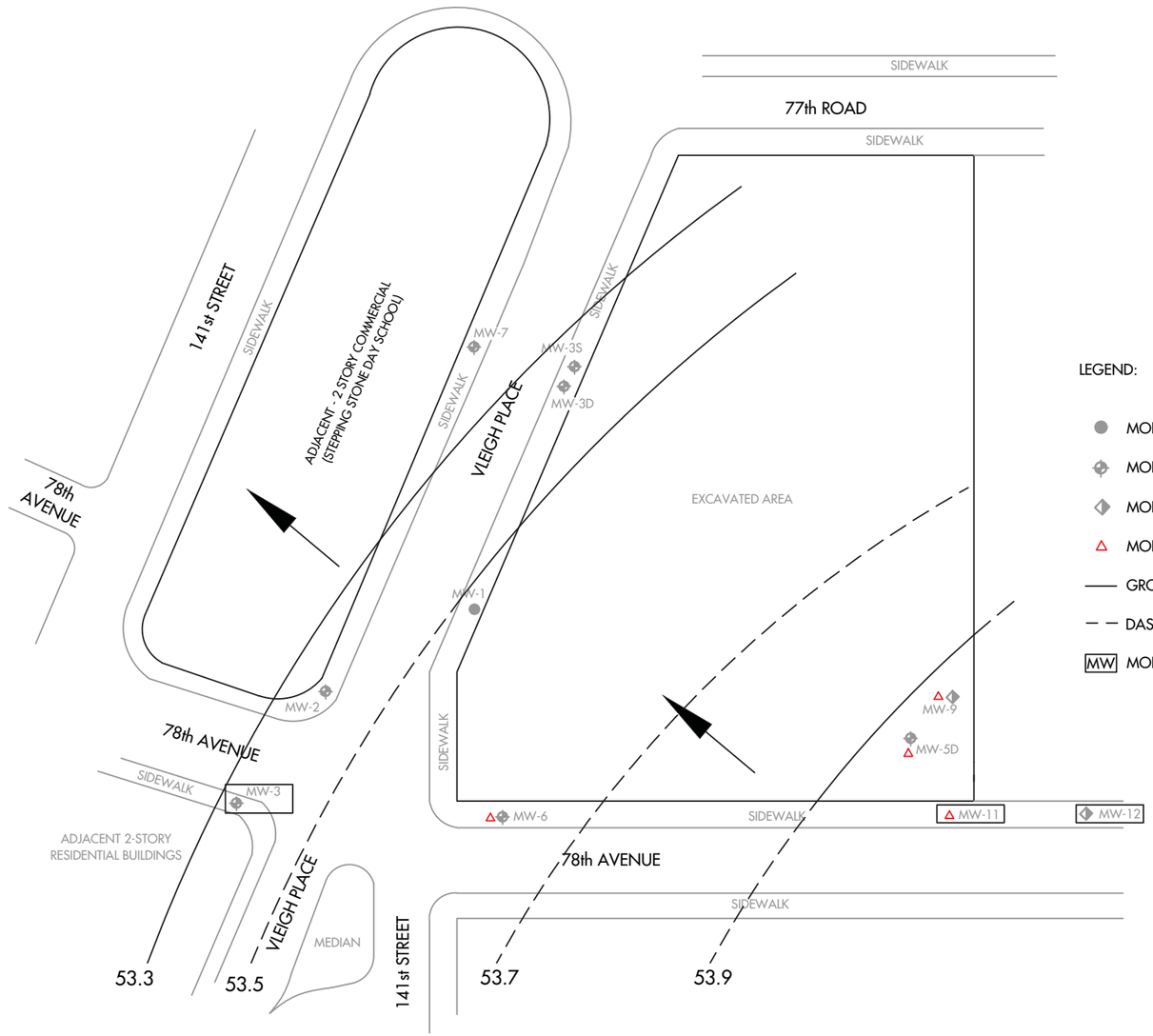
BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

PROJECT FIGURE

FIGURE 3D: GROUNDWATER FLOW CONTOUR MAP - OCTOBER 2016

PROJECT NO.	DATE
180120	08/05/2019
DRAWN BY: G.T.	REVIEWED BY: P.M.
SCALE (11X17): AS NOTED	APPROVED BY: P.M.



LEGEND:

- MONITORING WELL LOCATION (MW) - INSTALLED DURING JANUARY 2014
- MONITORING WELL LOCATIONS (MW) - INSTALLED DURING THE R.I. NOVEMBER 25 & 27 AND DECEMBER 2, 2015
- MONITORING WELL LOCATIONS (MW) - INSTALLED DURING THE R.I. MARCH 23, 2016
- MONITORING WELL LOCATIONS (MW) - REINSTALLED DURING SEPTEMBER 2019
- GROUNDWATER CONTOUR LINE
- DASHED WHERE INFERRED
- MW MONITORING WELL OUTSIDE CONTOUR RANGE

C.I. = 0.20 FEET	
MONITOR WELL I.D.	GROUNDWATER ELEVATIONS
MW-1	53.59
MW-2	53.43
MW-3S	52.90
MW-3D	53.84
MW-5D	53.94
MW-6	53.53
MW-7D	53.28
MW-9	53.99
MW-11	53.86
MW-12	53.30
MW-13	55.36

0' 20' 40' 60'
SCALE IN FEET (FT.)

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

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TAREK ZAKI KHOURI
086611
LICENSED PROFESSIONAL ENGINEER

HydroTech

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

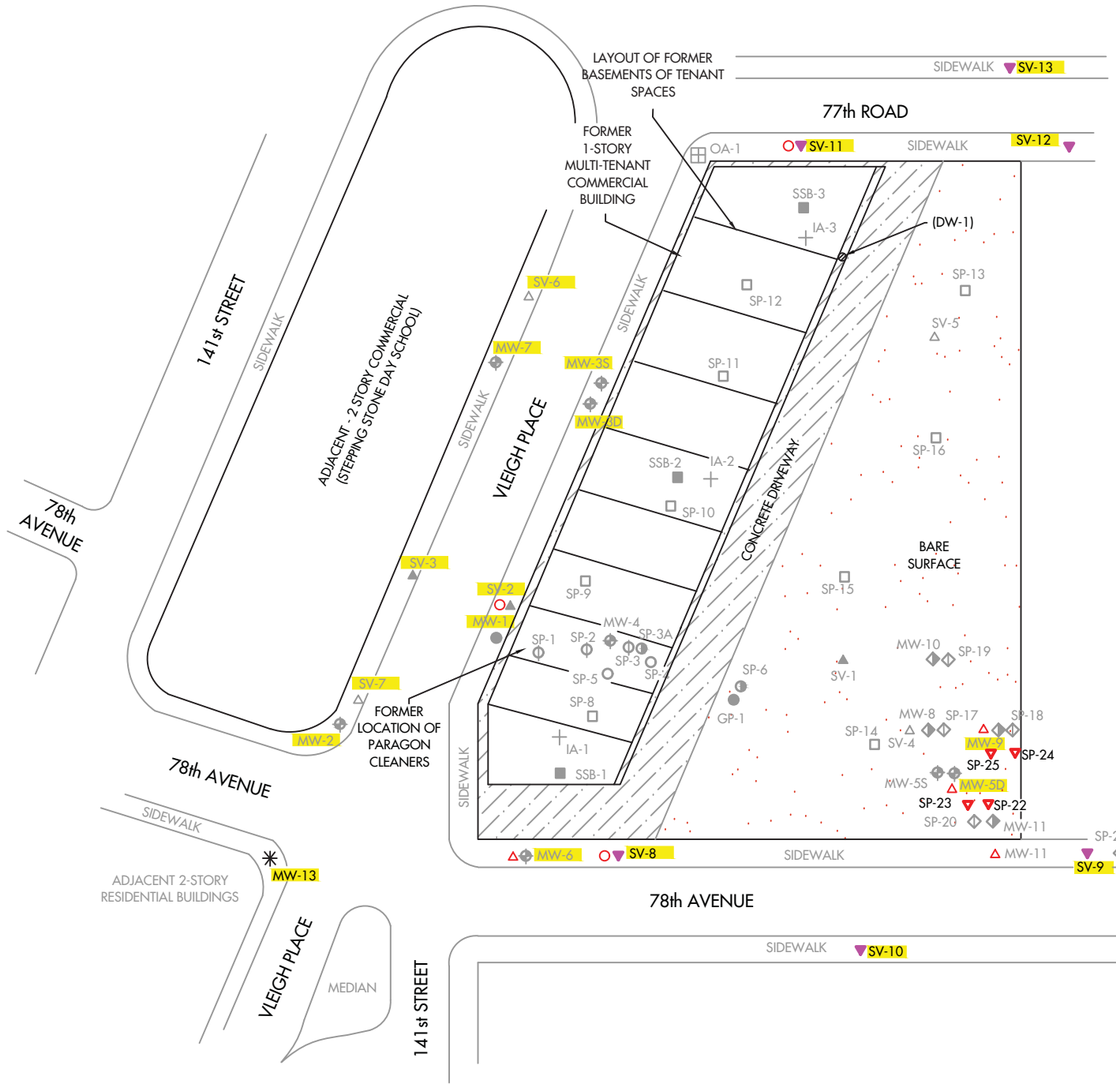
PROJECT NAME AND ADDRESS

77-57 VLEIGH PLACE
FLUSHING, NEW YORK

PROJECT FIGURE

FIGURE 3E: GROUNDWATER FLOW CONTOUR MAP - OCTOBER 2019

PROJECT NO.	DATE
180120	12/02/2019
DRAWN BY G.T.	REVIEWED BY P.M.
SCALE (11X17) AS NOTED	APPROVED BY P.M.



LEGEND:

- SOIL PROBES LOCATIONS (SP) - INSTALLED DURING OCTOBER 2013
- GROUNDWATER PROBE LOCATION (GP) - INSTALLED DURING OCTOBER 2013
- SOIL PROBES LOCATIONS (SP) - INSTALLED DURING JANUARY 2014
- MONITORING WELL LOCATION (MW) - INSTALLED DURING JANUARY 2014
- SOIL PROBE INSTALLED (SP) - INSTALLED DURING MARCH 2014
- SOIL PROBE/MONITORING WELL LOCATION (MW) - INSTALLED DURING NOVEMBER 2014
- SOIL VAPOR PROBES (SV) - INSTALLED DURING NOVEMBER 2014 - REINSTALLED DURING NOVEMBER 2019 (EXCEPT FOR SV-3 AND SV-11)
- SOIL PROBE LOCATIONS (SP) - INSTALLED DURING THE R.I. NOVEMBER 24 & 30 AND DECEMBER 1 & 2, 2015
- MONITORING WELL LOCATIONS (MW) - INSTALLED DURING THE R.I. NOVEMBER 25 & 27 AND DECEMBER 2, 2015
- SOIL VAPOR PROBE LOCATIONS (SV) - INSTALLED DURING THE R.I. DECEMBER 3, 2015 - REINSTALLED DURING NOVEMBER 2018
- SUB SLAB VAPOR PROBES (SSB) - INSTALLED DURING THE R.I. DECEMBER 3, 2015
- INDOOR AIR SAMPLE LOCATIONS (IA) - COLLECTED DURING THE R.I. DECEMBER 3, 2015
- OUTDOOR AIR SAMPLE LOCATION (OA) - COLLECTED DURING THE R.I. DECEMBER 3, 2015
- SOIL PROBE LOCATIONS (SP) - INSTALLED DURING THE R.I. MARCH 21 & 22, 2016
- MONITORING WELL LOCATIONS (MW) - INSTALLED DURING THE R.I. MARCH 23, 2016
- DRYWELL SAMPLE LOCATION (DW) - COLLECTED DURING THE R.I. MARCH 22, 2016
- SOIL PROBE LOCATIONS (SP) - INSTALLED DURING THE R.I. OCTOBER 10 & 11, 2016
- SOIL VAPOR PROBE LOCATIONS (SV) - INSTALLED DURING THE R.I. OCTOBER 11, 2016
- MONITORING WELL LOCATIONS (MW) - INSTALLED DURING THE R.I. OCTOBER 10, 2016
- SOIL VAPOR PROBE LOCATION (SV) - REINSTALLED OCTOBER 8, 2019
- MONITORING WELL LOCATION (MW) - REINSTALLED DURING SEPTEMBER 2019

NOTE:

HIGHLIGHTED SAMPLING LOCATIONS INDICATE ACTIVE STATUS

0' 20' 40' 60'

SCALE IN FEET (FT.)

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

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77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

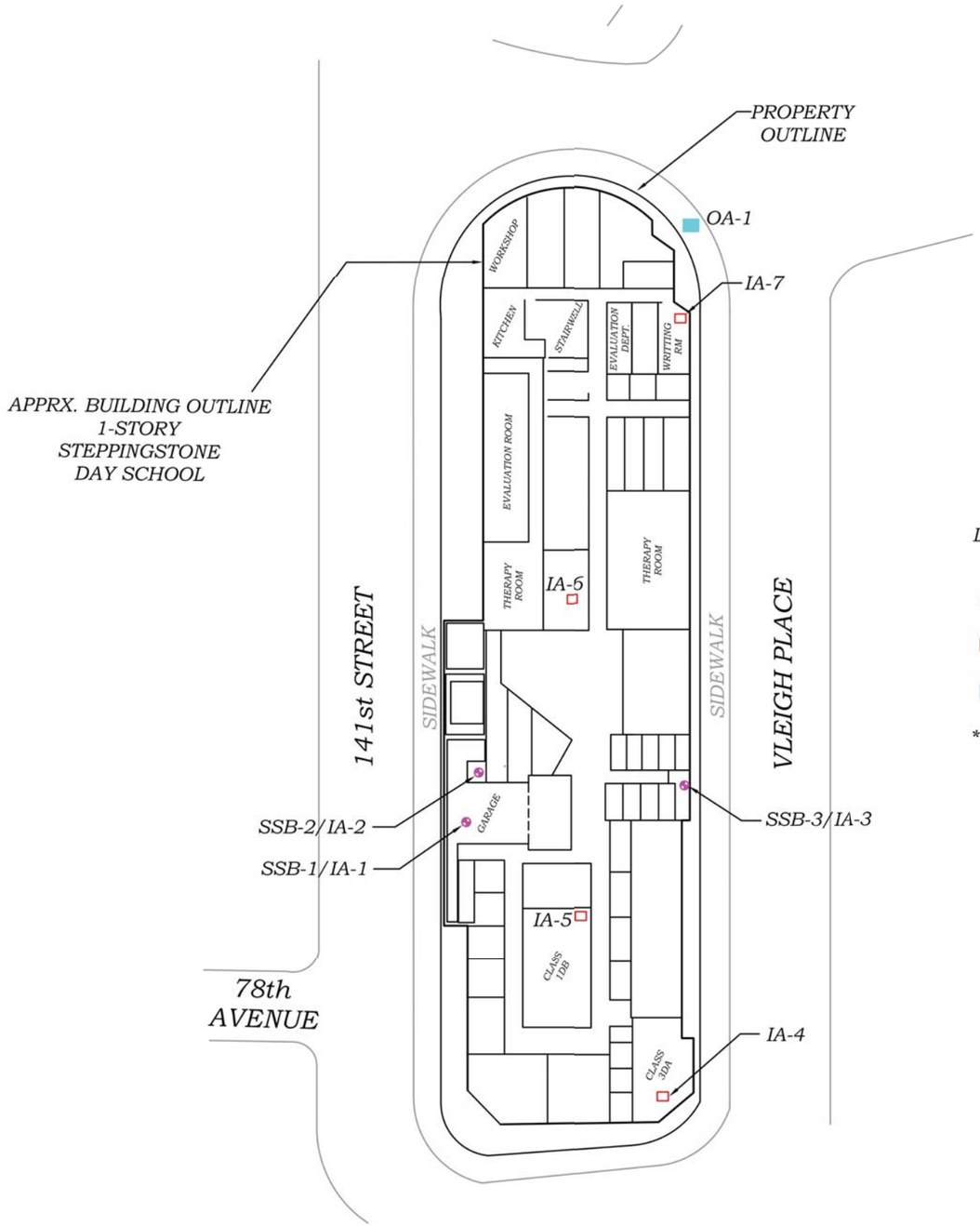
BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

PROJECT FIGURE

FIGURE 4: ON-SITE AND OFF-SITE SAMPLING MAP

PROJECT NO.	DATE
180120	10/18/2019
DRAWN BY G.T.	REVIEWED BY P.M.
SCALE (11X17) AS NOTED	APPROVED BY P.M.



N

LEGEND:

- *PROPOSED SUBSLAB / INDOOR AIR SAMPLING LOCATIONS (SSB/IA)*
- *PROPOSED INDOOR AIR SAMPLING LOCATIONS (IA)*
- *PROPOSED OUTDOOR AIR SAMPLING LOCATIONS (OA)*

** *MOST ROOMS WHICH ARE NOT LABELED ON THE PLAN ARE VARIOUS TYPES OF CLASSROOMS.*

DATE	DESCRIPTION	CHK

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15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

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PROJECT NAME AND ADDRESS

PROJECT FIGURE

FIGURE 5: SAMPLING LOCATIONS AT STEPPINGSTONE DAY SCHOOL

PROJECT NO.	DATE
180120	08/05/2019
DRAWN BY: G.T.	REVIEWED BY: P.M.
SCALE (11X17): NOT TO SCALE	APPROVED BY: P.M.

DATE	DESCRIPTION	CHK

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HAUPPAUGE, NY 11788

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PROJECT NAME AND ADDRESS

PROJECT FIGURE

FIGURE 6: SAMPLING LOCATIONS AT KEW GARDEN OWNERS CORP

PROJECT NO.	DATE
180120	08/05/2019
DRAWN BY: G.T.	REVIEWED BY: P.M.
SCALE (11X17): NOT TO SCALE	APPROVED BY: P.M.

DATE	DESCRIPTION	CHK

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15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

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BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

PROJECT FIGURE

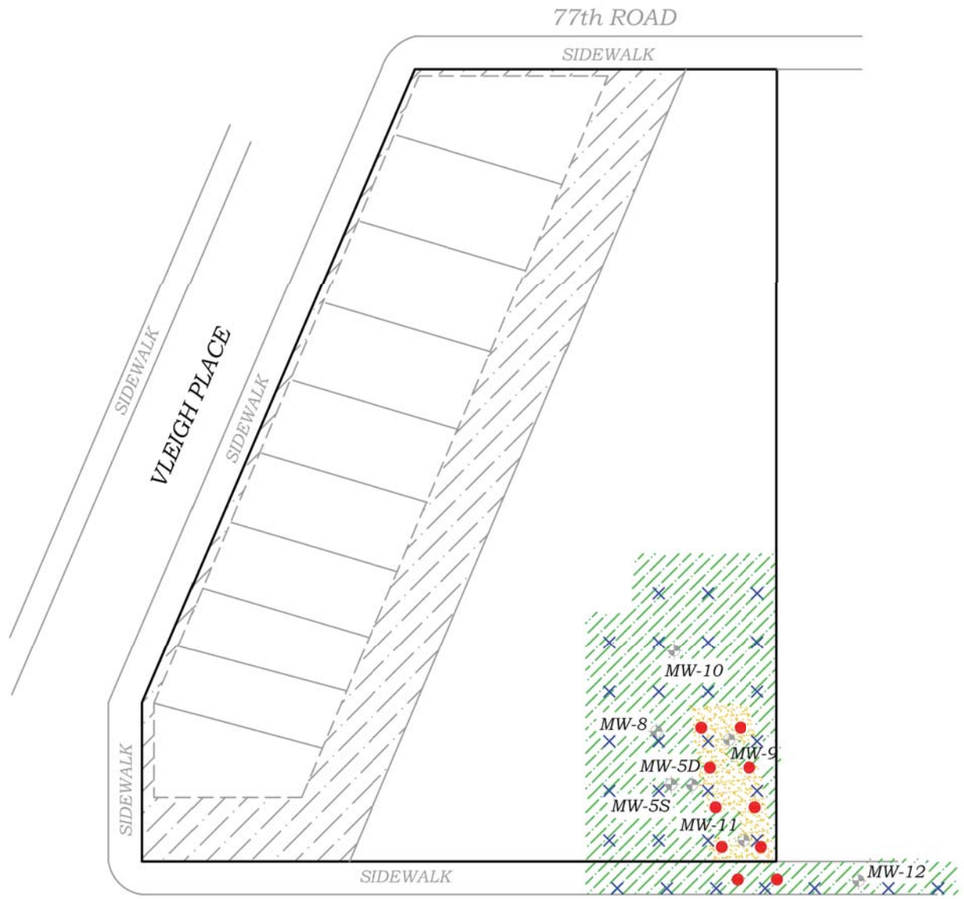
FIGURE 7: SAMPLING LOCATIONS AT REGENCY GARDEN COMPANY

PROJECT NO.	DATE
180120	08/05/2019
DRAWN BY: G.T.	REVIEWED BY: P.M.
SCALE (11X17): AS NOTED	APPROVED BY: P.M.

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

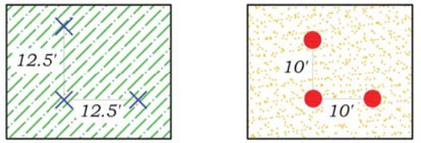
STATE OF NEW YORK
TAREK ZAKI KHOURI
086611
LICENSED PROFESSIONAL ENGINEER

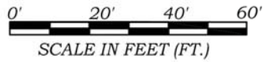


LEGEND:

- *PERSUFFOX INJECTION POINTS - MAY 2018 - SEPT. 2018*
- *3DME INJECTION POINTS- JAN. 2019*
- *MONITORING WELL LOCATIONS (MW)*

SPACING BETWEEN INJECTION POINTS





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15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

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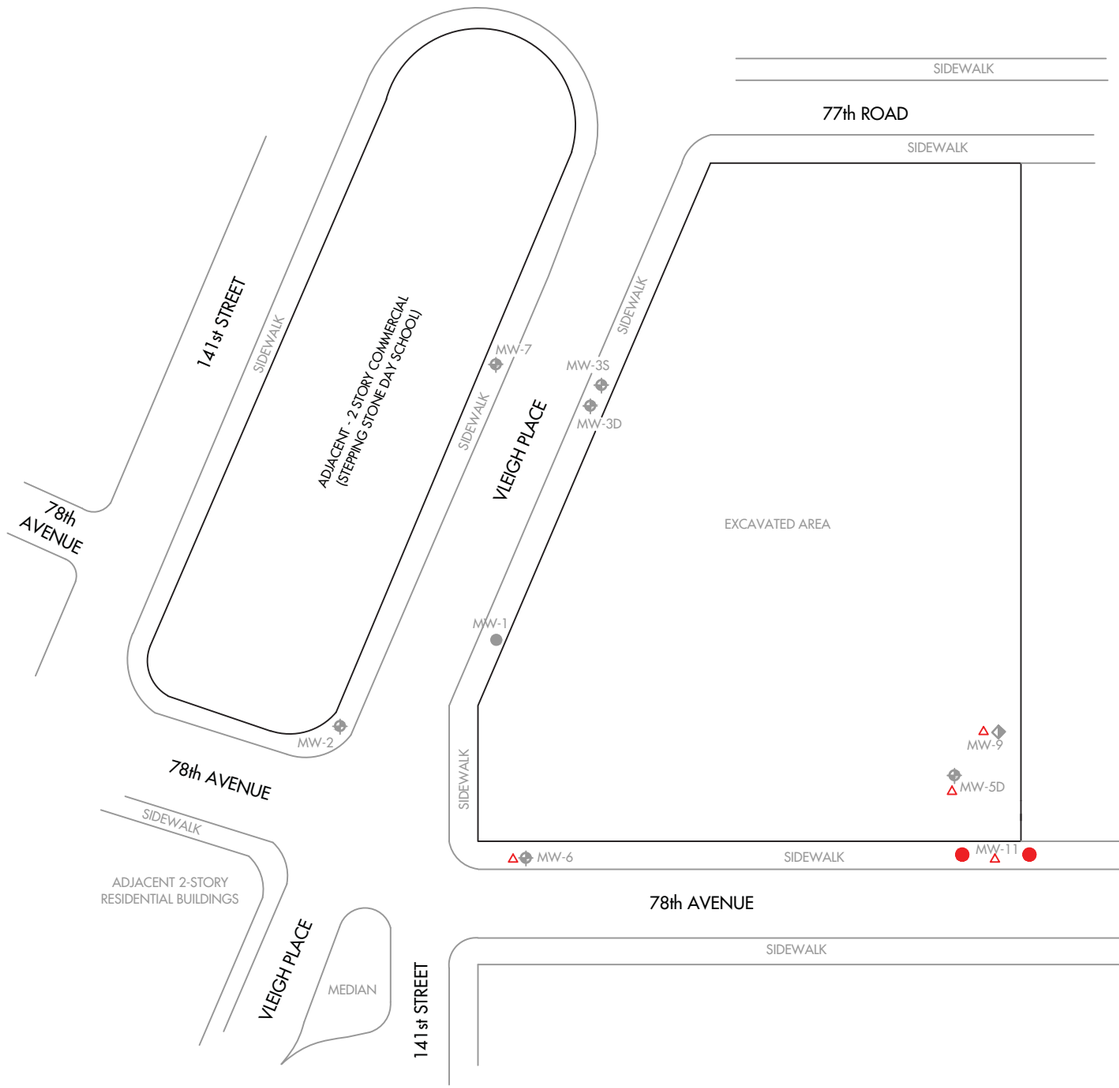
PROJECT NAME AND ADDRESS

PROJECT FIGURE

FIGURE 8A: INJECTION POINT LOCATIONS

PROJECT NO.	DATE
180120	08/05/2019
DRAWN BY: G.T.	REVIEWED BY: P.M.
SCALE (11X17): AS NOTED	APPROVED BY: P.M.



LEGEND:

- MONITORING WELL LOCATION (MW) - INSTALLED DURING JANUARY 2014
- MONITORING WELL LOCATIONS (MW) - INSTALLED DURING THE R.I. NOVEMBER 25 & 27 AND DECEMBER 2, 2015
- MONITORING WELL LOCATIONS (MW) - INSTALLED DURING THE R.I. MARCH 23, 2016
- MONITORING WELL LOCATIONS (MW) - REINSTALLED DURING SEPTEMBER 2019
- PERSUFFOX INJECTION POINTS - DEC. 2019

0' 20' 40' 60'
SCALE IN FEET (FT.)

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

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77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

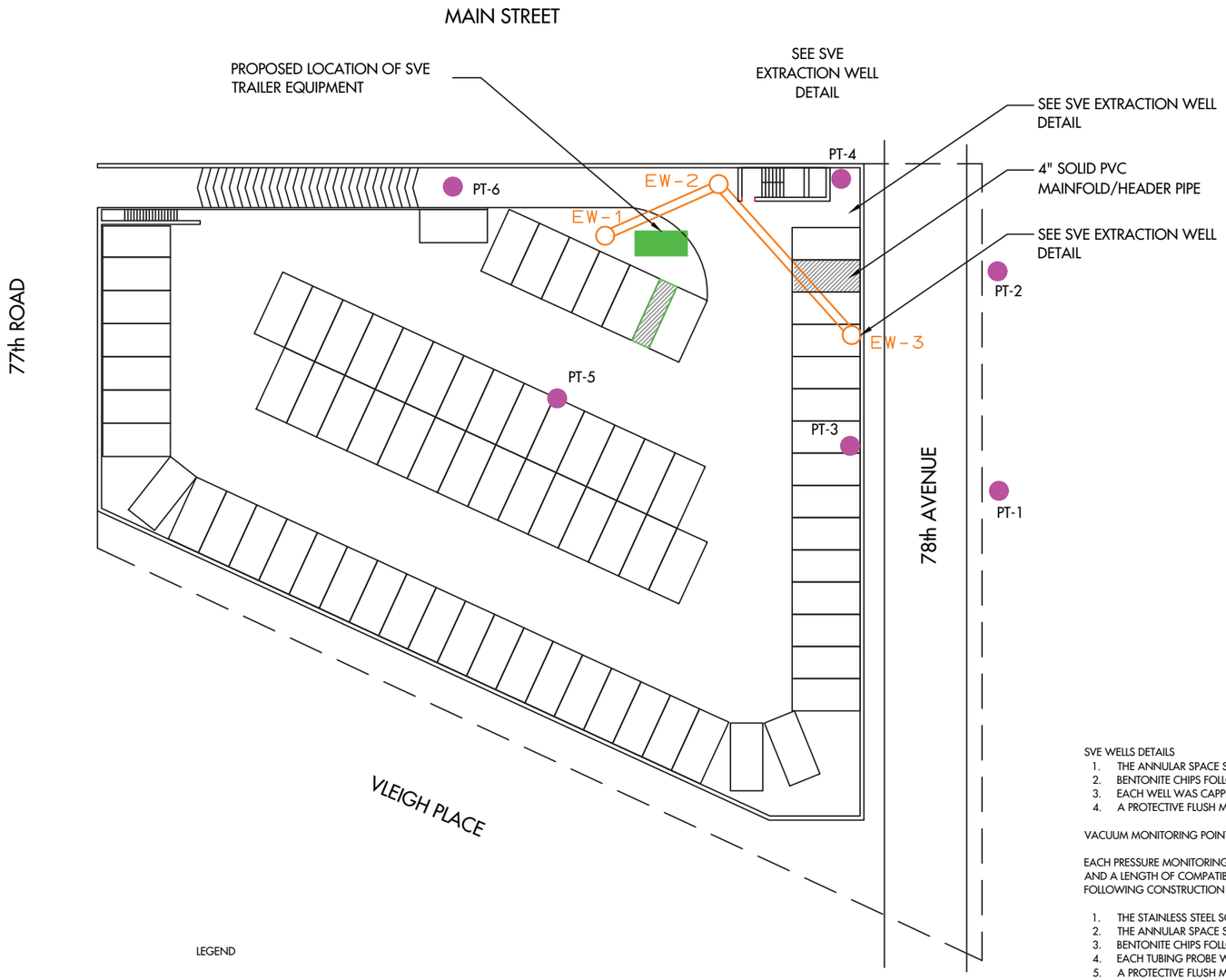
PROJECT NAME AND ADDRESS

77-57 VLEIGH PLACE
FLUSHING, NEW YORK

PROJECT FIGURE

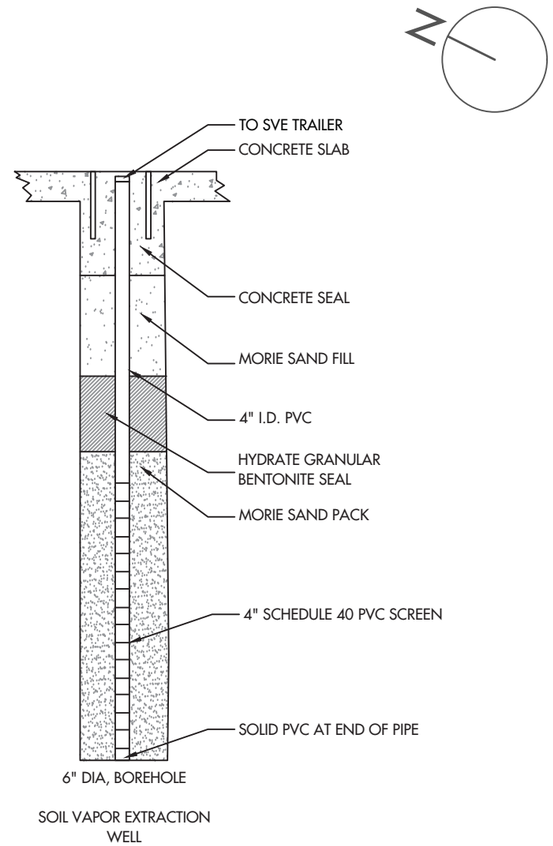
FIGURE 8B: INJECTION POINT LOCATIONS

PROJECT NO.	DATE
180120	10/31/2019
DRAWN BY: G.T.	REVIEWED BY: P.M.
SCALE (11X17): AS NOTED	APPROVED BY: P.M.



LEGEND

- 3" SOLID PVC PIPING TO SVE TRAILER
- EWO PROPOSED SVE VAPOR EXTRACTION WELL
- PROPOSED LOCATION OF SVE EQUIPMENT TRAILER
- PRESSURE MONITORING POINTS



SOIL VAPOR EXTRACTION WELL

SVE WELLS DETAILS

1. THE ANNULAR SPACE SURROUNDING THE EXTRACTION WELLS WAS FILLED WITH CLEAN PEA GRAVEL TO 1' ABOVE THE TOP OF THE SCREEN.
2. BENTONITE CHIPS FOLLOWED BY CONCRETE TO GRADE WAS USED TO SEAL EACH WELL LOCATION TO ENSURE NO AMBIENT AIR INTERFERENCES.
3. EACH WELL WAS CAPPED WITH BUTTERFLY VALVE FOR VOC TESTING VIA A PHOTOIONIZATION
4. A PROTECTIVE FLUSH MOUNTED COVER WAS PROVIDED FOR EACH WELL AT THE SURFACE

VACUUM MONITORING POINT DETAILS

EACH PRESSURE MONITORING POINT <VMP> WAS CONSTRUCTED USING A SIX-INCH LONG STAINLESS STEEL MONITORING IMPLANT <AT8617S> AT THE TERMINAL END AND A LENGTH OF COMPATIBLE-SIZED DIAMETER TEFLON-LINED TUBING RUNNING TO A BUTTERFLY OR BALL VALVE AND BARBED CONNECTION AT THE SURFACE. THE FOLLOWING CONSTRUCTION DETAILS WERE FOLLOWED

1. THE STAINLESS STEEL SCREENED IMPLANTS WAS INSTALLED 5 FEET BGS BENEATH SIDEWALK.
2. THE ANNULAR SPACE SURROUNDING BOTH STAINLESS STEEL SCREENED IMPLANTS WAS FILLED WITH CLEAN #2 SAND TO 1' ABOVE THE TOP OF THE SCREEN
3. BENTONITE CHIPS FOLLOWED BY CONCRETE TO GRADE WERE USED TO SEAL EACH VMP LOCATION TO ENSURE NO AMBIENT AIR INTERFERENCES
4. EACH TUBING PROBE WAS CAPPED WITH A BUTTERFLY VALVE FOR VOC TESTING VIA A PHOTOIONIZATION DETECTOR
5. A PROTECTIVE FLUSH MOUNTED COVER WAS PROVIDED FOR EACH PROBE AT THE SURFACE

SVE WELL ID	SCREENED INTERVAL	WELL SCREEN DIA.
EW-1	20' - 25'	0.03
EW-2	25' - 30'	0.03
EW-3	25' - 30'	0.03

DATE	DESCRIPTION	CHK

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HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

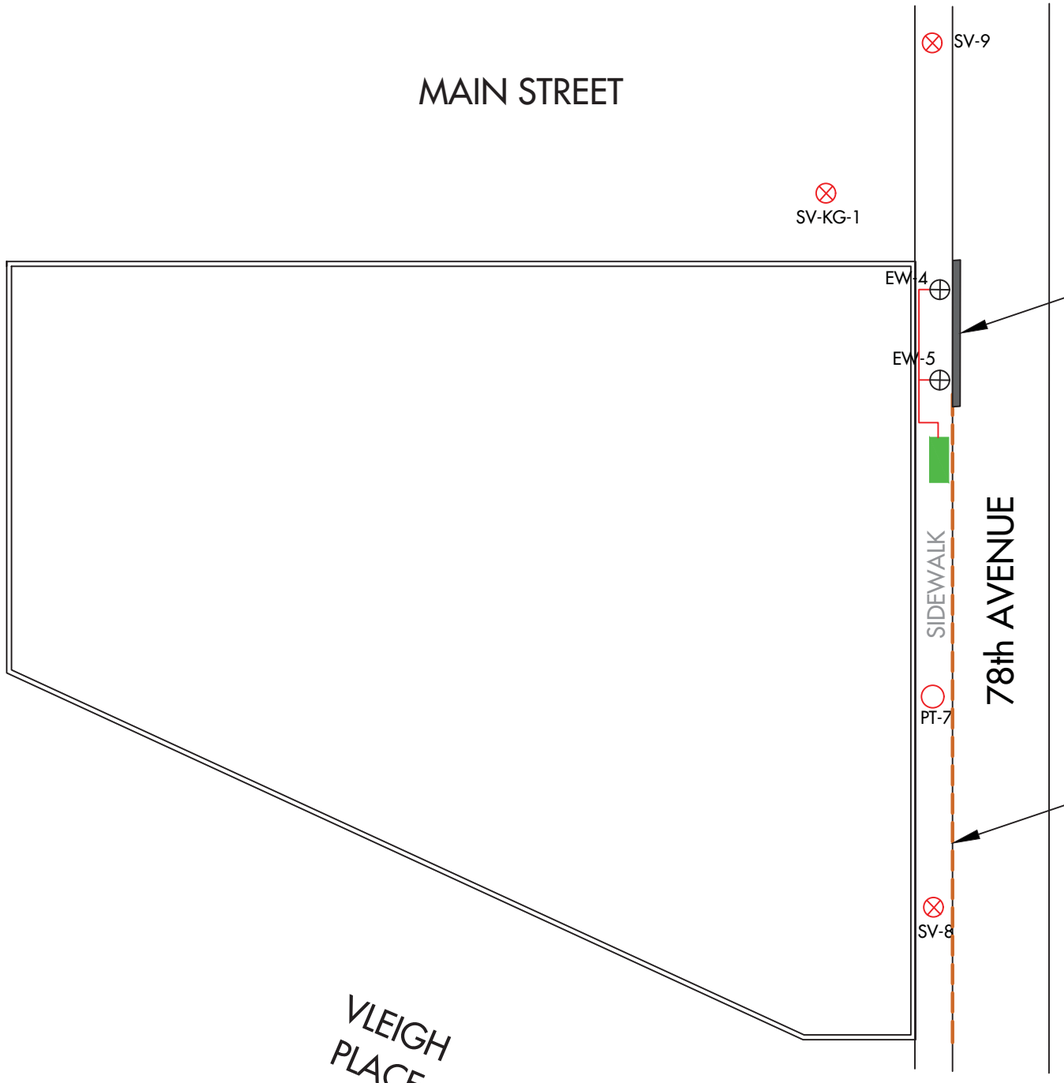
PROJECT NAME AND ADDRESS

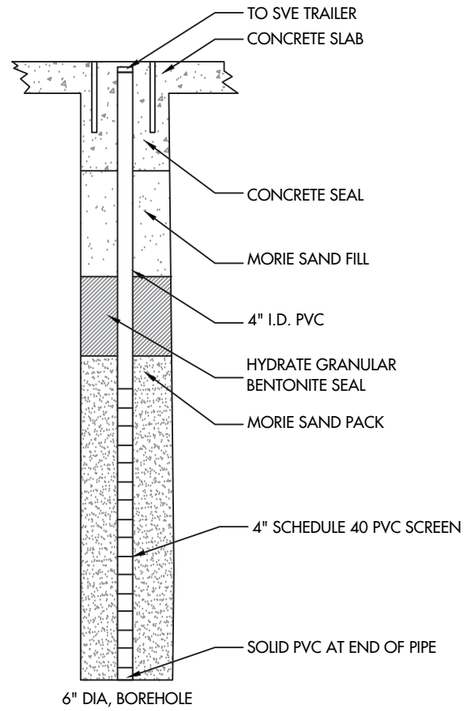
77-57 VLEIGH PLACE
FLUSHING, NEW YORK

PROJECT FIGURE

FIGURE 9 - INSTALLED INTERIM SVE SYSTEM PRIOR TO SITE EXCAVATION - JULY 2018 - APRIL 2019

PROJECT NO.	DATE
180120	10/29/2019
DRAWN BY G.T.	REVIEWED BY P.M.
SCALE (11X17) AS NOTED	APPROVED BY P.M.





SOIL VAPOR EXTRACTION WELL

SVE WELLS DETAILS

1. THE ANNULAR SPACE SURROUNDING THE EXTRACTION WELLS WAS FILLED WITH CLEAN PEA GRAVEL TO 1' ABOVE THE TOP OF THE SCREEN.
2. BENTONITE CHIPS FOLLOWED BY CONCRETE TO GRADE WAS USED TO SEAL EACH WELL LOCATION TO ENSURE NO AMBIENT AIR INTERFERENCES.
3. EACH WELL WAS CAPPED WITH BUTTERFLY VALVE FOR VOC TESTING VIA A PHOTOIONIZATION
4. A PROTECTIVE FLUSH MOUNTED COVER WAS PROVIDED FOR EACH WELL AT THE SURFACE

VACUUM MONITORING POINT DETAILS

EACH PRESSURE MONITORING POINT <VMP> WAS CONSTRUCTED USING A SIX-INCH LONG STAINLESS STEEL MONITORING IMPLANT <AT8617S> AT THE TERMINAL END AND A LENGTH OF COMPATIBLE-SIZED DIAMETER TEFLON-LINED TUBING RUNNING TO A BUTTERFLY OR BALL VALVE AND BARBED CONNECTION AT THE SURFACE. THE FOLLOWING CONSTRUCTION DETAILS WERE FOLLOWED

1. THE STAINLESS STEEL SCREENED IMPLANTS WAS INSTALLED 5 FEET BGS BENEATH SIDEWALK.
2. THE ANNULAR SPACE SURROUNDING BOTH STAINLESS STEEL SCREENED IMPLANTS WAS FILLED WITH CLEAN #2 SAND TO 1' ABOVE THE TOP OF THE SCREEN
3. BENTONITE CHIPS FOLLOWED BY CONCRETE TO GRADE WERE USED TO SEAL EACH VMP LOCATION TO ENSURE NO AMBIENT AIR INTERFERENCES
4. EACH TUBING PROBE WAS CAPPED WITH A BUTTERFLY VALVE FOR VOC TESTING VIA A PHOTOIONIZATION DETECTOR
5. A PROTECTIVE FLUSH MOUNTED COVER WAS PROVIDED FOR EACH PROBE AT THE SURFACE

SVE WELL ID	SCREENED INTERVAL	WELL SCREEN DIA.
EW-4	10' - 15'	0.03'
EW-5	20' - 25'	0.03'

LEGEND:

- ○ VACUUM MONITORING POINT
- ▬ LOCATION OF SVE EQUIPMENT TRAILER
- ——— 4" SOLID PVC MANIFOLDED PIPING TO SVE BLOWER
- ⊗ SOIL VAPOR PROBES (SV) TO BE USED AS VACUUM MONITORING POINT
- ⊕ SOIL VAPOR EXTRACTION WELL (EW)

DATE	DESCRIPTION	CHK

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77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

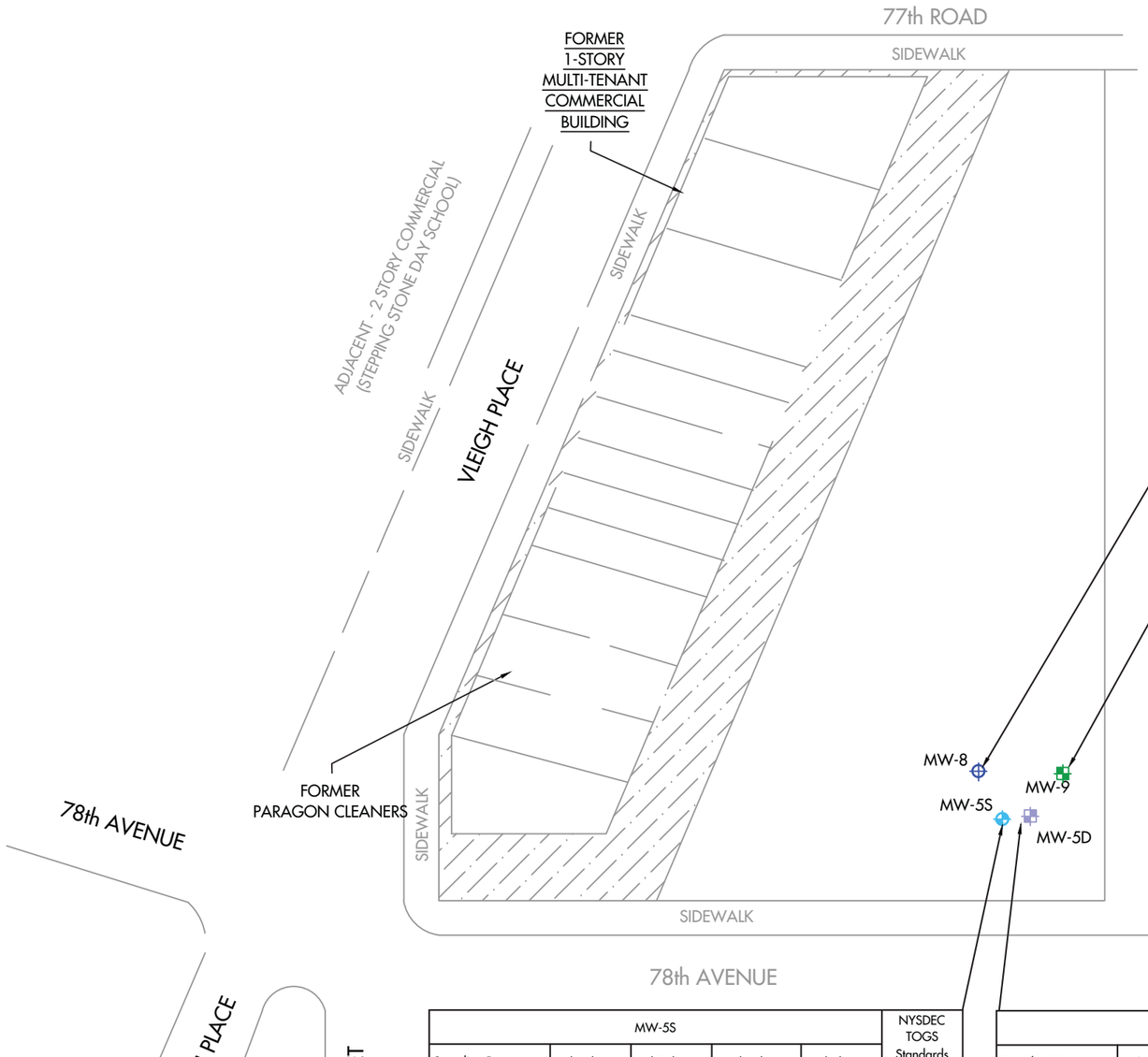
PROJECT NAME AND ADDRESS

77-57 VLEIGH PLACE
QUEENS, NY 11367

PROJECT FIGURE

FIGURE 10: INSTALLED INTERIM SVE SYSTEM POST SITE EXCAVATION - OCTOBER 2019

PROJECT NO.	DATE
180120	11/1/2019
DRAWN BY G.T.	REVIEWED BY P.M.
SCALE (11X17) NOT TO SCALE	APPROVED BY P.M.



MW-8					NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	330	433	314	5.52	5
Trichloroethylene	0.6	1.2	0.9	ND	5
Total VOCs	342	440	326	8	NS

MW-9						NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	10/4/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	33000	8800	3220	668	145	5
Trichloroethylene	29	12.7	6.1	0.67	ND	5
Total VOCs	33035	8908	3238	671	145.68	NS

MW-5S					NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	380	156	175	21.5	5
Trichloroethylene	1	1	0.58	ND	5
Total VOCs	383	164	187	24	NS

MW-5D						NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	10/2/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	29	ND	1170	856	21.90	5
Trichloroethylene	0.3	ND	1.26	1.23	0.22	5
Total VOCs	43	ND	1182	589	23.45	NS

LEGEND:

- MONITORING WELL LOCATION (MW) - INSTALLED OCTOBER 2016
- MONITORING WELL LOCATION (MW) - INSTALLED MARCH 2016
- MONITORING WELL LOCATIONS (MW) - INSTALLED DECEMBER 2015
- MONITORING WELL LOCATIONS (MW) - INSTALLED MARCH 2016 & REINSTALLED SEPTEMBER 2019
- MONITORING WELL LOCATIONS (MW) - INSTALLED DECEMBER 2015 & REINSTALLED SEPTEMBER 2019

VOC	VOLATILE ORGANIC COMPOUND
ND	NONE DETECTED
GQS	GROUNDWATER QUALITY STANDARDS
ug/L	MICROGRAM PER LITER
	EXCEEDS NYSDEC TOGS STANDARDS AND GUIDANCE VALUES-GA

0' 20' 40' 60'
SCALE IN FEET (FT.)

DATE	DESCRIPTION	CHK

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HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

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FAX: (631) 462-5877

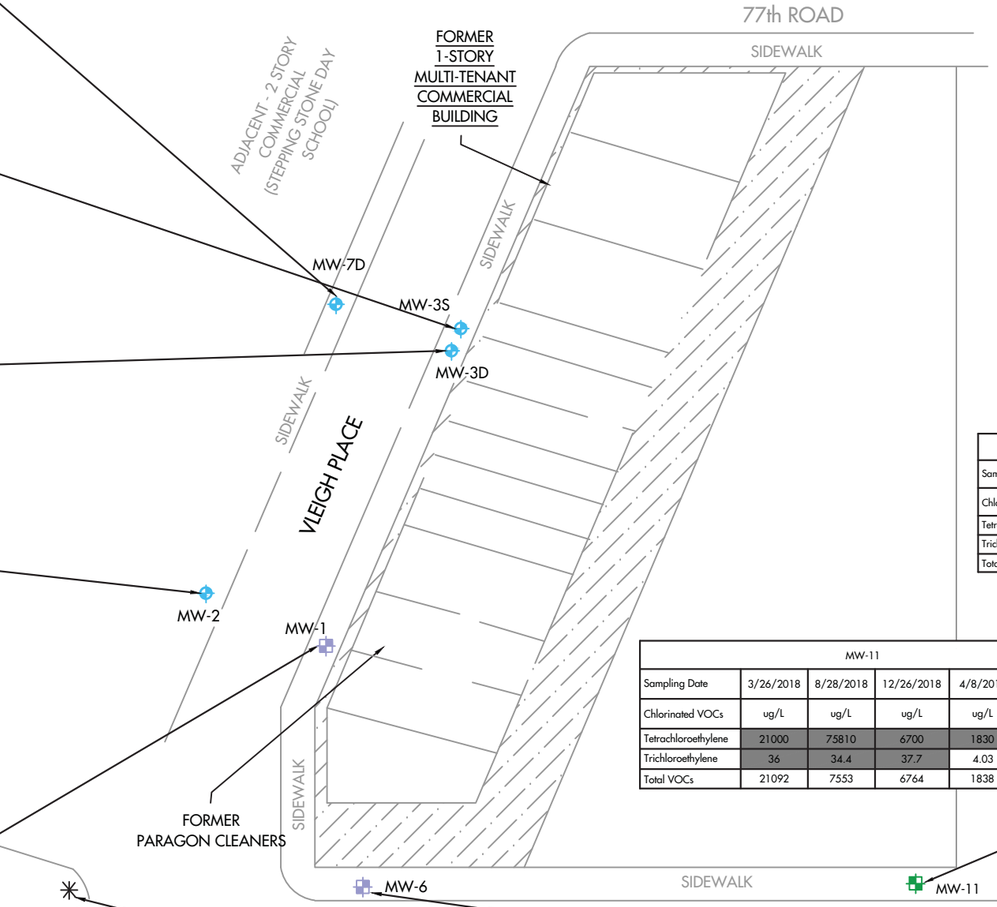
BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

PROJECT FIGURE

FIGURE 11A : PRE- & POST-INJECTION RESULTS OF PCE AND TCE IN GROUNDWATER

PROJECT NO.	DATE
180120	10/11/2019
DRAWN BY G.T.	REVIEWED BY P.M.
SCALE (11X17) AS NOTED	APPROVED BY P.M.



MW-7							NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	7/22/2019	9/30/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	ND	ND	ND	ND	ND	7.08	5
Trichloroethylene	ND	ND	ND	ND	ND	ND	5
Total VOCs	29	ND	23	25	96.98	27.39	NS

MW-3S							NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	7/22/2019	10/2/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	300	54.6	52.9	17.3	25.0	19.70	5
Trichloroethylene	4.7	1.2	0.5	ND	ND	ND	5
Total VOCs	313	231	91	45	77.0	40.80	NS

MW-3D							NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	7/22/2019	10/2/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	200	ND	2060	1410	39.90	22.10	5
Trichloroethylene	2.1	ND	12.8	7.14	0.38	ND	5
Total VOCs	221	ND	2097	1437	128.16	33.57	NS

MW-2						NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	9/30/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	200	175	8250	176	119	5
Trichloroethylene	3.2	4.4	95	3.17	2.70	5
Total VOCs	313	373	8423	190	138.61	NS

	MW-2(S)	MW-2(D)	NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	7/22/2019	7/22/2019	
Chlorinated VOCs	ug/L	ug/L	
Tetrachloroethylene	264	874	5
Trichloroethylene	6.790	8	5
Total VOCs	346.31	913.70	NS

MW-1						NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	10/3/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	280	397	222	535	145	5
Trichloroethylene	7	6.3	8.4	9.4	3.20	5
Total VOCs	298	580	243	555	156.27	NS

MW-12							NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	7/22/2019	10/4/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	ND	159	62.8	77.5	175	104	5
Trichloroethylene	ND	5.1	2.5	ND	23.40	5.90	5
Total VOCs	ND	381	84	115	273.28	112.33	NS

MW-11						NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	10/4/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	21000	75810	6700	1830	1640	5
Trichloroethylene	36	34.4	37.7	4.03	6.76	5
Total VOCs	21092	7553	6764	1838	1720.98	NS

MW-13						NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	10/1/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	0.5	1.7	ND	ND	ND	5
Trichloroethylene	ND	0.2	ND	ND	ND	5
Total VOCs	10	241	10	2	18.69	NS

	MW-13(S)	MW-13(D)	NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	7/22/2019	7/22/2019	
Chlorinated VOCs	ug/L	ug/L	
Tetrachloroethylene	ND	ND	5
Trichloroethylene	ND	ND	5
Total VOCs	97.50	73.97	NS

MW-6						NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	3/26/2018	8/28/2018	12/26/2018	4/8/2019	10/3/2019	
Chlorinated VOCs	ug/L	ug/L	ug/L	ug/L	ug/L	
Tetrachloroethylene	110	628	553	336	60.50	5
Trichloroethylene	1.4	30.7	31.9	15.6	2.46	5
Total VOCs	171	737	642	396	69.99	NS

LEGEND:

- MONITORING WELL LOCATION (MW) - INSTALLED OCTOBER 2016
- MONITORING WELL LOCATION (MW) - INSTALLED MARCH 2016
- MONITORING WELL LOCATIONS (MW) - INSTALLED DECEMBER 2015
- MONITORING WELL LOCATIONS (MW) - INSTALLED MARCH 2016 & REINSTALLED SEPTEMBER 2019
- MONITORING WELL LOCATIONS (MW) - INSTALLED DECEMBER 2015 & REINSTALLED SEPTEMBER 2019

VOC	VOLATILE ORGANIC COMPOUND
ND	NONE DETECTED
GQS	GROUNDWATER QUALITY STANDARDS
ug/L	MICROGRAM PER LITER
	EXCEEDS NYSDEC TOGS STANDARDS AND GUIDANCE VALUES-GA

0' 20' 40' 60'

SCALE IN FEET (FT.)

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

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HydroTech

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

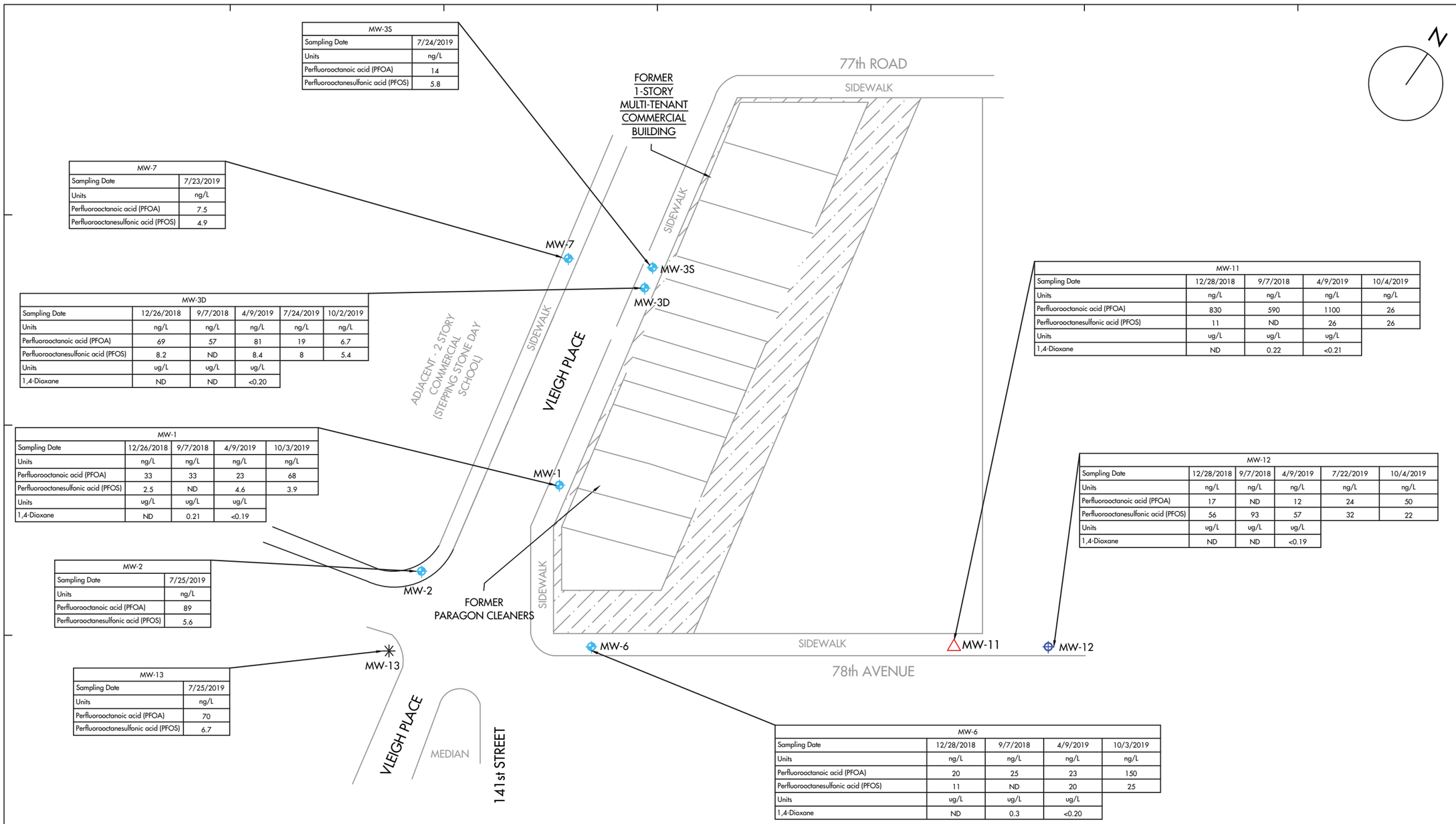
BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

PROJECT FIGURE

FIGURE 11B: PRE- & POST-INJECTION RESULTS OF PCE AND TCE IN GROUNDWATER

PROJECT NO. 180120	DATE 10/11/2019
DRAWN BY G.T.	REVIEWED BY P.M.
SCALE (11X17) AS NOTED	APPROVED BY P.M.



MW-3S	
Sampling Date	7/24/2019
Units	ng/L
Perfluorooctanoic acid (PFOA)	14
Perfluorooctanesulfonic acid (PFOS)	5.8

MW-7	
Sampling Date	7/23/2019
Units	ng/L
Perfluorooctanoic acid (PFOA)	7.5
Perfluorooctanesulfonic acid (PFOS)	4.9

MW-3D					
Sampling Date	12/26/2018	9/7/2018	4/9/2019	7/24/2019	10/2/2019
Units	ng/L	ng/L	ng/L	ng/L	ng/L
Perfluorooctanoic acid (PFOA)	69	57	81	19	6.7
Perfluorooctanesulfonic acid (PFOS)	8.2	ND	8.4	8	5.4
Units	ug/L	ug/L	ug/L		
1,4-Dioxane	ND	ND	<0.20		

MW-1				
Sampling Date	12/26/2018	9/7/2018	4/9/2019	10/3/2019
Units	ng/L	ng/L	ng/L	ng/L
Perfluorooctanoic acid (PFOA)	33	33	23	68
Perfluorooctanesulfonic acid (PFOS)	2.5	ND	4.6	3.9
Units	ug/L	ug/L	ug/L	
1,4-Dioxane	ND	0.21	<0.19	

MW-2	
Sampling Date	7/25/2019
Units	ng/L
Perfluorooctanoic acid (PFOA)	89
Perfluorooctanesulfonic acid (PFOS)	5.6

MW-13	
Sampling Date	7/25/2019
Units	ng/L
Perfluorooctanoic acid (PFOA)	70
Perfluorooctanesulfonic acid (PFOS)	6.7

MW-11				
Sampling Date	12/28/2018	9/7/2018	4/9/2019	10/4/2019
Units	ng/L	ng/L	ng/L	ng/L
Perfluorooctanoic acid (PFOA)	830	590	1100	26
Perfluorooctanesulfonic acid (PFOS)	11	ND	26	26
Units	ug/L	ug/L	ug/L	
1,4-Dioxane	ND	0.22	<0.21	

MW-12					
Sampling Date	12/28/2018	9/7/2018	4/9/2019	7/22/2019	10/4/2019
Units	ng/L	ng/L	ng/L	ng/L	ng/L
Perfluorooctanoic acid (PFOA)	17	ND	12	24	50
Perfluorooctanesulfonic acid (PFOS)	56	93	57	32	22
Units	ug/L	ug/L	ug/L		
1,4-Dioxane	ND	ND	<0.19		

MW-6				
Sampling Date	12/28/2018	9/7/2018	4/9/2019	10/3/2019
Units	ng/L	ng/L	ng/L	ng/L
Perfluorooctanoic acid (PFOA)	20	25	23	150
Perfluorooctanesulfonic acid (PFOS)	11	ND	20	25
Units	ug/L	ug/L	ug/L	
1,4-Dioxane	ND	0.3	<0.20	

LEGEND:

- ✳ MONITORING WELL LOCATION (MW) - INSTALLED OCTOBER 2016
- ⊕ MONITORING WELL LOCATION (MW) - INSTALLED MARCH 2016
- ⊕ MONITORING WELL LOCATIONS (MW) - INSTALLED DECEMBER 2015
- △ MONITORING WELL LOCATIONS (MW) - INSTALLED MARCH 2016 & REINSTALLED SEPTEMBER 2019
- ND NONE DETECTED
- ng/L NANOGRAM PER LITER
- ug/L MICROGRAM PER LITER

0' 20' 40' 60'
SCALE IN FEET (FT.)

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

STATE OF NEW YORK · TAREK ZAKI KHOURI · 086611 · LICENSED PROFESSIONAL ENGINEER

HydroTech

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

77-57 VLEIGH PLACE
FLUSHING, NEW YORK

PROJECT FIGURE

FIGURE 12: PFOA, PFOS AND 1,4-DIOXANE CONCENTRATIONS IN GROUNDWATER

PROJECT NO.	DATE
180120	10/31/2019
DRAWN BY G.T.	REVIEWED BY P.M.
SCALE (11X17) AS NOTED	APPROVED BY P.M.

SV-11			
Date	10/17/2016	11/15/2018	10/9/2019
VOCs	ug/m3	ug/m3	ug/m3
Tetrachloroethylene	2,100	5.2	220
Trichloroethylene	ND	ND	2.2

SV-6			
Date	12/3/2015	11/15/2018	10/9/2019
VOCs	ug/m3	ug/m3	ug/m3
Tetrachloroethylene	130	41.4	1.1
Trichloroethylene	ND	ND	ND

SV-3			
Date	11/23/2014	11/15/2018	10/9/2019
VOCs	ug/m3	ug/m3	ug/m3
Tetrachloroethylene	10	2.8	18
Trichloroethylene	0.64	1.0	5.1

SV-7			
Date	12/3/2015	11/15/2018	10/9/2019
VOCs	ug/m3	ug/m3	ug/m3
Tetrachloroethylene	72	35.9	110
Trichloroethylene	4.10	8.6	68

SV-8			
Date	10/17/2016	11/15/2018	10/9/2019
VOCs	ug/m3	ug/m3	ug/m3
Tetrachloroethylene	37,000	813.6	320
Trichloroethylene	6,000	41.4	320

SV-13		
Date	10/17/2016	10/9/2019
VOCs	ug/m3	ug/m3
Tetrachloroethylene	9	3.9
Trichloroethylene	ND	ND

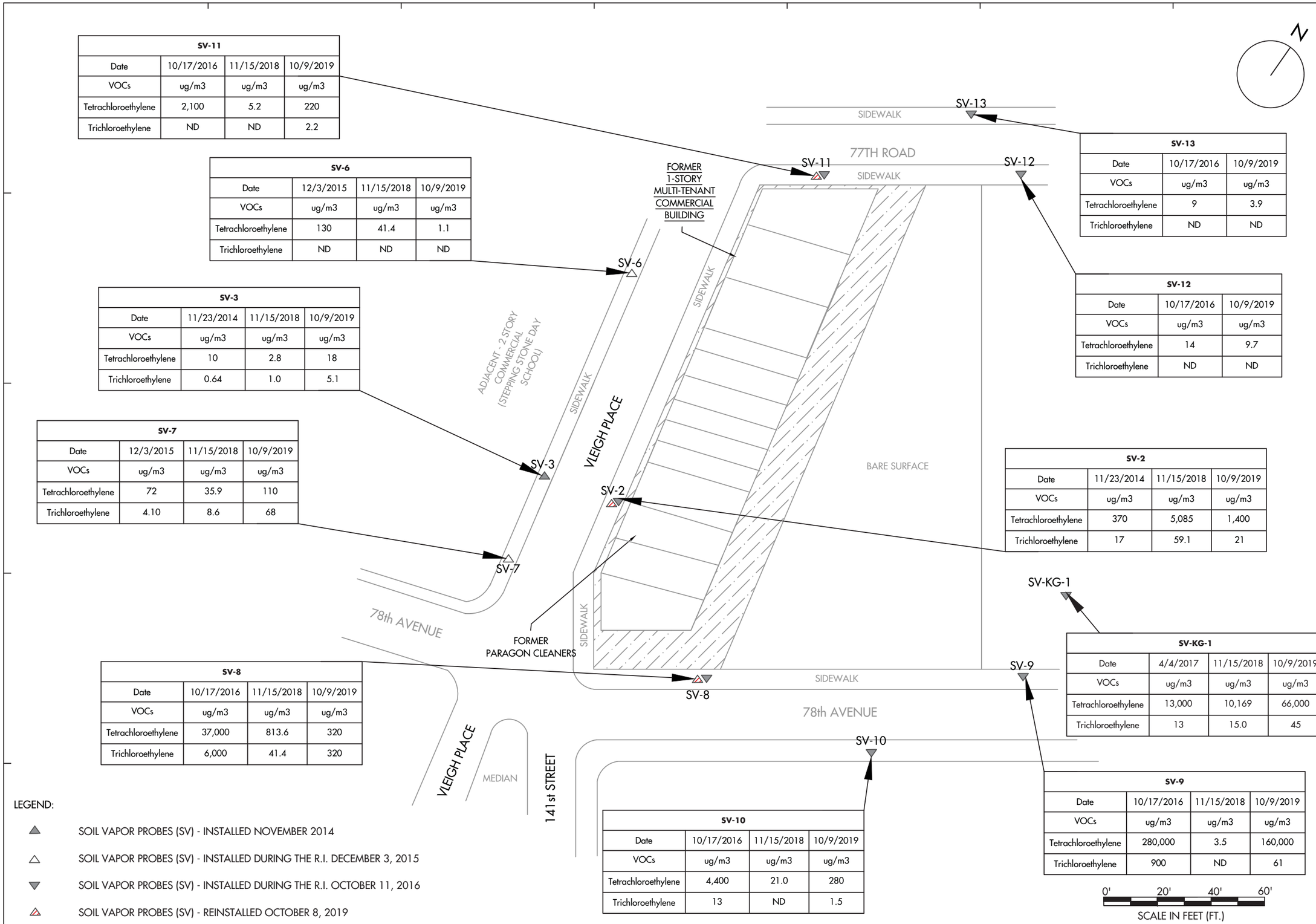
SV-12		
Date	10/17/2016	10/9/2019
VOCs	ug/m3	ug/m3
Tetrachloroethylene	14	9.7
Trichloroethylene	ND	ND

SV-2			
Date	11/23/2014	11/15/2018	10/9/2019
VOCs	ug/m3	ug/m3	ug/m3
Tetrachloroethylene	370	5,085	1,400
Trichloroethylene	17	59.1	21

SV-KG-1			
Date	4/4/2017	11/15/2018	10/9/2019
VOCs	ug/m3	ug/m3	ug/m3
Tetrachloroethylene	13,000	10,169	66,000
Trichloroethylene	13	15.0	45

SV-9			
Date	10/17/2016	11/15/2018	10/9/2019
VOCs	ug/m3	ug/m3	ug/m3
Tetrachloroethylene	280,000	3.5	160,000
Trichloroethylene	900	ND	61

SV-10			
Date	10/17/2016	11/15/2018	10/9/2019
VOCs	ug/m3	ug/m3	ug/m3
Tetrachloroethylene	4,400	21.0	280
Trichloroethylene	13	ND	1.5



LEGEND:

- SOIL VAPOR PROBES (SV) - INSTALLED NOVEMBER 2014
- SOIL VAPOR PROBES (SV) - INSTALLED DURING THE R.I. DECEMBER 3, 2015
- SOIL VAPOR PROBES (SV) - INSTALLED DURING THE R.I. OCTOBER 11, 2016
- SOIL VAPOR PROBES (SV) - REINSTALLED OCTOBER 8, 2019

0' 20' 40' 60'

SCALE IN FEET (FT.)

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

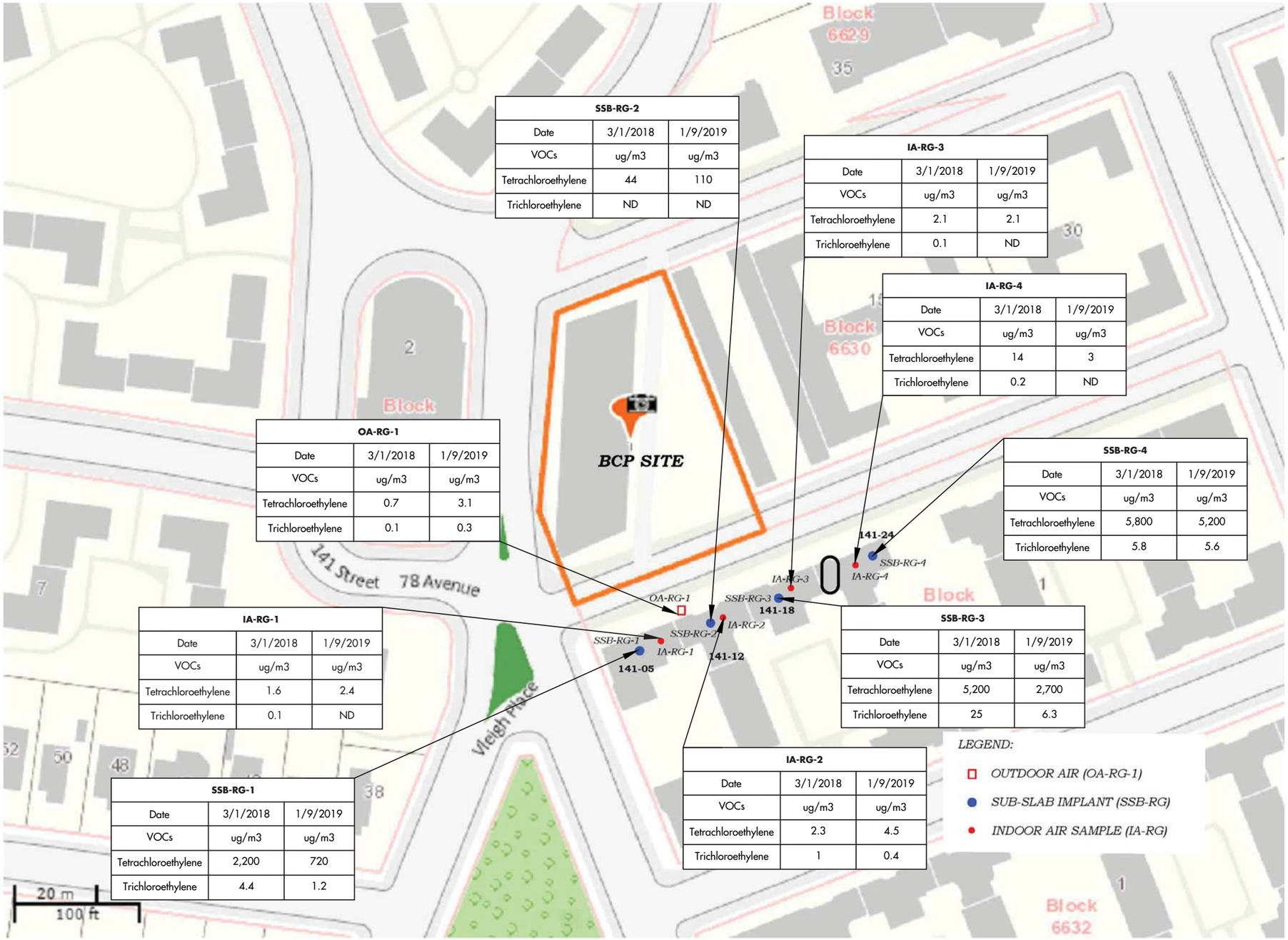
PROJECT NAME AND ADDRESS

77-57 VLEIGH PLACE
QUEENS, NY

PROJECT FIGURE

FIGURE 13: PCE AND TCE CONCENTRATIONS IN OFF-SITE SOIL VAPORS

PROJECT NO.	DATE
180120	12/19/2019
DRAWN BY A.R.	REVIEWED BY P.M.
SCALE (11X17) AS NOTED	APPROVED BY P.M.



SSB-RG-2		
Date	3/1/2018	1/9/2019
VOCs	ug/m3	ug/m3
Tetrachloroethylene	44	110
Trichloroethylene	ND	ND

IA-RG-3		
Date	3/1/2018	1/9/2019
VOCs	ug/m3	ug/m3
Tetrachloroethylene	2.1	2.1
Trichloroethylene	0.1	ND

IA-RG-4		
Date	3/1/2018	1/9/2019
VOCs	ug/m3	ug/m3
Tetrachloroethylene	14	3
Trichloroethylene	0.2	ND

OA-RG-1		
Date	3/1/2018	1/9/2019
VOCs	ug/m3	ug/m3
Tetrachloroethylene	0.7	3.1
Trichloroethylene	0.1	0.3

SSB-RG-4		
Date	3/1/2018	1/9/2019
VOCs	ug/m3	ug/m3
Tetrachloroethylene	5,800	5,200
Trichloroethylene	5.8	5.6

IA-RG-1		
Date	3/1/2018	1/9/2019
VOCs	ug/m3	ug/m3
Tetrachloroethylene	1.6	2.4
Trichloroethylene	0.1	ND

SSB-RG-3		
Date	3/1/2018	1/9/2019
VOCs	ug/m3	ug/m3
Tetrachloroethylene	5,200	2,700
Trichloroethylene	25	6.3

SSB-RG-1		
Date	3/1/2018	1/9/2019
VOCs	ug/m3	ug/m3
Tetrachloroethylene	2,200	720
Trichloroethylene	4.4	1.2

IA-RG-2		
Date	3/1/2018	1/9/2019
VOCs	ug/m3	ug/m3
Tetrachloroethylene	2.3	4.5
Trichloroethylene	1	0.4

N

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

STATE OF NEW YORK · TAREK ZAKI KHOURI · LICENSED PROFESSIONAL ENGINEER · 086611

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

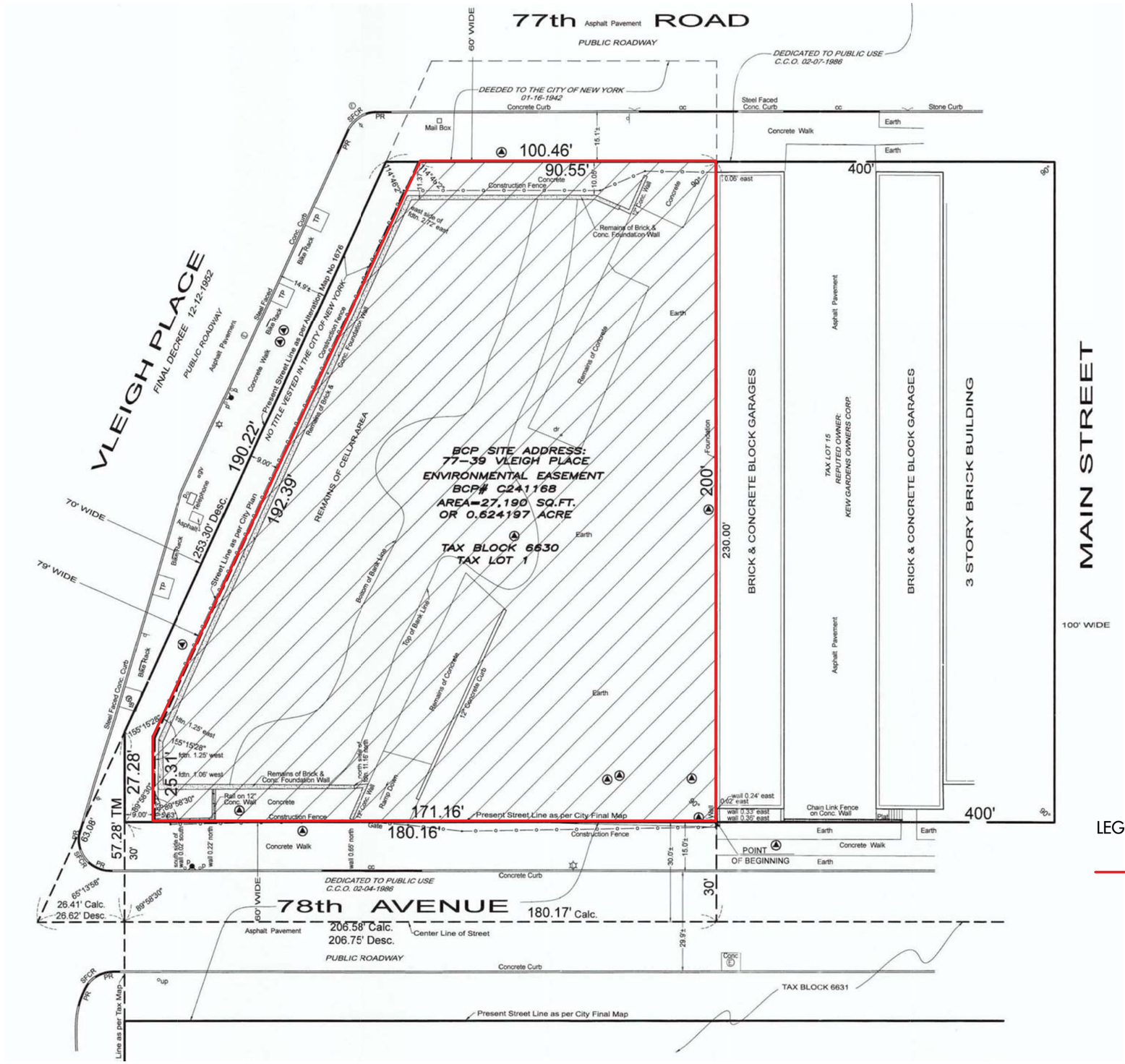
PROJECT NAME AND ADDRESS

77-57 VLEIGH PLACE
QUEENS, NY

PROJECT FIGURE

FIGURE 14: PCE AND TCE CONCENTRATIONS IN SUB-SLAB VAPORS AT REGENCY GARDEN COMPANY

PROJECT NO.	DATE
180120	12/19/2019
DRAWN BY: A.R.	REVIEWED BY: P.M.
SCALE (11X17): AS NOTED	APPROVED BY: P.M.



LEGEND:

INSTITUTIONAL CONTROL BOUNDARIES

0 30 60

APPROXIMATE SCALE IN FEET

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

STATE OF NEW YORK
TAREK ZAKI KHOURI
LICENSED PROFESSIONAL ENGINEER
086611

HydroTech

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

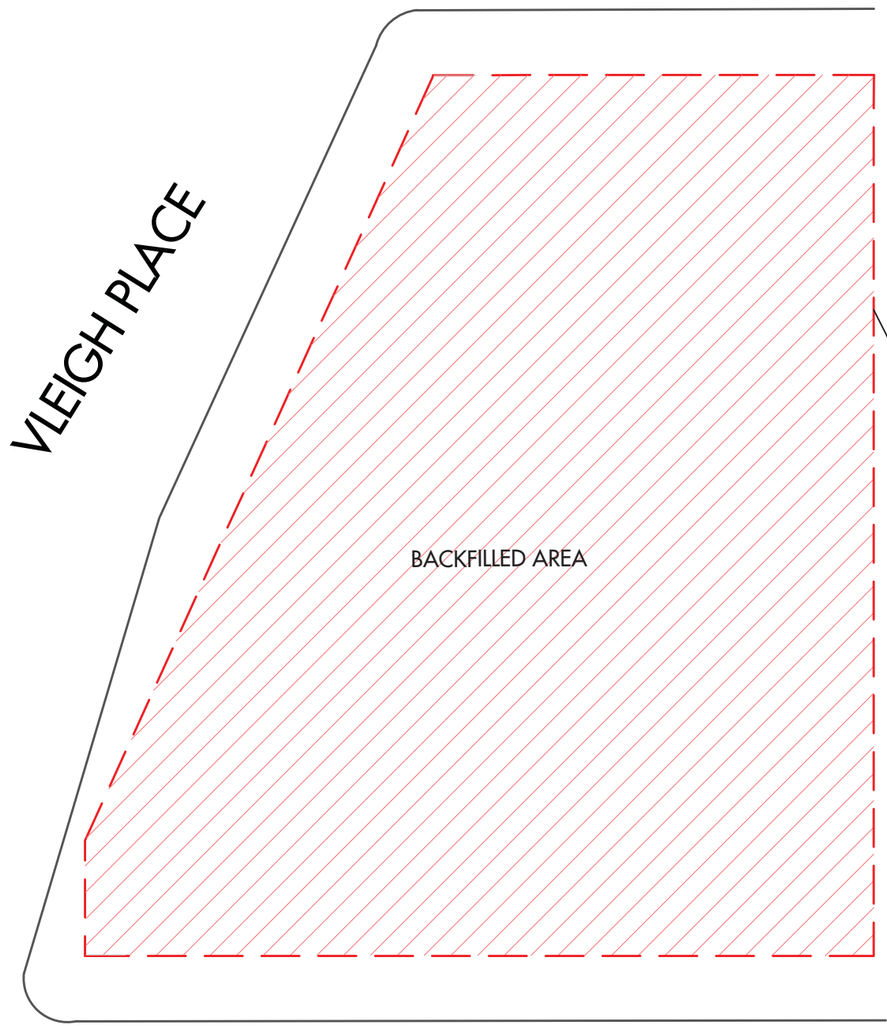
PROJECT NAME AND ADDRESS

77-57 VLEIGH PLACE
QUEENS, NY 11367

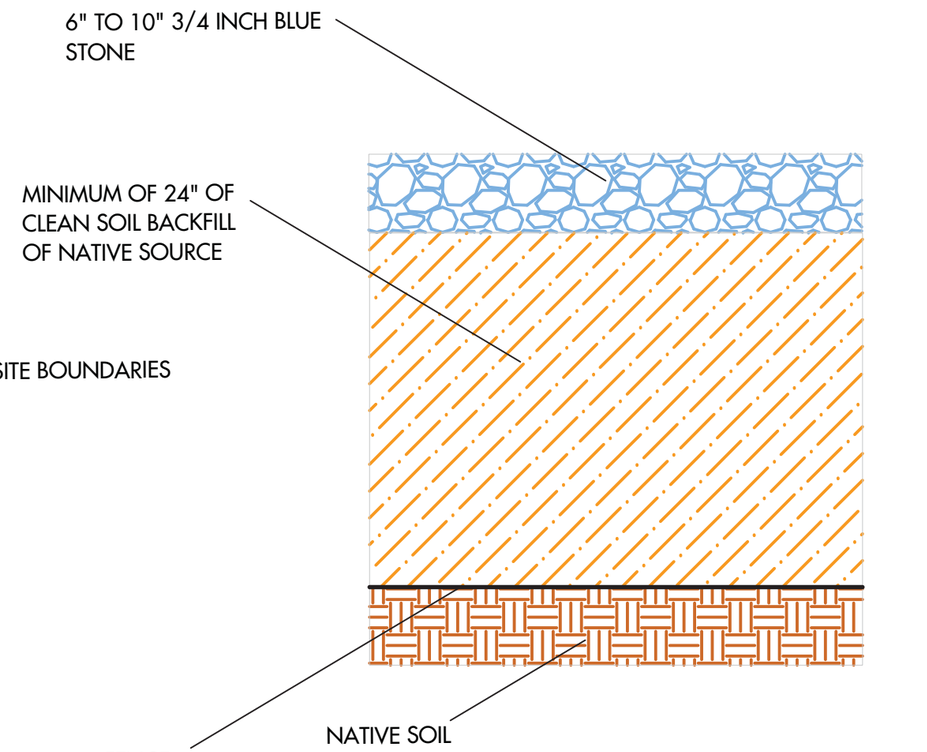
PROJECT FIGURE

FIGURE 15: INSTITUTIONAL CONTROL BOUNDARIES

PROJECT NO.	DATE
180120	10/29/19
DRAWN BY: G.T.	REVIEWED BY: P.M.
SCALE (11X17): NOT TO SCALE	APPROVED BY: P.M.



PLAN VIEW OF INSTALLED ENGINEERING CONTROLS



CROSS SECTION OF BACKFILL

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

STATE OF NEW YORK · TAREK ZAKI KHOURI · LICENSED PROFESSIONAL ENGINEER · 086611

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HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

77-57 VLEIGH PLACE
QUEENS, NY

PROJECT FIGURE

FIGURE 16: LOCATION OF INSTALLED ENGINEERING CONTROLS

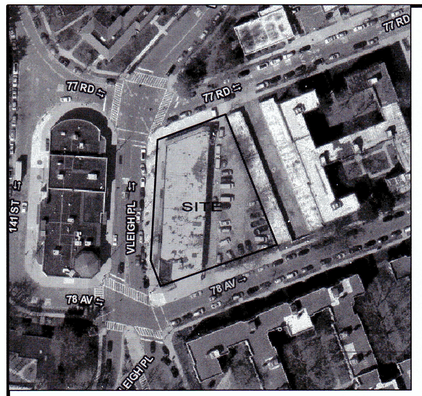
PROJECT NO.	DATE
180120	10/29/2019
DRAWN BY G.T.	REVIEWED BY P.M.
SCALE (11X17) NOT TO SCALE	APPROVED BY P.M.

Appendix 1
Environmental Easement

TITLE NO. CLS 4611

SURVEY NO. 66447–2

66447–2.DWG
66447001.CRD



VICINITY MAP
NOT TO SCALE

LEGAL DESCRIPTION

ENTIRE PROPERTY

ALL that certain plot, piece or parcel of land, situate, lying and being in the Borough and County of Queens, State of New York, bounded and described as follows:

BEGINNING at a point on the northerly side of 78th Avenue, distant 400.00 feet westerly from the corner formed by the intersection of the westerly side of Main Street with the northerly line of 78th Avenue,

RUNNING THENCE southerly, parallel to Main Street, a distance of 30.00 feet to a point in the center line of 78th Avenue, as laid out and shown on the Final Topographical Map of the City of New York;

RUNNING THENCE westerly at right angles along the center line of 78th Avenue, 206.75 feet to the easterly side of Vleigh Place, as shown 70 feet wide on Alteration Map Number 1676 of the Topographical Bureau of The City of New York;

RUNNING THENCE northerly along the easterly side of Vleigh Place a distance of 253.30 feet to its point of intersection with the southerly side of 77th Road, 60 feet wide, as ceded to The City of New York;

RUNNING THENCE easterly along the southerly side of 77th Road, 100.46 feet;

RUNNING THENCE southerly at right angles to the last mentioned course and parallel with Main Street, 200.00 feet to the point or place of BEGINNING.

EXCEPTING THEREFROM the triangle strip of land at the southwest corner of the premises measuring 57.28 feet, 26.62 feet, 63.08 feet.

Subject to a 30 foot easement for street purposes (78th Avenue) along the southerly 30 feet of premises.

Excepting therefrom so much as taken for the widening of Vleigh Place.

The above described parcel has an area of 34,553 square feet of 0.7932 Acre.

FOR INFORMATION ONLY:
Block: 6630 Lot: 1.

SCHEDULE B ITEMS

4. Covenants, conditions, easements, leases, agreements of record, etc. more fully set forth in Schedule herein.

6. Sewer Agreement in Liber 4182 cp 586.

7. Rights of others over and across and in and to so much of the subject premises as may be used as an alley and easement as set forth on the Tax Map for the subject premises.

9. A portion of the subject premises described m Schedule A herein lies in the bed of Vleigh Place as the same is laid out on the official map of the City of New York. This portion of the land is subject to the restricted use and limitations imposed by the provisions of Section 35 of the General City Law.

10. Variation between Tax Map and record description.

NOTES:

1. BELOW GRADE ENCROACHMENTS AND VAULTS IF ANY NOT LOCATED.
2. THERE ARE NO PARKING SPACES ON THE PREMISES.
3. THE PREMISES IS SERVED BY GAS, WATER, ELECTRICITY, TELEPHONE AND SANITARY SEWER LINES INSTALLED IN STREET & IN EASEMENT.
4. THE PREMISES HAS DIRECT ACCESS TO 78th AVENUE, VLEIGH PLACE & 77th ROAD
5. THERE IS EVIDENCE OF CONSTRUCTION OR EARTH MOVING.
6. NO EVIDENCE OF WETLANDS OBSERVED.
7. NO EVIDENCE OF CEMETERIES OR BURIAL GROUNDS FOUND.
8. THE PROPERTY DESCRIBED HEREIN IS THE SAME PROPERTY DESCRIBED IN COASTAL LAND SERVICES, INC. AS AGENT FOR OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY COMMITMENT NO. CLS 4611 WITH AN EFFECTIVE DATE OF 06-15-2018.
9. THE STREET ADDRESS OF THE SUBJECT PROPERTY IS 77-39 VLEIGH PLACE, QUEENS, NY.

ENVIRONMENTAL EASEMENT DESCRIPTION

ALL that certain plot piece or parcel of land situate lying and being in the Borough and County of Queens, City and State of New York bounded and described as follows:

BEGINNING at point on the northerly side of 78th Avenue (60 feet wide), distant 400.00 feet westerly from the corner formed by the intersection of the westerly side of Main Street (100 feet wide) with the northerly line of 78th Avenue;

RUNNING THENCE westerly along the northerly side of 78th Avenue, 180.16 feet to the easterly side of Vleigh Place as shown on present City Final Map;

RUNNING THENCE northerly along the easterly side of Vleigh Place, 27.28 feet to an angle point;

RUNNING THENCE continuing northerly along the easterly side of Vleigh Place (70 feet wide), 190.22 feet to the southerly side of 77th Road (60 feet wide);

RUNNING THENCE easterly along the southerly side of 77th Road, 100.46 feet to a point;

RUNNING THENCE southerly at right angles to the southerly side 77th Road, 200 feet to the northerly side of 78th Avenue the point or place of BEGINNING.

The above described parcel has an area of 29,148 square feet or 0.66915 Acres.

THE PROPERTY IS COVERED BY BCP SITE # C241168

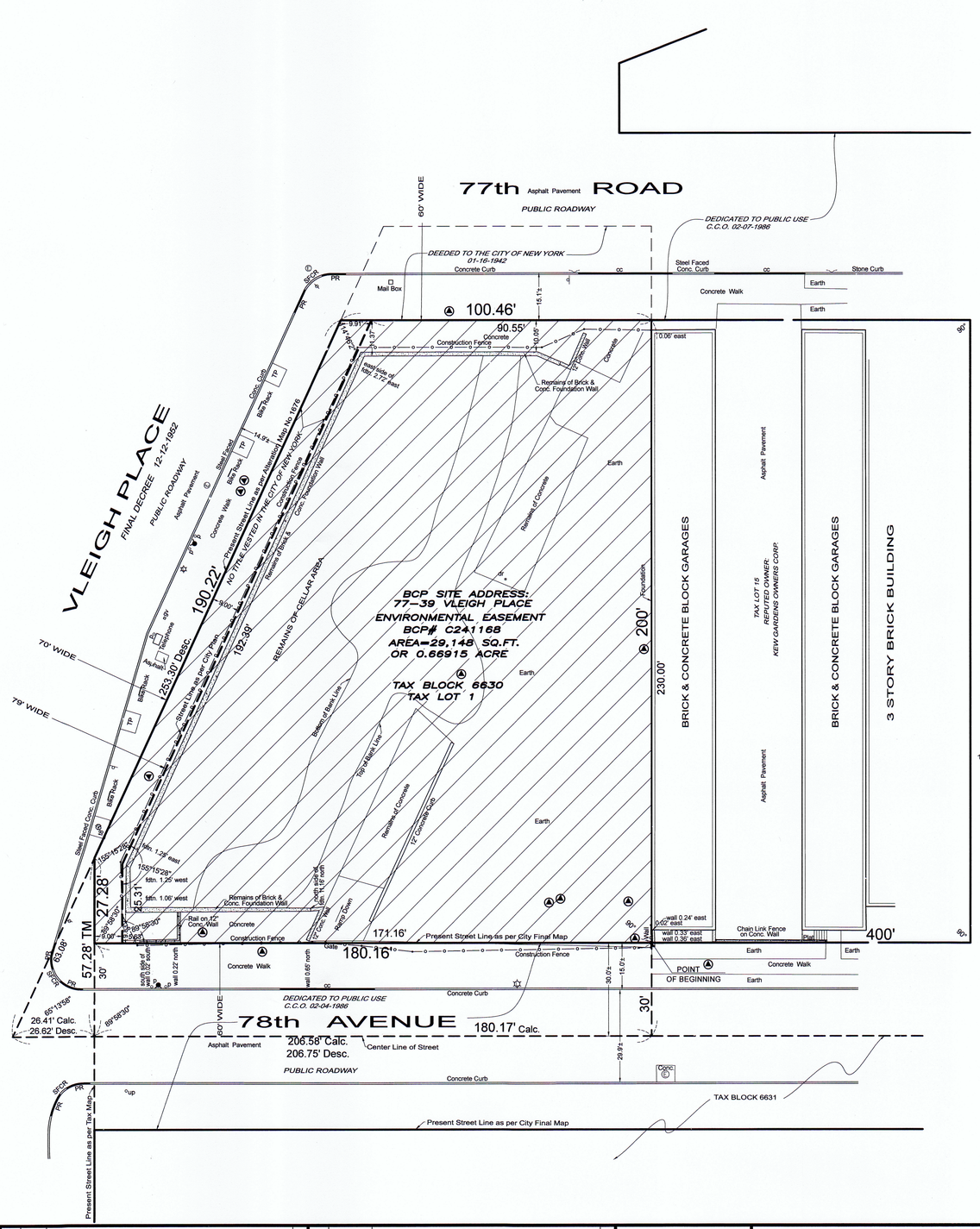
ENVIRONMENTAL EASEMENT AREA ACCESS

THE DEC OR THEIR AGENT MAY ACCESS THE ENVIRONMENTAL EASEMENT AREA AS SHOWN HEREON THROUGH ANY EXISTING STREET ACCESS OR BUILDING INGRESS/EGRESS ACCESS POINT.

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the New York Environmental Conservation Law.

THE ENGINEERING AND INSTITUTIONAL CONTROLS for the Easement are set forth in more detail in the Site Management Plan ("SMP"). A copy of the SMP must be obtained by any party with an interest in the property. The SMP may be obtained from the New York State Department of Environmental Conservation, Division of Environmental Remediation, Site Control Section, 625 Broadway, Albany, NY 12233 or at derweb@gw.dec.state.ny.us.

BROWNFIELD SITE &
ENVIRONMENTAL EASEMENT AREA



LEGEND

ASPH.....ASPHALT	PR.....PEDESTRIAN RAMP
BK.....BRICK	RET.....RETAINING
BSMT.....BASEMENT	RIM.....RIM ELEVATION SEWER MANHOLE
CC.....CURB CUT	SFCR.....STEEL FACED CURB ROUND
CCR.....CONCRETE CURB ROUND	STY.....STORY
CD.....CELLAR DOOR	TB.....TOP OF BANK ELEVATION
CLF.....CHAIN LINK FENCE	.....TRAFFIC LIGHT
CO.....CATCH BASIN CLEAN OUT	TEL.....TELEPHONE
CONC.....CONCRETE	TP.....TREE PIT
CRF.....CHAIN ROPE FENCE	.....TRAFFIC SIGN
CWA.....CELLAR WINDOW AREA	TW.....ELEVATION AT TOP OF WALL
DR.....DRAIN	UP.....UTILITY POLE
EL.....ELEVATION	VU.....VALVE UNKNOWN
FAB.....FIRE ALARM BOX	VLTU.....VAULT UNKNOWN
FC.....FILL CAP	VP.....VENT PIPE
FL EL.....FLOOR ELEVATION	WV.....WATER VALVE
GP.....GUARD POLE	12"G.....GAS MAIN WITH SIZE
GV.....GAS VALVE	12"S.....SEWER MAIN WITH SIZE
IF.....IRON FENCE	12"W.....WATER MAIN WITH SIZE
INL.....CATCH BASIN INLET ELEVATION	.....CATCH BASIN
INV.....SEWER INVERT ELEVATION	.....ELECTRIC MANHOLE / VAULT
.....LIGHT POLE	.....FIRE MANHOLE
MB.....MAIL BOX	.....GAS MANHOLE
MHU.....UNKNOWN MANHOLE	.....SEWER MANHOLE
OF.....OIL FILL	.....TELEPHONE MANHOLE
OHW.....OVERHEAD WIRES	.....WATER MANHOLE
P.....POLE	.....STEAM MANHOLE
PAVT.....PAVEMENT	STV.....STEAM VALVE
PM.....PARKING METER	.....TRAFFIC VAULT
PMULT...POLE, MULTIPLE USAGE	.....HYDRANT
.....SPRINKLER	.....TREE WITH SIZE
CATV.....CABLE TV BOX	17.0.....ESTABLISHED/LEGAL GRADE
.....SIAMESE	.....TRAFFIC FLOW
	.....MONITORING WELL

FLOOD HAZARD NOTE

THE PARCEL SURVEYED IS COMPRISED OF AREAS DESIGNATED AS ZONE X (LESS THAN 0.2% CHANCE OF FLOODING)
FEDERAL EMERGENCY MANAGEMENT AGENCY
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP
COMMUNITY PANEL NUMBER 360497 0227 F
EFFECTIVE DATE SEPTEMBER 5, 2007

20 0 20 40 60
GRAPHIC SCALE – FEET

DRAWN: GP

ESTABLISHED 1876 * SUCCESSOR TO:
B.G. MENIKHEIM C.S.*C.U. POWELL C.E.,C.S.*L.C.L. SMITH C.S.*NATHAN CAMPBELL C.E.,C.S.*A.U. WHITSON C.E.,C.S.* WILLIAM L. SAVACOOL C.E.,L.S.,C.S.*A.U. WHITSON INC. C.E.,C.S.*G. WEBER L.S.,C.S.*C. STIDOLPH R.A.,L.S.*WHITSON & POWELL INC. P.E.,L.S.,C.S.*KELLER & POWELL P.E.,L.S.,C.S.*LOUIS MONTROSE C.E.,L.S.,C.S.*FRED J. POWELL P.E.,L.S.,C.S.*

REV	DATE	DESCRIPTION	ck

REV	DATE	DESCRIPTION	ck
	03–21–19	ENVIRONMENTAL EASEMENT SURVEY	
A	- - -	ENVIRONMENTAL EASEMENT BOUNDARY REVISED	

UNAUTHORIZED ALTERATION OR ADDITION

MONTROSE
SURVEYING CO., LLP.
CITY & LAND SURVEYORS
116 20 METROPOLITAN AVE * RICHMOND HILL NY 11418–1090 * (718) 849–0600

CITY OF NEW YORK
COUNTY QUEENS
TAX BLOCK 6630
TAX LOT 1

SCALE: 1" = 20'

NYC DEPARTMENT OF FINANCE
OFFICE OF THE CITY REGISTER

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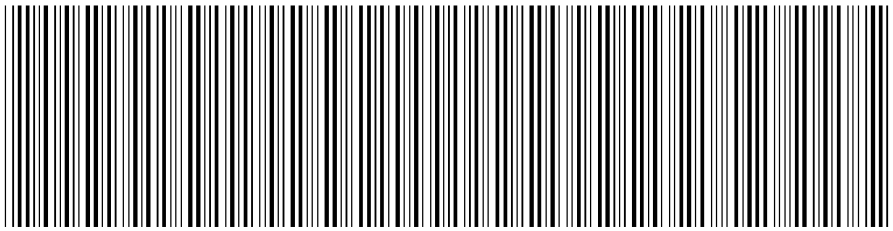

2019091000582001001E43FE

RECORDING AND ENDORSEMENT COVER PAGE **PAGE 1 OF 10**

Document ID: 2019091000582001 Document Date: 07-31-2019 Preparation Date: 09-10-2019
Document Type: EASEMENT
Document Page Count: 9

PRESENTER:
CHICAGO TITLE INSURANCE CO. (PICK-UP)
711 THIRD AVE, 5TH FLOOR
CT19-80118-Q CB
NEW YORK, NY 10017
212-880-1200
CTINYRECORDING@CTT.COM

RETURN TO:
BROWN DUKE & FOGEL, P. C.
350 FIFTH AVENUE, SUITE 4640
NEW YORK, NY 10118

PROPERTY DATA

Borough	Block	Lot	Unit	Address
QUEENS	6630	1	Partial Lot	77-39 VLEIGH PLACE

Property Type: OTHER Easement

CROSS REFERENCE DATA

CRFN_____ *or* DocumentID_____ *or* _____ Year_____ Reel____ Page_____ *or* File Number_____

PARTIES

GRANTOR/SELLER:
VP CAPITAL HOLDINGS LLC
62 WEST 47TH STREET, SUITE 603
NEW YORK, NY 10036

GRANTEE/BUYER:
NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION
625 BROADWAY
ALBANY, NY 12233

FEES AND TAXES

Mortgage :

Mortgage Amount:	$	0.00
Taxable Mortgage Amount:	$	0.00
Exemption:		
TAXES: County (Basic):	$	0.00
City (Additional):	$	0.00
Spec (Additional):	$	0.00
TASF:	$	0.00
MTA:	$	0.00
NYCTA:	$	0.00
Additional MRT:	$	0.00
TOTAL:	$	0.00
Recording Fee:	$	82.00
Affidavit Fee:	$	0.00

Filing Fee: $ 100.00

NYC Real Property Transfer Tax: $ 0.00

NYS Real Estate Transfer Tax: $ 0.00

RECORDED OR FILED IN THE OFFICE OF THE CITY REGISTER OF THE CITY OF NEW YORK
Recorded/Filed 09-23-2019 14:34
City Register File No.(CRFN): **2019000306865**

City Register Official Signature

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 31st day of July, 2019, between Owner(s) VP Capital Holdings LLC, having an office at 62 West 47th Street, Suite 603, New York, New York, 10036, County of New York, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee."), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 77-39 thru 77-63 Vleigh Place in the City of New York, County of Queens and State of New York, known and designated on the tax map of the New York City Department of Finance as tax map parcel number: Block 6630 Lot 1, being a portion of the property conveyed to Grantor by deed dated July 10, 2018 and recorded in the City Register of the City of New York as CRFN # 2018000235922. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 0.66915 +/- acres, and is hereinafter more fully described in the Land Title Survey dated March 21, 2019 prepared by Saeid Jalilvand, PLS, of Montrose Surveying Co., LLP., which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is

extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Brownfield Cleanup Agreement Index Number: C241168-03-15, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health and Mental Hygiene to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation

pursuant to Title 36 of Article 71 of the Environmental Conservation Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5) the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: C241168
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and

communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

11. Consistency with the SMP. To the extent there is any conflict or inconsistency between the terms of this Environmental Easement and the SMP, regarding matters specifically addressed by the SMP, the terms of the SMP will control.

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IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

VP Capital Holdings, LLC:

By: _____

Print Name: AVI MATOV

Title: Member Date: 7/22/19

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF Kings)

On the 22nd day of July, in the year 2019, before me, the undersigned, personally appeared Avi Matatov, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

_____
Notary Public - State of New York

NELLI TEPLINSKY
No. 01TE6055696
Notary Public, State of New York
Qualified in Kings County
My Commission Expires 03-05-2022

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting By and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: _____
Michael J. Ryan, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 31st day of July, in the year 2019 before me, the undersigned, personally appeared Michael J. Ryan, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

_____
Notary Public - State of New York

David J. Chiusano
Notary Public, State of New York
No. 01CH5032146
Qualified in Schenectady County
Commission Expires August 22, 20

SCHEDULE "A" PROPERTY DESCRIPTION

ENVIRONMENTAL EASEMENT DESCRIPTION

ALL that certain plot piece or parcel of land situate lying and being in the Borough and County of Queens, City and State of New York bounded and described as follows:

BEGINNING at point on the northerly side of 78th Avenue (60 feet wide), distant 400.00 feet westerly from the corner formed by the intersection of the westerly side of Main Street (100 feet wide) with the northerly line of 78th Avenue;

RUNNING THENCE westerly along the northerly side of 78th Avenue, 180.16 feet to the easterly side of Vlelgh Place as shown on present City Final Map;

RUNNING THENCE northerly along the easterly side of Vleigh Place, 27.28 feet to an angle point;

RUNNING THENCE continuing northerly along the easterly side of Vleigh Place (70 feet wide), 190.22 feet to the southerly side of 77th Road (60 feet wide);

RUNNING THENCE easterly along the southerly side of 77th Road, 100.46 feet to a point;

RUNNING THENCE southerly at right angles to the southerly side of 77th Road, 200 feet to the northerly side of 78th Avenue the point or place of BEGINNING.

The above described parcel has an area of 29,148 square feet or 0.66915 Acres.

Appendix 2
List of Site Contacts

LIST OF SITE CONTACTS

77-57 Vleigh Place
77-39/63 Vleigh Place a.k.a. 141-15 78th Avenue
Queens, New York
NYSDEC Site Number: C241168

Name	**Phone/Email Address**
Site Owner and Remedial Party Aldrich Management Co., LL Denis Rodgers	(516) 223-6200 DenisRodger@upcli.com
VP Capital Holdings LLC Avi Matatov	(212) 391-8029 avi@qblvdh.com
Hydro Tech Project Manager Hydro Tech Environmental Paul I. Matli	(718) 636-0800 pmatli@hydrotechenvironmental.com
NYSDEC DER Project Manager Daniel McNally	(518) 402-9767 Daniel.McNally@dec.ny.gov
NYSDEC Regional HW Engineer Michael J. Komoroske	(518) 402-9767 michael.komoroske@dec.ny.gov
NYSDOH Project Manager Dawn Hettrick	dawn.hettrick@health.ny.gov

Appendix 3
Monitoring Wells
Construction Logs

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631) 462-5866 • F (631) 462-5877

NYC OFFICE:
15 OCEAN AVENUE, SECOND FLOOR
BROOKLYN, NEW YORK 11225
T (718) 636-0800 • F (718) 636-0900

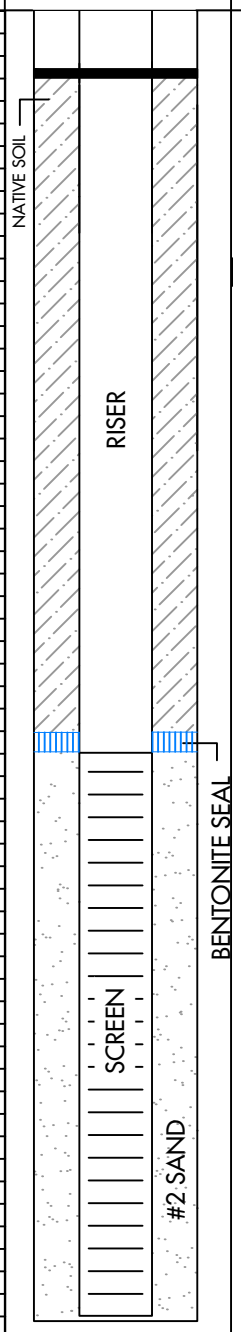
WELL CONSTRUCTION LOG

Job No: 140010 Date: 2-04-2014 Page: 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-1	Screen Size:	0.020"
Drilling Method:	DIRECT PUSH	Screen Interval:	25.00'
Total Depth:	55'	Diameter:	1"
Depth to Water:	35.33'	Riser Length:	30'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description



5" MANHOLE COVER

0'-30' - NATIVE SOIL

30'-31' - BENTONITE SEAL

31'-55' - #2 SAND

0'-31' - RISER

31'-55 - SCREEN

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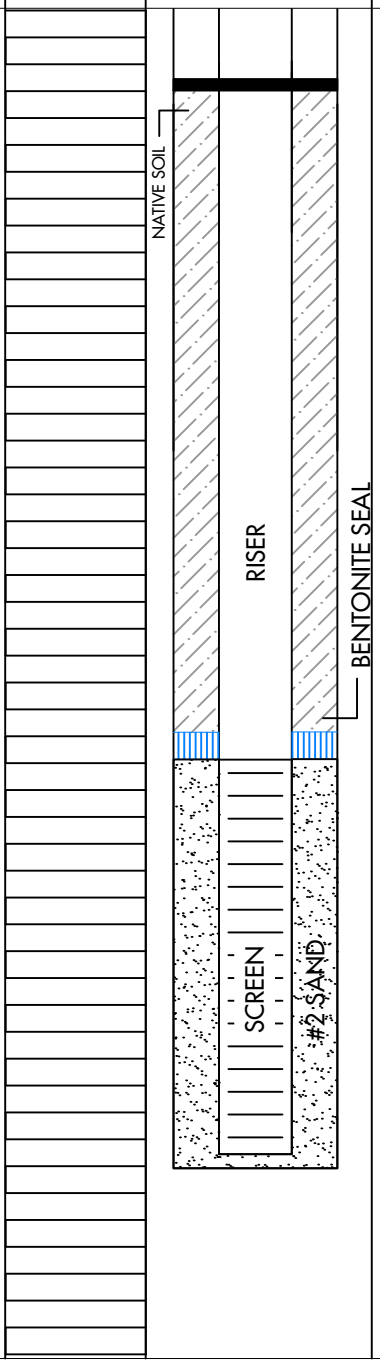
WELL CONSTRUCTION LOG

Job No:	180120	9/6/2019	1 OF 1
Location:	77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367		

Well Number:	MW-1	Screen Size:	0.020"
Drilling Method:	DIRECT PUSH	Screen Interval:	15'
Total Depth:	40'	Diameter:	1"
Depth to Water:	26.18'	Riser Length:	25'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description



5" MANHOLE COVER

0'-(24)' - NATIVE SOIL

(24)'-(25)' - BENTONITE SEAL

(25)'-(40)' - #2 SAND

0'-(25)' - RISER

(25)'-(40)' - SCREEN

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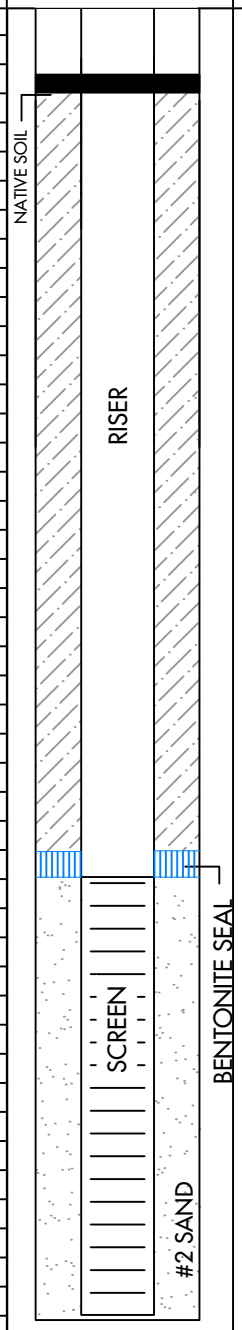
WELL CONSTRUCTION LOG

Job No: 1500127 Date: 11-27-2015 Page: 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-2	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	15'
Total Depth:	42.00'	Diameter:	1"
Depth to Water:	31.72'	Riser Length:	27'
Manhole Size:	8"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description
2, 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42			8" MANHOLE COVER 0'-26' - NATIVE SOIL 26'-27' - BENTONITE SEAL 27'-42' - #2 SAND 0'-27' - RISER 27'-42 - SCREEN

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

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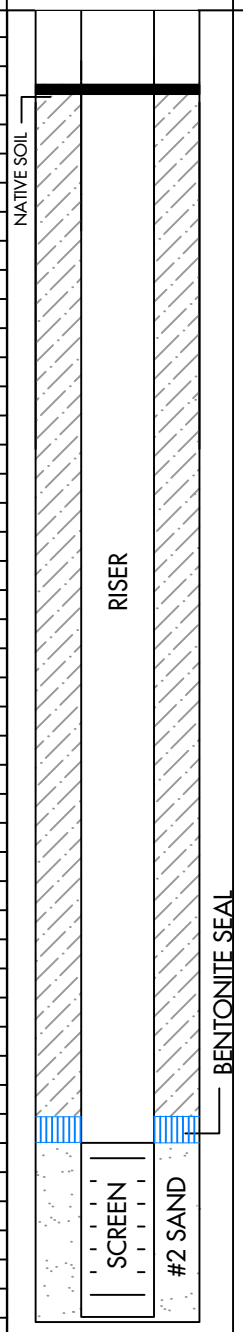
WELL CONSTRUCTION LOG

Job No: 1500127 Date: 11-30-2015 Page: 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-3D	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	5'
Total Depth:	42.00'	Diameter:	1"
Depth to Water:	31.37'	Riser Length:	37'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description
2, 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42			5" MANHOLE COVER 0'-36' - NATIVE SOIL 36'-37' - BENTONITE SEAL 37'-42' - #2 SAND 0'-37' - RISER 37'-42' - SCREEN

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NYC OFFICE:
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BROOKLYN, NEW YORK 11225
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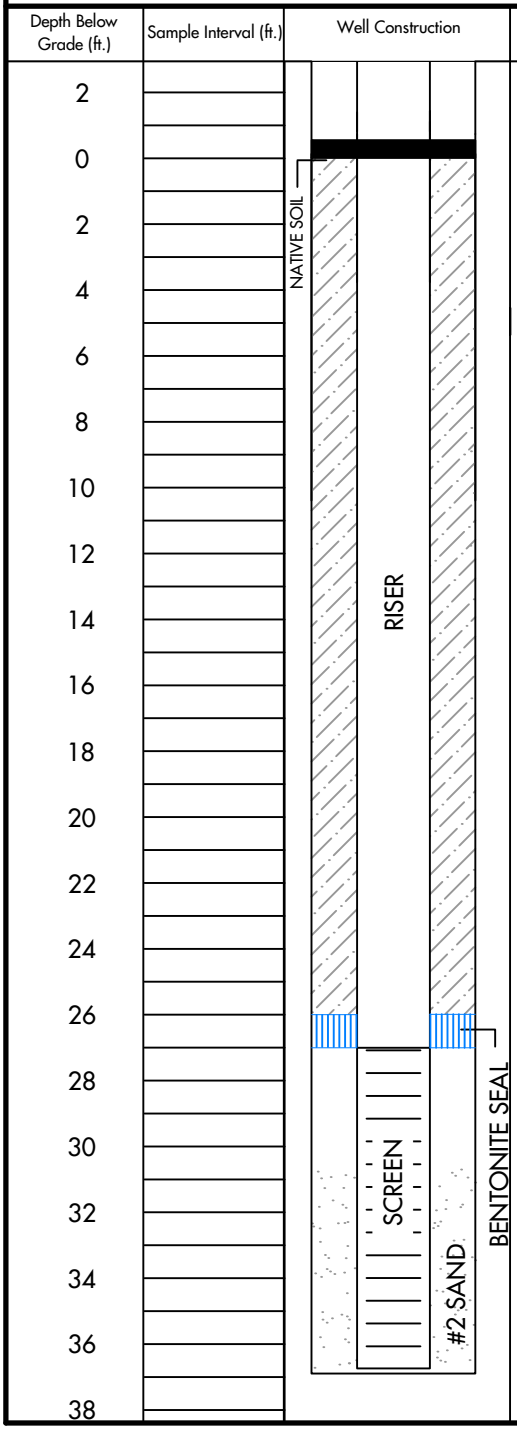
WELL CONSTRUCTION LOG

Job No: 140067 | 11-30-2015 | 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-3S	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	10.00'
Total Depth:	37.00'	Diameter:	1"
Depth to Water:	30.08'	Riser Length:	27'
Manhole Size:	8"	Sand Size:	#2



Description

8" MANHOLE COVER

0'-26' - NATIVE SOIL

26'-27' - BENTONITE SEAL

27'-37' - #2 SAND

0'-27' - RISER

27'-37' - SCREEN

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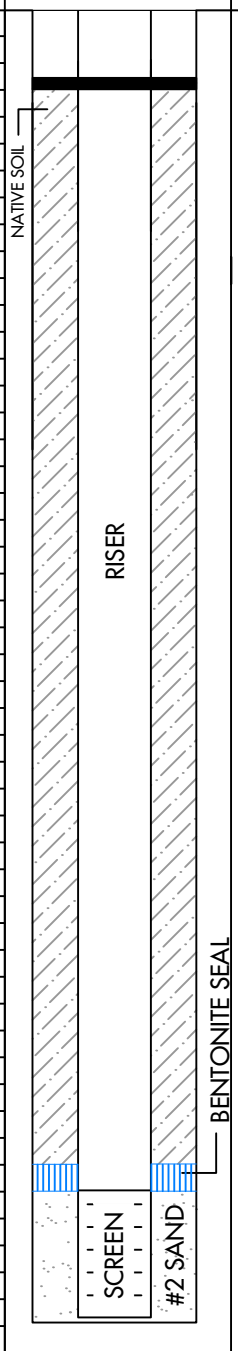
WELL CONSTRUCTION LOG

Job No: 150127 | 06/08/2018 | 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-5D	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	5.00'
Total Depth:	46.00'	Diameter:	1"
Depth to Water:	35.00'	Riser Length:	41'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description



5" MANHOLE COVER

0'-40' - NATIVE SOIL

40'-41' - BENTONITE SEAL

41'-46' - #2 SAND

0'-41' - RISER

41'-46' - SCREEN

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

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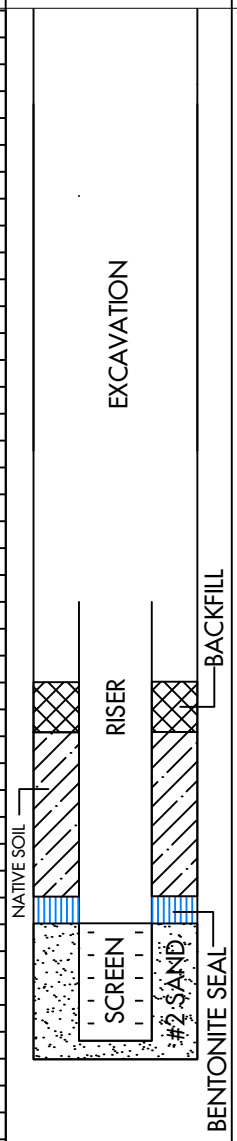
WELL CONSTRUCTION LOG

Job No: 180120 | 9/5/2019 | 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-5D	Screen Size:	0.020"
Drilling Method:	DIRECT PUSH	Screen Interval:	5'
Total Depth:	36'	Diameter:	1"
Depth to Water:	26'	Riser Length:	5'
Manhole Size:	N/A	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description
2			
0			
2			
4			22'-24' - BACKFILL
6			24'-30' - NATIVE SOIL
8			30'-31' - BENTONITE SEAL
10			31'-36' - #2 SAND
12			19'-31' - RISER
14			31'-36' - SCREEN
16			
18			
20			
22			
24			
26			
28			
30			
32			
34			
36			
38			
40			
42			
44			
46			



HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631) 462-5866 ● F (631) 462-5877

NYC OFFICE:
15 OCEAN AVENUE, SECOND FLOOR
BROOKLYN, NEW YORK 11225
T (718) 636-0800 ● F (718) 636-0900

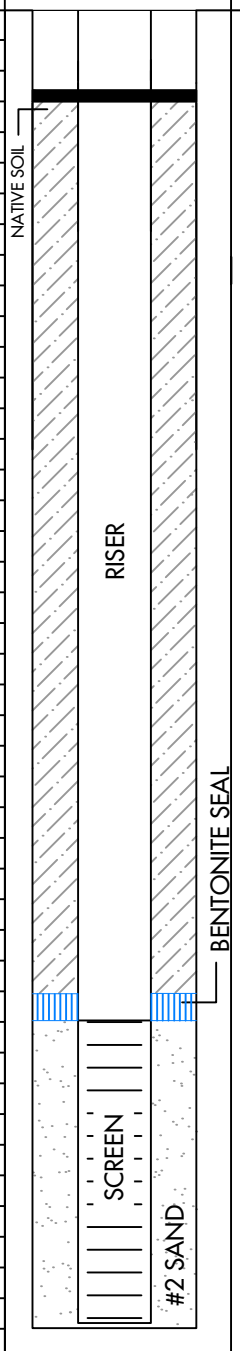
WELL CONSTRUCTION LOG

Job No: 150127 | 06/08/2018 | 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-5S	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	10.00'
Total Depth:	40.00'	Diameter:	1"
Depth to Water:	35.00'	Riser Length:	30'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description



5" MANHOLE COVER

0'-29' - NATIVE SOIL

29'-30' - BENTONITE SEAL

30'-40' - #2 SAND

0'-30' - RISER

30'-40' - SCREEN

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BROOKLYN, NEW YORK 11225
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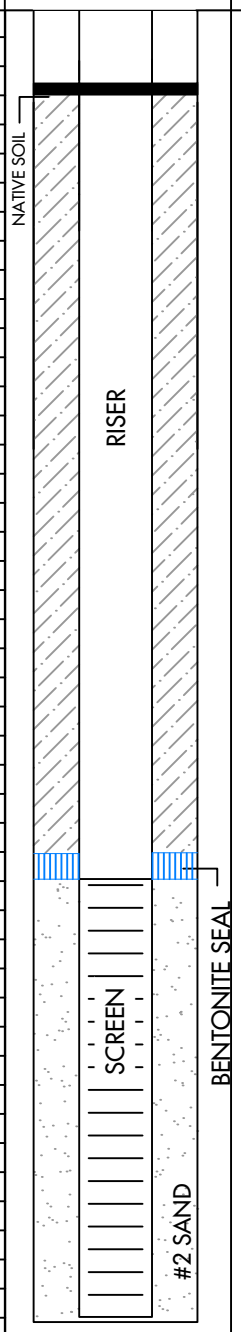
WELL CONSTRUCTION LOG

Job No: 1500127 Date: 12-02-2015 Page: 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-6	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	15'
Total Depth:	42.00'	Diameter:	1"
Depth to Water:	34.14'	Riser Length:	27'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description



5" MANHOLE COVER

0'-26' - NATIVE SOIL

26'-27' - BENTONITE SEAL

27'-42' - #2 SAND

0'-27' - RISER

27'-42 - SCREEN

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631) 462-5866 ● F (631) 462-5877

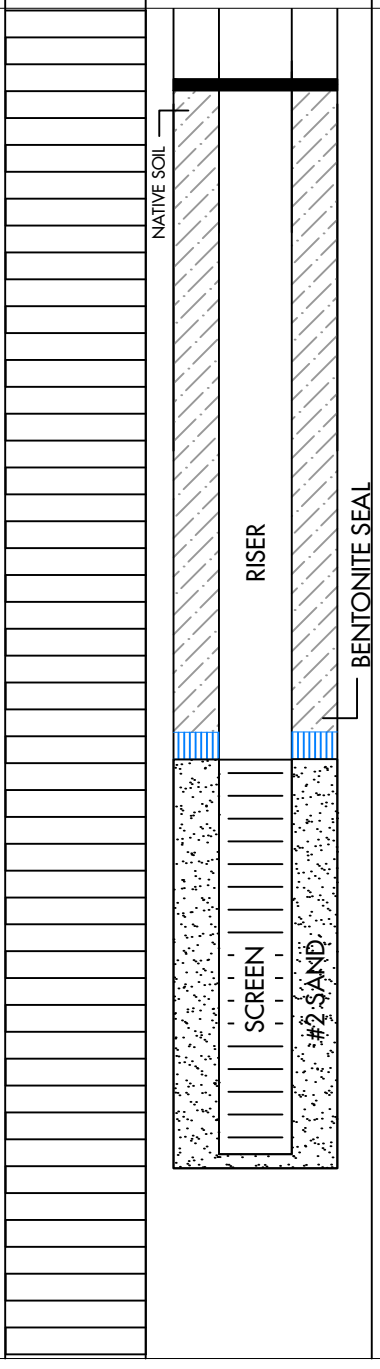
NYC OFFICE:
15 OCEAN AVENUE, SECOND FLOOR
BROOKLYN, NEW YORK 11225
T (718) 636-0800 ● F (718) 636-0900

WELL CONSTRUCTION LOG

Job No:	180120	9/6/2019	1 OF 1
Location:	77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367		

Well Number:	MW-6	Screen Size:	0.020"
Drilling Method:	DIRECT PUSH	Screen Interval:	15'
Total Depth:	40'	Diameter:	1"
Depth to Water:	28.79'	Riser Length:	25'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description



5" MANHOLE COVER

0'-(24)' - NATIVE SOIL

(24)'-(25)' - BENTONITE SEAL

(25)'-(40)' - #2 SAND

0'-(25)' - RISER

(25)'-(40)' - SCREEN

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631) 462-5866 • F (631) 462-5877

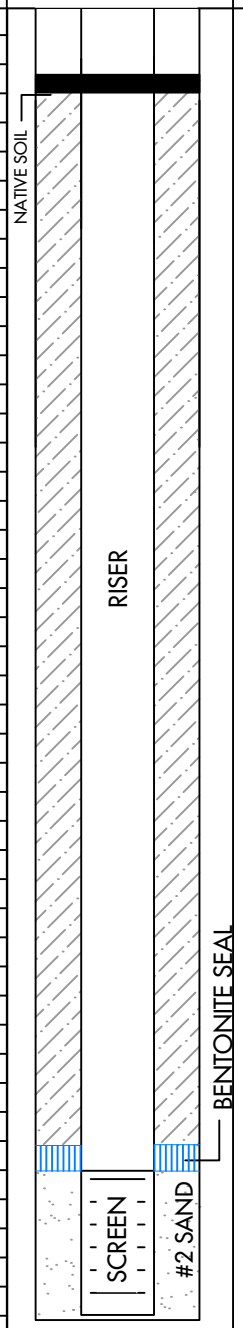
NYC OFFICE:
15 OCEAN AVENUE, SECOND FLOOR
BROOKLYN, NEW YORK 11225
T (718) 636-0800 • F (718) 636-0900

WELL CONSTRUCTION LOG

Job No: 1500127 Date: 11-27-2015 Page: 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-7D	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	5'
Total Depth:	42.00'	Diameter:	1"
Depth to Water:	30.94'	Riser Length:	37'
Manhole Size:	8"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description
2, 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42			8" MANHOLE COVER 0'-36' - NATIVE SOIL 36'-37' - BENTONITE SEAL 37'-42' - #2 SAND 0'-37' - RISER 37'-42 - SCREEN

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631) 462-5866 • F (631) 462-5877

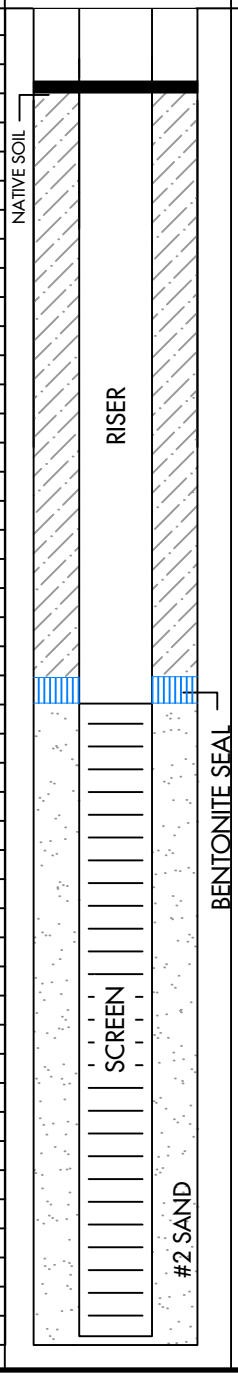
NYC OFFICE:
15 OCEAN AVENUE, SECOND FLOOR
BROOKLYN, NEW YORK 11225
T (718) 636-0800 • F (718) 636-0900

WELL CONSTRUCTION LOG

Job No: 160097 Date: 03-23-2016 Page: 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-8	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	22'
Total Depth:	43.00'	Diameter:	1"
Depth to Water:	32.80'	Riser Length:	21'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description
2, 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42			5" MANHOLE COVER 0'-20' - NATIVE SOIL 20'-21' - BENTONITE SEAL 21'-43' - #2 SAND 0'-21' - RISER 21'-43 - SCREEN

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

MAIN OFFICE:
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HAUPPAUGE, NEW YORK 11788
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NYC OFFICE:
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BROOKLYN, NEW YORK 11225
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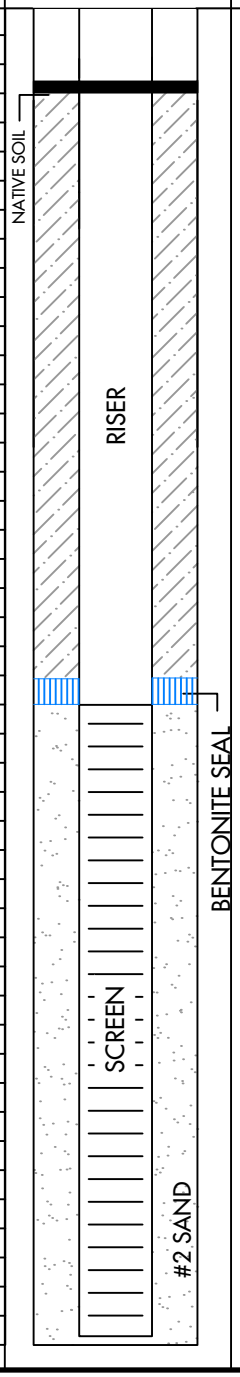
WELL CONSTRUCTION LOG

Job No: 160097 Date: 03-23-2016 Page: 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-9	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	22'
Total Depth:	43.00'	Diameter:	1"
Depth to Water:	32.53'	Riser Length:	21'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description
2, 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42			5" MANHOLE COVER 0'-20' - NATIVE SOIL 20'-21' - BENTONITE SEAL 21'-43' - #2 SAND 0'-21' - RISER 21'-43 - SCREEN

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631) 462-5866 ● F (631) 462-5877

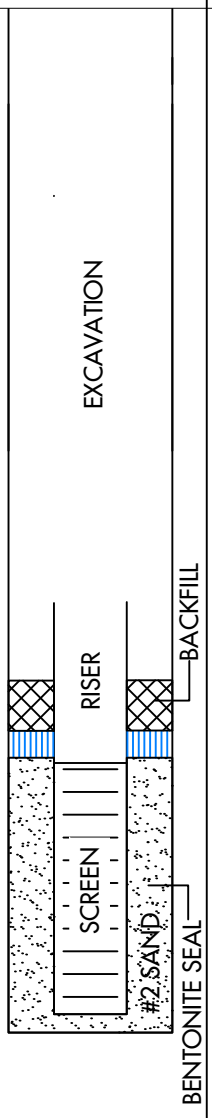
NYC OFFICE:
15 OCEAN AVENUE, SECOND FLOOR
BROOKLYN, NEW YORK 11225
T (718) 636-0800 ● F (718) 636-0900

WELL CONSTRUCTION LOG

Job No: 180120 | 9/5/2019 | 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-9	Screen Size:	0.020"
Drilling Method:	DIRECT PUSH	Screen Interval:	10'
Total Depth:	35'	Diameter:	1"
Depth to Water:	26'	Riser Length:	6'
Manhole Size:	N/A	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description
2, 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46			22'-24' - BACKFILL 24'-25' - BENTONITE SEAL 25'-35' - #2 SAND 19'-25' - RISER 25'-35' - SCREEN

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

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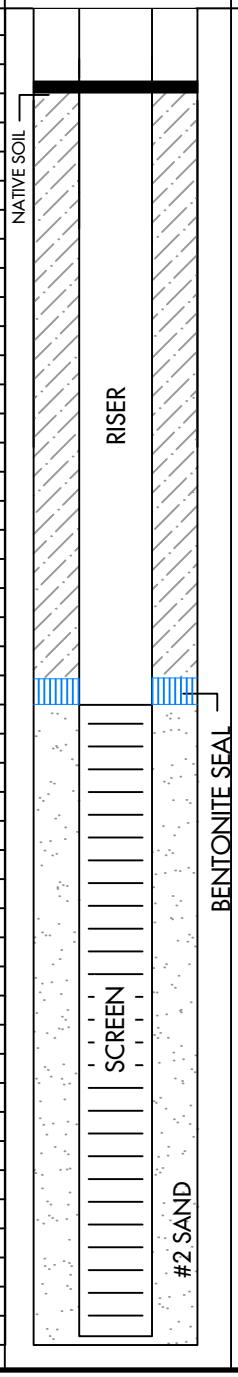
BROOKLYN, NEW YORK 11225
T (718) 636-0800 • F (718) 636-0900

WELL CONSTRUCTION LOG

Job No: 160097 Date: 03-23-2016 Page: 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-10	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	22'
Total Depth:	43.00'	Diameter:	1"
Depth to Water:	32.30'	Riser Length:	21'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description
2, 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42			5" MANHOLE COVER 0'-20' - NATIVE SOIL 20'-21' - BENTONITE SEAL 21'-43' - #2 SAND 0'-21' - RISER 21'-43 - SCREEN

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

MAIN OFFICE:
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HAUPPAUGE, NEW YORK 11788
T (631) 462-5866 ● F (631) 462-5877

NYC OFFICE:
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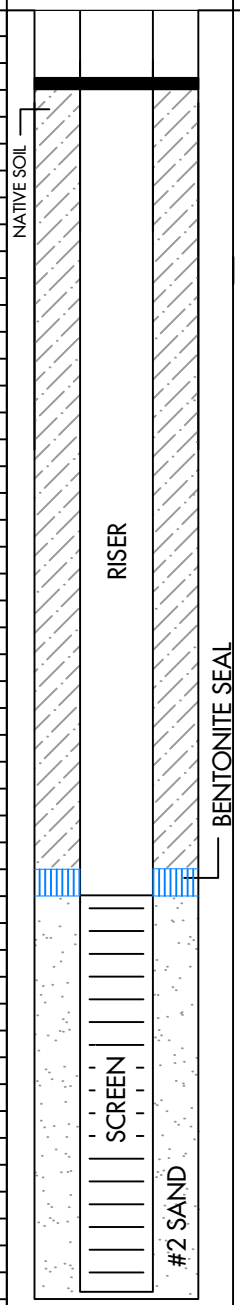
BROOKLYN, NEW YORK 11225
T (718) 636-0800 ● F (718) 636-0900

WELL CONSTRUCTION LOG

Job No: 160097 | 03-23-2016 | 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-11	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	15.00'
Total Depth:	45.00'	Diameter:	1"
Depth to Water:	33.57'	Riser Length:	30'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description
2, 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46			5" MANHOLE COVER 0'-29' - NATIVE SOIL 29'-30' - BENTONITE SEAL 30'-45' - #2 SAND 0'-30' - RISER 30'-45' - SCREEN

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

MAIN OFFICE:
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HAUPPAUGE, NEW YORK 11788
T (631) 462-5866 ● F (631) 462-5877

NYC OFFICE:
15 OCEAN AVENUE, SECOND FLOOR
BROOKLYN, NEW YORK 11225
T (718) 636-0800 ● F (718) 636-0900

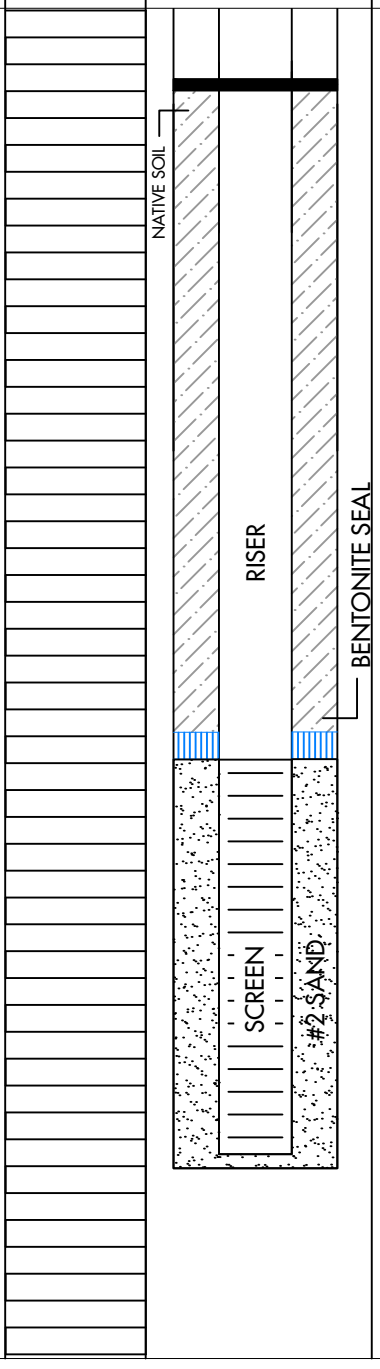
WELL CONSTRUCTION LOG

Job No: 180120 | 9/6/2019 | 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-11	Screen Size:	0.020"
Drilling Method:	DIRECT PUSH	Screen Interval:	15'
Total Depth:	40'	Diameter:	1"
Depth to Water:	26.18'	Riser Length:	25'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description



5" MANHOLE COVER

0'-(24)' - NATIVE SOIL

(24)'-(25)' - BENTONITE SEAL

(25)'-(40)' - #2 SAND

0'-(25)' - RISER

(25)'-(40)' - SCREEN

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

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BROOKLYN, NEW YORK 11225
T (718) 636-0800 ● F (718) 636-0900

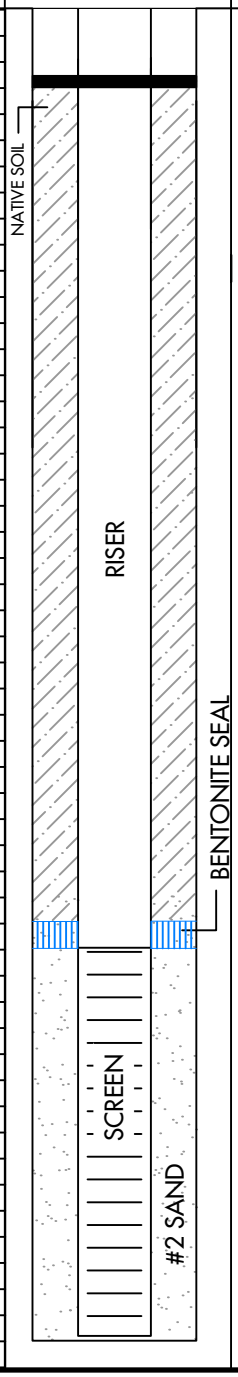
WELL CONSTRUCTION LOG

Job No: 160097 | 03-23-2016 | 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-12	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	15.00'
Total Depth:	48.00'	Diameter:	1"
Depth to Water:	36.00'	Riser Length:	33'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description



5" MANHOLE COVER

0'-32' - NATIVE SOIL

22'-33' - BENTONITE SEAL

33'-48' - #2 SAND

0'-33' - RISER

33'-48' - SCREEN

HYDRO TECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

MAIN OFFICE:
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HAUPPAUGE, NEW YORK 11788
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BROOKLYN, NEW YORK 11225
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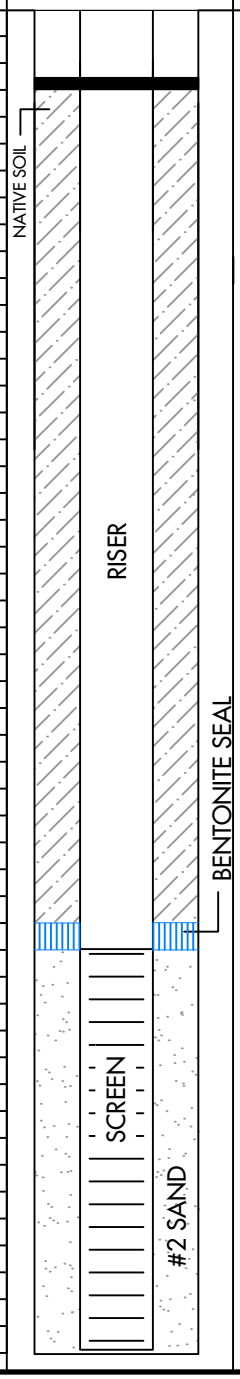
WELL CONSTRUCTION LOG

Job No: 160097 | 10-10-2016 | 1 OF 1

Location: 77-57 VLEIGH PLACE, QUEENS, NEW YORK 11367

Well Number:	MW-13	Screen Size:	0.010"
Drilling Method:	DIRECT PUSH	Screen Interval:	15.00'
Total Depth:	47.00'	Diameter:	1"
Depth to Water:	34.00'	Riser Length:	32'
Manhole Size:	5"	Sand Size:	#2

Depth Below Grade (ft.)	Sample Interval (ft.)	Well Construction	Description
2, 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46			5" MANHOLE COVER 0'-31' - NATIVE SOIL 31'-32' - BENTONITE SEAL 32'-47' - #2 SAND 0'-32' - RISER 32'-47' - SCREEN

Appendix 4
UST Removal Documentation

AARCO Environmental Services Corp.

Date: 06/14/2019

Attn: Chief Inspector Camacho
New York City Fire Department
Bureau of Fire Prevention
9 Metrotech, 3rd Floor
Brooklyn, NY 11201

**** AFFIDAVIT ****

Site Location: 77-55 Vleigh Place, Queens NY 11374
Job Description: Removal of one (1) 1,100 Fuel Oil Underground Storage Tank (UST)

In accordance with FDNY Code R3404-01:
I have supervised the permanent removal of: one (1) 1,100 Fuel Oil Underground storage tank(s) at: 77-55 Vleigh Place, Queens NY 11374

- Contents of tank(s) were removed and legally disposed of
- Tanks were thoroughly cleaned and rendered free of combustible vapors
- All pipes were removed
- Fill ports were removed
- Work was performed on: 04/12/2019
- Tank was Removed

Roger Terlaga

New York City Underground Tank Installer
Certified of License# 85314227, expiration 7-22-2019

Sworn before me this 14 day of June 2019

Pamela Pink
Notary Public

PAMELA PINK
NOTARY PUBLIC-STATE OF NEW YORK
No. 01PI6140141
Qualified in Suffolk County
My Commission Expires 01-23-2022

50 Gear Avenue, Lindenhurst, NY 11757 Phone (631) 586-5900 Fax (631) 586-5910

V-6857

J# 4566

Please print or type
(Form designed for use on elite (12-pitch) typewriter)

NON-HAZARDOUS MANIFEST

1. Generator's US EPA ID No. . . . . | Manifest Doc. No. 66503 | 2. Page 1 of

3. Generator's Name and Mailing Address
VP Capital Holdings LLC
62 West 47th Street Suite 603 New York NY 10036
4. Generator's Phone ( )

77-5[illegible] Vleigh Ave
Queens, NY 11374

5. Transporter 1 Company Name	6. US EPA ID Number	A. Transporter's Phone
AARCO ENVIRONMENTAL SERVICES CORP.	N.Y.R.0.0.0.1.0.7.3.2.6	631-586-5900
7. Transporter 2 Company Name	8. US EPA ID Number	B. Transporter's Phone
9. Designated Facility Name and Site Address	10. US EPA ID Number	C. Facility's Phone
DALE TRANSFER CORP. 129 DALE STREET WEST BABYLON, NY 11704	N/A	631-393-2882

11. Waste Shipping Name and Description	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
a. NON-HAZARDOUS WASTE SOLID				P
b. NON-HAZARDOUS WASTE LIQUID #2 Fuel oil	1	TT	1100	G
c.				
d.				

D. Additional Descriptions for Materials Listed Above

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
EMERGENCY PHONE # 631-586-5900

Profile # 2019-004

16. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name	Signature	Month	Day	Year
Samer Husein / Agent of Generator		04	12	19

17. Transporter 1 Acknowledgment of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
John Marchetti	John Marchetti	04	12	19

18. Transporter 2 Acknowledgment of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in item 19.

Printed/Typed Name	Signature	Month	Day	Year
Armando Sanchez		04	12	19

GENERATOR

TRANSPORTER

FACILITY

ORIGINAL – RETURN TO GENERATOR

R679

J# 4566

Please print or type
(Form designed for use on elite (12-pitch) typewriter.)

NON-HAZARDOUS MANIFEST

1. Generator's US EPA ID No. . . . . | Manifest Doc. No. 66502 | 2. Page 1 of

GENERATOR

3. Generator's Name and Mailing Address
VP Capatal Holding
62 West 47th Str. Suite 603 NY NY 10036

77-55/7 Vleigh Ave
Queens, NY 11374

4. Generator's Phone ( )

5. Transporter 1 Company Name
AARCO ENVIRONMENTAL SERVICES CORP.

6. US EPA ID Number
N.Y.R.0.0.0.1.0.7.3.2.6

A. Transporter's Phone
631-586-5900

7. Transporter 2 Company Name

8. US EPA ID Number

B. Transporter's Phone

9. Designated Facility Name and Site Address
DALE TRANSFER CORP.
129 DALE STREET
WEST BABYLON, NY 11704

10. US EPA ID Number
N/A

C. Facility's Phone
631-393-2882

11. Waste Shipping Name and Description	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
a. NON-HAZARDOUS WASTE SOLID TANK BOTTOMS.	0.1	DM	.400	P
b. NON-HAZARDOUS WASTE LIQUID				G
c.				
d.				

D. Additional Descriptions for Materials Listed Above

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
EMERGENCY PHONE # 631-586-5900 JOB# 4566

Profile # 2019-006

16. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name	Signature	Month	Day	Year
Samer Husein / Agent & generator		10	11	2019

TRANSPORTER

17. Transporter 1 Acknowledgment of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
JUAN C TORRES				

18. Transporter 2 Acknowledgment of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in item 19.

Printed/Typed Name	Signature	Month	Day	Year
Armando Sanchez		10	11	2019

ORIGINAL – RETURN TO GENERATOR

PBS # : 2-613061

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Petroleum Bulk Storage Program
Facility Information Report

Printed : 8/16/2019 pbsfacrpt_foil.rpt

Site Information

VACANT LOT
77-55 VLEIGH PLACE
QUEENS, NY 11367

Tax Map Information

Boro/Sec.: Queens
Block: 6630
Lot: 1

Site Owner Information

VP CAPITAL HOLDINGS, LLC
77-39 / 77-63 VLEIGH PLACE
QUEENS, NY 11367

(212) 704-4209

Owner Type : Corporate/Commercial/Other

Mail Correspondent Information

HYDRO TECH ENV. ENGINEERING &
15 OCEAN AVENUE, SUITE 2B
BROOKLYN, NY 11225

ATTN: PAUL I. MATLI

(718) 636-0800

Site Phone: (212) 704-4209
Town: New York City County: Queens
Facility Operator: NA

Authorized Representative: AVI MATATOV

Emergency Contact: AVI MATATOV
Emergency Phone: (212) 704-4209

Site Status : Unregulated/Closed
Site Type: Other

Reg Expires : 08/16/2024 Cert Printed:
Cert Issued: 08/16/2019

Total Active Tanks : 0
Total Active Capacity : 0

Last Inspected:
Inspected By:

(2) Tank No	(3) Tank Loc	(4) Status	(5) Date Instal	(5) Date Closed	(6) Capacity (gals)	(7) Product	(8) Tank Type	(9) Tank IP	(10) Tank EP	(11) Tank SC	(12) Tank LD	(13) Tank OP	(14) Tank SP	(15) Tank Disp	(16) Pipe Loc	(17) Pipe Type	(18) Pipe EP	(19) Pipe SC	(20) Pipe LD	(21) UDC	Next Tank Test	Next Line Test	Tank Owner
001	5	3	07/12/2018	04/12/2019	1,100	0001	01	00	00	00	00	00	00	00	00	00	00	00	00				
Subpart: 3		Category: 3																					

(See Reverse Side or Last Page for Code Keys)

Appendix 5
Excavation Work Plan

EXCAVATION WORK PLAN (EWP)

1. NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the NYSDEC. Table 1 below includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix 2

Table 1: Notifications*

NYSDEC Project Manager Daniel McNally	(518) 402-9767
NYSDEC Regional HW Engineer Michael J. Komoroske	(518) 402-9767

* Note: Notifications are subject to change and will be updated as necessary.

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work;
- A summary of the applicable components of this EWP;

- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix 5 of this SMP;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

2. SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a qualified environmental professional during all excavations into known or potentially contaminated material (remaining contamination). Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided in Section 4 of this Appendix.

3. SOIL STAGING METHODS

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

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

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

4. MATERIALS EXCAVATION AND LOAD-OUT

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site.

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

A truck wash will be operated on-site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other

materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

5. MATERIALS TRANSPORT OFF-SITE

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

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

Attachment 1 provides a map showing Truck transport routes. All trucks loaded with site materials will exit the vicinity of the site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport; (g) community input [where necessary]

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

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

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

6. MATERIALS DISPOSAL OFF-SITE

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

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

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

7. MATERIALS REUSE ON-SITE

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for reuse on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site will not be reused on-site.

8. FLUIDS MANAGEMENT

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

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a SPDES permit.

9. COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system installed at the Site will be restored in a manner that complies with decision document. In the absence of a finalized building foundation design plan, an interim composite cover comprised of a minimum of 6 to 10 inches of ¾-inch bluestone underlain by a minimum of 24 inches of clean soil fill material was installed at the bottom of excavation. This cover system is designed to be capped in the future by a 6-inch thick mat building slab. The demarcation layer, consisting of orange safety net, will be replaced to provide a visual reference to the top of the remaining contamination zone, the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this SMP. If the type of cover system changes from that which exists prior to the

excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP.

10. BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the site. A Request to Import/Reuse Fill or Soil form, which can be found at http://www.dec.ny.gov/regulations/67386.html, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

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

All imported soils will meet the backfill and cover soil quality standards established for the protection of groundwater and protection of ecological resources criteria in 6NYCRR 375-6.7(d). Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Solid waste will not be imported onto the site.

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

11. STORMWATER POLLUTION PREVENTION

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at

the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.

Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

12. EXCAVATION CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the site history and previous sampling results

provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

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

13. COMMUNITY AIR MONITORING PLAN

Location of air sampling stations will be based on the location of invasive action at the Site and also on generally prevailing wind conditions. These locations will be adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and at least two downwind monitoring stations. If a sensitive receptor, such as a school, day care or residential area is developed in the future adjacent to the site, a fixed monitoring station should be located at that site perimeter, regardless of wind direction,

Exceedances of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers.

14. ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site and on-site. Specific odor control methods to be used on a routine basis will include the application of spraying of an odor-suppressing agent, brand name Biosolve. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the remedial party's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

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

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

15. DUST CONTROL PLAN

A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved though the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

16. OTHER NUISANCES

A plan for rodent control will be developed and utilized by the contractor prior to and during site clearing and site grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.

ATTACHMENT 1

TRUCK TRANSPORT ROUTES

Figure 12: Truck Routes

Appendix 6
Health and Safety Plan

HEALTH & SAFETY PLAN

77-57 Vleigh Place
Block 6330; Lot 1
Flushing, New York

NYSDEC BCP Site Number: C241168

Table of Content

Figures
1. Directions to Hospital

Attachments
A. Accident/Incident Report Log
B. Health and Safety Fact Sheets

1.0 Introduction

The HASP has been prepared in conformance with the United States Department of Labor's Occupational Safety and Health Administration (OSHA) applicable regulations, safe work practices and the project's requirements. It addresses those activities associated with the implementation of the proposed Remedial Action Work Plan (RAWP) for the property located at 77-39/63 Vleigh Place in Kew Garden Hills neighborhood of Flushing Section of the County of Queens, New York (the "Site"). The Project Manager (PM), Site Safety Officer (SSO) and Hydro Tech field staff will implement the Plan during site work under the direction of the Qualified Environmental Professional (QEP) and the Corporate Safety Officer (CSO). Compliance with this HASP is required of all persons and third parties who perform fieldwork for this project. Assistance in implementing this HASP can be obtained from the Hydro Tech's SSO. The content of this HASP may change or undergo revision based upon additional information that is made available to health and safety personnel, monitoring results or changes in the technical scope of work. Any changes proposed must be reviewed by the SSO.

SCOPE OF WORK

The Scope of Work activities will include the following:

- SVE installation,
- SSDS Installation,
- Groundwater Sampling
- Soil excavation;

EMERGENCY NUMBERS

Contact	Phone Number
Jamaica Hospital Medical Center	718-206-7001
New York City EMS	911
NYPD	911
NYFD	911
National Response Center	800-424-8802
Poison Information Center	800-562-8816
Chemtree	800-424-9555

Project Management/Health and Safety Personnel

Title	Contact	Phone Number	Cell Phone
PM/QEP	Paul Matli	(718) 636-0800	(631) 457-0033
CSO	Dorina Aliu	(631) 462-5866	(631) 457-0032
SSO	Ruijie Xiu	(718) 636-0800	(631) 229-7090

Directions to *Jamaica Hospital Medical Center (See Figure 1)*

Upon leaving the Site, start going north on Vleigh Place toward 77th Road. Turn right onto 77th Road and then right onto Main Street. Take the ramp on the left to Verrazano-Narrows. Keep right at the fork, follow signs for Hillside Avenue/Jamaica Avenue and merge onto Van Wyck Boulevard. The hospital will be on the left side.

2.0 Health and Safety Staff

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

PROJECT MANAGER (PM)

- Maintains the overall responsibility for the health and safety of site personnel
- Ensures that adequate resources are provided to the field health and safety staff to carry out their responsibilities as outlined below.

- Ensures that fieldwork is scheduled with adequate personnel and equipment resources to complete the job safely.
- Ensures that adequate telephone communication between field crews and emergency response personnel is maintained.
- Ensures that field site personnel are adequately trained and qualified to work at the Site.

Resumes for Hydro Tech Project Staff involved in this project are provided in the QAPP (Appendix E) of the Supplemental Remedial Investigation Work Pan (Supplemental RIWP).

SITE SAFETY OFFICER (SSO)

As necessary, the Site Safety Officer will perform the following:

- Directs and coordinates health and safety monitoring activities.
- Ensures that field teams utilize proper personal protective equipment (PPE).
- Conducts initial on-Site, specific training prior to personnel and/or subcontractors proceeding to work.
- Conducts and documents periodic safety briefings; ensures that field team members comply with this
- Construction HASP.
- Completes and maintains Accident/Incident Report Forms.
- Notifies corporate administration of all accidents/incidents.
- Determines upgrade or downgrade of PPE based on site conditions and/or downgrade of PPE based
- on site conditions and/or real-time monitoring results.
- Ensures that monitoring instruments are calibrated daily or as determined by manufacturer's suggested
- instructions.
- Maintains health and safety field log books.
- Develops and ensures implementation of the Construction HASP.
- Approves revised or new safety protocols for field operations.
- Coordinates revisions of this Construction HASP with field personnel and the SSO Division
- Contracting Officer.
- Responsible for the development of new company safety protocols and procedures and resolution of
- any outstanding safety issues which may arise during the conduction of site work.
- Reviews personnel and subcontractors current and up-to-date medical examination and acceptability of health and safety training.

Appendix B contains Accident/Incident Report Log

FIELD PERSONNEL AND SUBCONTRACTORS (IF ANY)

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

3.0 Chemical & Waste Description/Characterization

The following list of chemicals is based on the materials either once stored onsite or believed to be formerly stored onsite:

- Known Contaminant(s) including VOCs, SVOCs, TAL metals, pesticides, PCBs

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

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

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

4.0 Hazard Assessment

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

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

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

CHEMICAL HAZARDS

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

- SVE installation, SSDS Installation, Groundwater Remediation and Soil excavation;

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

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

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

PHYSICAL HAZARDS

A variety of physical hazards may be present during Site activities. These hazards are similar to those associated with any construction type project. These physical hazards are due to motor vehicles, and heavy equipment operation, the use of improper use of power and hand tools, misuse of pressurized cylinders, walking on objects, tripping over objects, working on surfaces which have the potential to promote falling

(slips, trips, falls), mishandling and improper storage of solid and hazardous materials, skin burns, crushing of fingers, toes, limbs, hit on the head by falling objects or hit one's head due to not seeing the object of concern, temporary loss of one's hearing and/or eyesight. Theses hazards are not unique and are generally familiarly to most hazardous waste site workers at construction sites. Additional task specific safety requirements will be covered during safety briefings.

Noise

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

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

Heat/Cold Stress

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

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

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

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

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

- Acclimatize the body. Allow a period of adjustment to make further heat exposure endurable.
- Drink more liquids to replace body water lost during sweating.
- Rest is necessary and should be conducted under the monitoring condition from the SSO and the effect personnel physiological state.

- Wearing personal cooling devices. There are two basic designs; units with pockets for holding frozen packets and units that circulate a cooling fluid from a reservoir through tubes to different parts of the body. Both designs can be in the form of a vest, jacket or coverall. Some circulating units also have a copy for cooling the head

Cold temperatures can cause problems. The severe effects are FROSTBITE and HYPOTHERMIA. FROSTBITE is the most common injury resulting from exposure to cold. The extremities of the body are often affected. The signs of frostbite are:

- The skin turns white or grayish-yellow
- Pain is sometimes felt early but subsides later. Often there is no pain
- The affected part feels intensely cold and numb

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

STANDARD OPERATING PROCEDURES –where necessary, Hydro Tech will provide the necessary devices to effectively lockout or tagout energy isolating devices. Lockout/tagout devices will be the only

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

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

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

STANDARD OPERATING PROCEDURES

I. APPLICATION OF CONTROLS

A. Preparing to Shut Down Equipment

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

B. Equipment Shutdown and Isolation

1. If equipment is in operation, shut it down by the normal stopping procedure (stop button, switch).
2. Operate disconnects, switches, valves, or other energy isolating devices so that the equipment is de-energizing and isolated from its energy source(s).
3. Verify that equipment is shut down by operating equipment from the normal operating location and any remote locations.

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

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

b. Attempting to operate the equipment or machinery that is locked or tagged out. This includes all sources of energy, i.e. electrical, hydraulic, gravity, air, water, stream pressure, etc.
c. Verifying the presence and effectiveness of restraint (blocking) and energy dissipation or release (bleeding).

4. If there is a possibility of the re-accumulation of stored energy to a hazardous level, verification of isolation will be contained until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists.

D. Group Lockout/Tagout

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

II. RETURNING EQUIPMENT TO SERVICE

A. Restore Equipment to Normal Operating Status

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

B. Verify Equipment Ready for Operation

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

C. Notify Affected Employees of Impending Start-up

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

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

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

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

III. TEMPORARY REMOVAL OF LOCKOUT/TAGOUT PROTECTION

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

1. Clear the equipment of tools and materials that are non-essential to the operation.
2. Ensure the equipment components are operationally intact.
3. Remove employees from the equipment area.
4. Remove the lockout/tagout devices by the employee who installed in/them.
5. Energize and proceed with testing or positioning.

6. De-energize all systems and re-install all energy control measures.
7. Verify re-installed energy control measures are effective.

IV. SHIFT OR PERSONNEL CHANGES

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

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

V. CONTRACTOR NOTIFICATION

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

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

DEFINITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

GENERAL MACHINERY AND EQUIPMENT LIST

EQUIPMENT/LOCATION	ENERGY SOURCES/LOCATION
A. Excavator/backhoe	Diesel Engine
B. Dewatering pumps and piping system	Electric Power

5.0 Training

GENERAL HEALTH AND SAFETY TRAINING

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

Completion of the Hydro Tech Health and Safety Training Course for Hazardous Waste Operations or an approved equivalent will fulfill the requirements of this section. In addition to the required initial training, each employee shall have received 3 days of directly supervised on-the-job training. This training will address the duties the employees are expected to perform.The Hydro Tech SSO the responsibility of ensuring that personnel assigned to this project complies with these requirements. Written certification of completion of the required training will be provided to the SSO.

MANAGER/SUPERVISOR TRAINING

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

ANNUAL 8-HOUR REFRESHER TRAINING

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

SITE SPECIFIC TRAINING

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

ONSITE SAFETY BRIEFINGS

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

ADDITIONAL TRAINING

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

SUBCONTRACTOR TRAINING

Subcontractor personnel who work onsite, only occasionally, for a specific limited task and who are unlikely to be exposed over permissible exposure limits, may be exempted from the initial 40-hour training requirement. The SSO will determine if this exemption is allowed. In any case, the subcontractor personnel who are exposed to hazards are not exempted from the 40-hours training requirement nor medical surveillance requirements found in Section 8.1.

6.0 Medical Surveillance

GENERAL

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

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

MEDICAL SURVEILLANCE PROTOCOL
The medical surveillance protocol to be implemented is the occupational physicians' responsibility, but shall meet the requirements of CFR 1910.120 and ANSI Z88.2 (2000). The medical surveillance protocol shall, as a minimum, cover the following:

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

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

7.0 Site Control, PPE & Communications

SITE CONTROL

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

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

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

PERSONAL PROTECTIVE EQUIPMENT

GENERAL
The level of protection worn by field personnel will be enforced by the SSO. Levels of protection for general operations are provided below and are defined in this section. Levels of protection may be upgraded or downgraded at the discretion of the SSO. The decision shall be based on real-time air monitoring, site history data, and prior site experience. Any changes in the level of protection shall be recorded in the health and safety field logbook. It is assumed that Level D PPE will be required during the entire duration of the Site redevelopment.

PERSONAL PROTECTIVE EQUIPMENT SPECIFICATIONS
For tasks requiring Level B PPE, the following equipment shall be used:

- Cotton or disposable coveralls
- Chemical protective suit (e.g. Saran-coated Tyvek®)
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC), steel toe/shank
- Boot Covers (as needed)
- Hard Hat
- Hearing protection (as needed)
- Splash suit and face shield for decontamination operations (as needed)
- An airline respirator or self-contained breathing apparatus (SCBA)

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

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

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

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

For tasks requiring respiratory protection, the following equipment shall be used:
Level D - No respiratory protective equipment necessary except for a dust mask
Level C - A full-face air-purifying respirator equipped with organic vapor/pesticide-HEPA cartridges
Level B - An air line respirator or a self-contained breathing apparatus (SCBA)

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

LEVEL OF PERSONAL PROTECTIVE EQUIPMENT REQUIRED

Activity	**Level of Protection Respiratory/PPE**
Excavation	D/D
Sampling	D/D

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

- Walkie-Talkies - Hand held radios would be utilized as much as possible by field teams for communication between downrange operations and the Command Post base station.

- Telephones - A mobile telephone will be located in the Command Post vehicle in the Support Zone for communication with emergency support services/facilities. If a telephone is demobilized, the nearest public phones will be identified.

- Air Horns - A member of the downrange field team will carry an air horn and another will be evident in the Support Zone to alert field personnel to an emergency situation.

- Hand Signals - Members of the field team long with use of the buddy system will employ this communication method. Signals become especially important when in the vicinity of heavy moving equipment and when using Level B respiratory equipment. The signals shall become familiar to the entire field team before site operations commence and they will be reinforced and reviewed during site-specific training.

HAND SIGNALS FOR ONSITE COMMUNICATION

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

8.0 Air Monitoring Plan

GENERAL

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

REAL-TIME MONITORING

INSTRUMENTATION

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

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

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

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

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

ACTION LEVELS

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

MONITORING DURING FIELD ACTIVITIES

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

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

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

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

The record keeping will include:

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

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

ACTION LEVELS OF AIRBORNE CONTAMINANTS

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

PERSONNEL MONITORING PROCEDURE

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

Procedures to be followed include:

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

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

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

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

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

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

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

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

AIR MONITORING REPORTS

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

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

9.0 Safety Considerations

GENERAL

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

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

- As needed, all open holes, trenches and obstacles will be properly barricaded in accordance with local site requirements. These requirements will be determined by proximity to traffic ways, both pedestrian and vehicular, and site of the hole, trench or obstacle. If holes are required to be

left open during non- working hours, they will be adequately decked over or barricaded and sufficiently lighted.

- Before any digging or boring operations are conducted, underground utility locations will be identified.

- All boring, excavation and other site work will be planned and performed with consideration for underground lines. Any excavation work will be performed in accordance with Hydro Tech's Standard Operating Procedures for Excavations.

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

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

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

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

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

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

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

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

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

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

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

- Horseplay is prohibited in the work area.

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

POSTED SIGNS

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

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

INVASIVE OPERATIONS

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

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

SOIL SAMPLING

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

SAMPLE HANDLING

Personnel responsible for the handling of samples will wear the prescribed level of protection. Samples are to be identified as to their hazard and packaged as to prevent spillage or breakage. Any unusual sample conditions shall be noted. Laboratory personnel and all field personnel shall be advised of sample hazard

levels and the potential contaminants present. This can be accomplished by a phone call to the lab coordinator and/or including a written statement with the samples reviewing lab safety procedures in handling in order to assure that the practices are appropriate for the suspected contaminants in the sample.

HEAVY EQUIPMENT DECONTAMINATION

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

ADDITIONAL SAFETY CONSIDERATIONS

Currently, no other additional safety considerations are to be considered.

10.0 Decontamination and Disposal Procedures

CONTAMINATION PREVENTION

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

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

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

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

PERSONNEL DECONTAMINATION

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

EQUIPMENT DECONTAMINATION

Equipment used at the Site that is potentially contaminated shall be decontaminated to prevent hazardous materials from leaving the Site. All heavy equipment will be decontaminated at the decontamination pad and inspected by the SSO and Project Manager before it leaves the Site. The decontamination area will provide for the containment of all wastewater from the decontamination process. Respirators, airline and any other personnel equipment that comes in contact with contaminated soils shall pass through a field wash.

DECONTAMINATION DURING MEDICAL EMERGENCIES

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

No attempt will be made to wash or rinse the victim, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material that could also cause severe injury or loss of

life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed. Note that heat stroke requires prompt treatment to prevent irreversible damage or death. Protective clothing must be promptly removed. Less serious forms of heat stress also require prompt attention and removal of protective clothing immediately; unless the victim is obviously contaminated, decontamination should be omitted or minimized and treatment begun immediately.

DISPOSAL PROCEDURES

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

11.0 Emergency Plan

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

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

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

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

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

EVACUATION

In the event of an emergency situation, such as fire, explosion, or significant release of toxic gases, an air horn or other appropriate device will be sounded for approximately 10 second intervals indicating the initiation of evacuation procedures. All personnel will evacuate and assemble near the entrance to the site. The location shall be upwind of the Site where possible.

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

POTENTIAL OR ACTUAL FIRE OR EXPLOSION

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

PERSONNEL INJURY

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

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

ACCIDENT/INCIDENT REPORTING

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

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

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

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

OVERT PERSONNEL EXPOSURE

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

ADVERSE WEATHER CONDITIONS

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

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

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

EMERGENCY RESPONSE EQUIPMENT LIST

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

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

LARGE EQUIPMENT

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

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

12.0 Logs, Reports and Record Keeping

MEDICAL AND TRAINING RECORDS

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

ONSITE LOG

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

EXPOSURE RECORDS

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

ACCIDENT/INCIDENT REPORTS

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

OSHA FORM 200

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

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

HEALTH AND SAFETY FIELD LOG BOOK

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

13. Sanitation

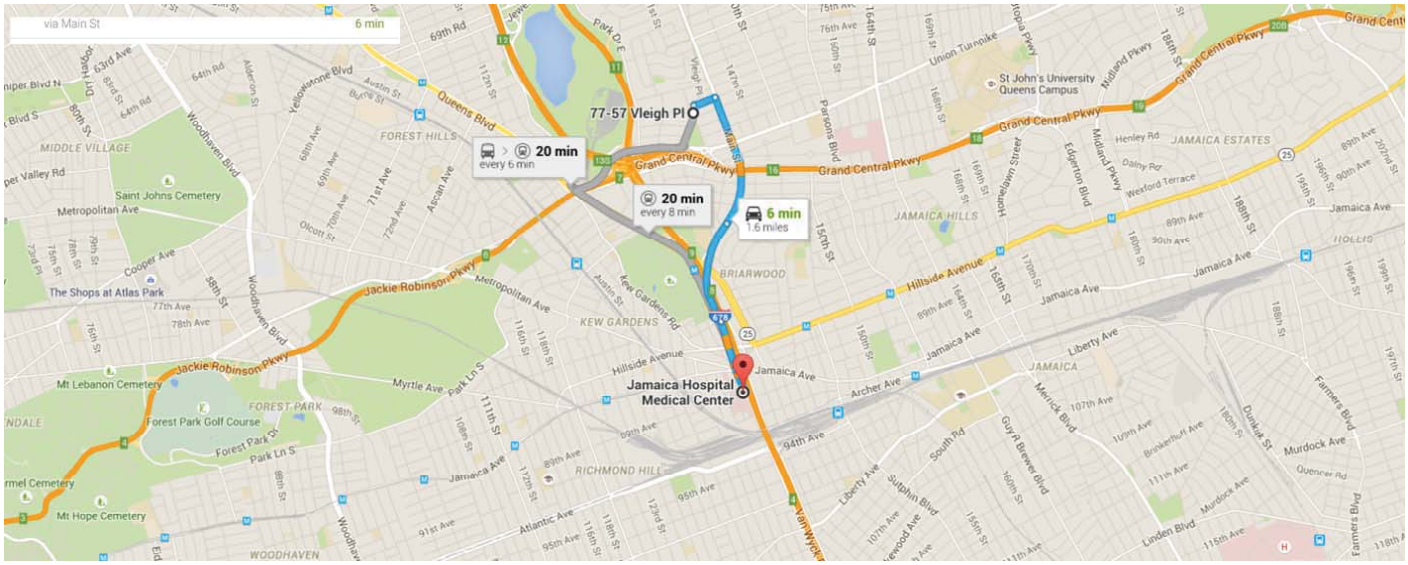
If sanitary sewers are not provided at the Site, provisions shall be made for access to sanitary systems by using nearby public facilities consistent with provisions of governing local ordinance codes. In the latter case, provisions are required for the removal of accumulated waste products within those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

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

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

Figure 1

Directions to Hospital


via Main St
6 min
77-57 Vleigh Pl
20 min
every 6 min
20 min
every 8 min
6 min
1.6 miles
Jamaica Hospital
Medical Center
Grand Central Pkwy
Queens Blvd
Jackie Robinson Pkwy
Hillside Avenue
Jamaica Ave
Metropolitan Ave
Myrtle Ave
Archer Ave
Liberty Ave
FOREST HILLS
KEW GARDENS
BRIARWOOD
JAMAICA HILLS
JAMAICA ESTATES
JAMAICA
RICHMOND HILL
WOODHAVEN
MIDDLE VILLAGE
FOREST PARK
St John's University
Queens Campus
Forest Park Golf Course
Mt Lebanon Cemetery
Mt Hope Cemetery
Saint Johns Cemetery
The Shops at Atlas Park

Attachment A

Accident/Incident Report Log

Accident / Incident Reporting Log

Unit:	Chartering Organization:

INFORMATION ON PERSON IN CHARGE OF THE GROUP

Name:		
Address:		
Phone numbers:	Home:	Work:
	Fax:	E-Mail:

INFORMATION ON THE INCIDENT

Nature of the activity:	
Place of the activity:	
Date of the incident:	Time of the incident:
Exact location of the incident:	
Weather Conditions (if applicable):	
Name of Person in charge at the time:	
Description of incident (if machinery involved, list owner and operator and details on incident)	

Witness Name:	Home Phone:	Work Phone:
Witness Name:	Home Phone:	Work Phone:

COMPLETE ONLY IF THIS INCIDENT WAS REPORTED TO THE NYPD or FDNY

Station Name, Number:
Station Address:
Name and Phone Number of Officer in Charge:

INFORMATION ON INJURED PERSON OR OWNER OF DAMAGED PROPERTY		
Name:		Birth date:
Address:		
Phone Numbers:	Home:	Work:
Please describe nature of injury or property damage		
Complete if applicable:	Name of doctor consulted:	Phone:
Complete if applicable:	Name and address of hospital or clinic:	Phone:

REPORTING DETAILS		
This report must be signed by person in charge of Site Operations at time of incident including Site Supervisor, or Project Manager or Site Safety officer	Print full name:	
	Position:	
	Street Address:	
	Town, State, Zip:	
	Telephone (Home)	(work)
	Fax:	Email:
	Signature:	Date:

Attachment B
Health and Safety Fact Sheets

SAFETY DATA SHEET

Creation Date 03-Feb-2010 **Revision Date** 23-Jan-2018 **Revision Number** 4

1. Identification

Product Name **Trichloroethylene**

Cat No. : **AC421520000; AC421520025; AC421525000**

CAS-No 79-01-6
Synonyms Triclene; Trichloroethene; Ethylene trichloride

Recommended Use Laboratory chemicals.
Uses advised against

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Germ Cell Mutagenicity	Category 2
Carcinogenicity	Category 1A
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Heart, spleen, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness

Suspected of causing genetic defects
May cause cancer
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Harmful to aquatic life with long lasting effects
WARNING. Cancer and Reproductive Harm - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Trichloroethylene	79-01-6	>95

4. First-aid measures

General Advice Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation	Move to fresh air. If not breathing, give artificial respiration. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.
Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms and effects	May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	410 °C / 770 °F
Explosion Limits	
Upper	44.8 vol %
Lower	8 vol %
Oxidizing Properties	Not oxidising
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Hydrogen chloride gas Chlorine Phosgene Carbon monoxide (CO) Carbon dioxide (CO_2)
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
2	1	0	N/A

6. Accidental release measures

Personal Precautions	Ensure adequate ventilation. Use personal protective equipment. Keep people away from and upwind of spill/leak. Evacuate personnel to safe areas.
Environmental Precautions	Should not be released into the environment. Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Use only under a chemical fume hood. Do not breathe vapors or spray mist. Do not ingest.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from light. Do

not store in aluminum containers.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Trichloroethylene	TWA: 10 ppm STEL: 25 ppm	(Vacated) TWA: 50 ppm (Vacated) TWA: 270 mg/m^3 Ceiling: 200 ppm (Vacated) STEL: 200 ppm (Vacated) STEL: 1080 mg/m^3 TWA: 100 ppm	IDLH: 1000 ppm	TWA: 100 ppm TWA: 535 mg/m^3 STEL: 200 ppm STEL: 1080 mg/m^3

Legend

ACGIH *- American Conference of Governmental Industrial Hygienists*
OSHA *- Occupational Safety and Health Administration*
NIOSH IDLH: *The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health*

Engineering Measures Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

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

Skin and body protection Long sleeved clothing.

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

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-85 °C / -121 °F
Boiling Point/Range	87 °C / 188.6 °F
Flash Point	No information available
Evaporation Rate	0.69 (Carbon Tetrachloride = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	44.8 vol %
Lower	8 vol %
Vapor Pressure	77.3 mbar @ 20 °C
Vapor Density	4.5 (Air = 1.0)
Specific Gravity	1.460
Solubility	Insoluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	410 °C / 770 °F
Decomposition Temperature	> 120°C

Viscosity	0.55 mPa.s (25°C)
Molecular Formula	C2 H Cl3
Molecular Weight	131.39

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Light sensitive.

Conditions to Avoid Incompatible products. Excess heat. Exposure to light. Exposure to moist air or water.

Incompatible Materials Strong oxidizing agents, Strong bases, Amines, Alkali metals, Metals,

Hazardous Decomposition Products Hydrogen chloride gas, Chlorine, Phosgene, Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Trichloroethylene	LD50 = 4920 mg/kg (Rat) LD50 = 4290 mg/kg (Rat)	LD50 = 29000 mg/kg (Rabbit) LD50 > 20 g/kg (Rabbit)	LC50 = 26 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization May cause sensitization by skin contact

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Trichloroethylene	79-01-6	Group 1	Known Reasonably Anticipated	A2	X	Not listed

IARC: (International Agency for Research on Cancer)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)

NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)

A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mutagenic Effects Mutagenic effects have occurred in humans.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)
STOT - repeated exposure Kidney Liver Heart spleen Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Do not empty into drains. The product contains following substances which are hazardous for the environment. Contains a substance which is:. Harmful to aquatic organisms. Toxic to aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Trichloroethylene	EC50: = 175 mg/L, 96h (Pseudokirchneriella subcapitata) EC50: = 450 mg/L, 96h (Desmodesmus subspicatus)	LC50: 31.4 - 71.8 mg/L, 96h flow-through (Pimephales promelas) LC50: 39 - 54 mg/L, 96h static (Lepomis macrochirus)	EC50 = 0.81 mg/L 24 h EC50 = 115 mg/L 10 min EC50 = 190 mg/L 15 min EC50 = 235 mg/L 24 h EC50 = 410 mg/L 24 h EC50 = 975 mg/L 5 min	EC50: = 2.2 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Trichloroethylene	2.4

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Trichloroethylene - 79-01-6	U228	-

14. Transport information

DOT

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE
Hazard Class 6.1
Packing Group III

TDG

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE
Hazard Class 6.1
Packing Group III

IATA

UN-No	UN1710
Proper Shipping Name	TRICHLOROETHYLENE
Hazard Class	6.1
Packing Group	III

IMDG/IMO

UN-No	UN1710
Proper Shipping Name	TRICHLOROETHYLENE
Hazard Class	6.1
Packing Group	III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Trichloroethylene	X	X	-	201-167-4	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

Component	TSCA 12(b)
Trichloroethylene	Section 5 Section 6

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Trichloroethylene	79-01-6	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Trichloroethylene	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Trichloroethylene	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability

Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Trichloroethylene	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Trichloroethylene	79-01-6	Carcinogen Developmental Male Reproductive	14 µg/day 50 µg/day	Developmental Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Trichloroethylene	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 03-Feb-2010
Revision Date 23-Jan-2018
Print Date 23-Jan-2018
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 10-Dec-2009 **Revision Date** 23-Jan-2018 **Revision Number** 5

1. Identification

Product Name **Tetrachloroethylene**

Cat No. : **AC445690000; ACR445690010; AC445690025; AC445691000**

CAS-No 127-18-4
Synonyms Perchloroethylene

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness
May cause cancer
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Toxic to aquatic life with long lasting effects
WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Tetrachloroethylene	127-18-4	>95

4. First-aid measures

General Advice If symptoms persist, call a physician.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.

Inhalation Move to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur.

Ingestion Clean mouth with water and drink afterwards plenty of water.

Most important symptoms and effects	None reasonably foreseeable. May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated.

Hazardous Combustion Products
Chlorine Hydrogen chloride gas Phosgene
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	0	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Ensure adequate ventilation.
Environmental Precautions	Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Ensure adequate ventilation. Avoid ingestion and inhalation.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from sunlight.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Tetrachloroethylene	TWA: 25 ppm STEL: 100 ppm	(Vacated) TWA: 25 ppm (Vacated) TWA: 170 mg/m^3 Ceiling: 200 ppm TWA: 100 ppm	IDLH: 150 ppm	TWA: 100 ppm TWA: 670 mg/m^3 TWA: 200 ppm TWA: 1250 mg/m^3 STEL: 200 ppm STEL: 1340 mg/m^3

Legend

ACGIH *- American Conference of Governmental Industrial Hygienists*
OSHA *- Occupational Safety and Health Administration*
NIOSH IDLH: *The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health*

Engineering Measures Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

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

Skin and body protection Long sleeved clothing.

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

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic, sweet
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-22 °C / -7.6 °F
Boiling Point/Range	120 - 122 °C / 248 - 251.6 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	6.0 (Ether = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	18 mbar @ 20 °C
Vapor Density	No information available
Density	1.619
Specific Gravity	1.625
Solubility	0.15 g/L water (20°C)
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	> 150°C
Viscosity	0.89 mPa s at 20 °C
Molecular Formula	C2 Cl4
Molecular Weight	165.83

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Exposure to moist air or water.

Incompatible Materials Strong acids, Strong oxidizing agents, Strong bases, Metals, Zinc, Amines, Aluminium

Hazardous Decomposition Products Chlorine, Hydrogen chloride gas, Phosgene

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Tetrachloroethylene	LD50 = 2629 mg/kg (Rat)	LD50 > 10000 mg/kg (Rat)	LC50 = 27.8 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Tetrachloroethylene	127-18-4	Group 2A	Reasonably Anticipated	A3	X	A3

IARC: (International Agency for Research on Cancer)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)

NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)

A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

Mexico - Occupational Exposure Limits - Carcinogens
A1 - Confirmed Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Confirmed Animal Carcinogen
A4 - Not Classifiable as a Human Carcinogen
A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)

STOT - repeated exposure Kidney Liver Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information

Component	EU - Endocrine Disrupters Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Tetrachloroethylene	Group II Chemical	Not applicable	Not applicable

Other Adverse Effects Tumorigenic effects have been reported in experimental animals.

12. Ecological information

Ecotoxicity

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Tetrachloroethylene	EC50: > 500 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: 4.73 - 5.27 mg/L, 96h flow-through (Oncorhynchus mykiss) LC50: 11.0 - 15.0 mg/L, 96h static (Lepomis macrochirus) LC50: 8.6 - 13.5 mg/L, 96h static (Pimephales promelas) LC50: 12.4 - 14.4 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 100 mg/L 24 h EC50 = 112 mg/L 24 h EC50 = 120.0 mg/L 30 min	EC50: 6.1 - 9.0 mg/L, 48h Static (Daphnia magna)

Persistence and Degradability Insoluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility . Is not likely mobile in the environment due its low water solubility. Will likely be mobile in the environment due to its volatility.

Component	log Pow
Tetrachloroethylene	2.53 - 2.88

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Tetrachloroethylene - 127-18-4	U210	-

14. Transport information

DOT

UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

TDG

UN-No UN1897

Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

IATA
UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

IMDG/IMO
UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Subsidiary Hazard Class P
Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Tetrachloroethylene	X	X	-	204-825-9	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
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Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Tetrachloroethylene	127-18-4	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Tetrachloroethylene	-	-	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Tetrachloroethylene	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Tetrachloroethylene	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Tetrachloroethylene	127-18-4	Carcinogen	14 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Tetrachloroethylene	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant Y
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 10-Dec-2009
Revision Date 23-Jan-2018
Print Date 23-Jan-2018
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

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End of SDS

SAFETY DATA SHEET

Creation Date 31-May-2018 **Revision Date** 04-Jun-2018 **Revision Number** 7

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1. Product identification

Product Description:	**Xylenes, mixture of isomers**
Cat No. :	**383940000; 383940010; 383940050**
CAS-No	1330-20-7
EC-No.	215-535-7
Molecular Formula	C8 H10

1.2. Relevant identified uses of the substance or mixture and uses advised against

Recommended Use	Laboratory chemicals.
Sector of use	SU3 - Industrial uses: Uses of substances as such or in preparations at industrial sites
Product category	PC21 - Laboratory chemicals
Process categories	PROC15 - Use as a laboratory reagent
Environmental release category	ERC6a - Industrial use resulting in manufacture of another substance (use of intermediates)
Uses advised against	No Information available

1.3. Details of the supplier of the safety data sheet

Company	Acros Organics BVBA Janssen Pharmaceuticalaan 3a 2440 Geel, Belgium
E-mail address	begel.sdsdesk@thermofisher.com

1.4. Emergency telephone number

For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture

CLP Classification - Regulation (EC) No 1272/2008

Physical hazards

Flammable liquids	Category 3 (H226)

Health hazards

Aspiration Toxicity	Category 1 (H304)
Acute dermal toxicity	Category 4 (H312)
Acute Inhalation Toxicity - Vapors	Category 4 (H332)
Skin Corrosion/irritation	Category 2 (H315)
Serious Eye Damage/Eye Irritation	Category 2 (H319)
Specific target organ toxicity - (single exposure)	Category 3 (H335)
Specific target organ toxicity - (repeated exposure)	Category 2 (H373)

Environmental hazards	
Chronic aquatic toxicity	Category 3 (H412)

2.2. Label elements

Signal Word **Danger**

Hazard Statements

H226 - Flammable liquid and vapor
H304 - May be fatal if swallowed and enters airways
H312 - Harmful in contact with skin
H332 - Harmful if inhaled
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H335 - May cause respiratory irritation
H373 - May cause damage to organs through prolonged or repeated exposure
H412 - Harmful to aquatic life with long lasting effects

Precautionary Statements

P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking
P303 + P361 + P353 - IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower
P301 + P310 - IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician
P331 - Do NOT induce vomiting
P304 + P340 - IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing
P264 - Wash face, hands and any exposed skin thoroughly after handling
P337 + P313 - If eye irritation persists: Get medical advice/ attention
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection
P332 + P313 - If skin irritation occurs: Get medical advice/ attention

2.3. Other hazards

No information available

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. Substances

Component	CAS-No	EC-No.	Weight %	CLP Classification - Regulation (EC) No 1272/2008
Xylenes (o-, m-, p- isomers)	1330-20-7	EEC No. 215-535-7	>95	Flam. Liq. 3 (H226) Asp. Tox. 1 (H304) Acute Tox. 4 (H312) Acute Tox. 4 (H332)

				Skin Irrit. 2 (H315) Eye Irrit. 2 (H319) STOT SE 3 (H335) STOT RE 2 (H373) Aquatic Chronic 3 (H412)

Full text of Hazard Statements: see section 16

SECTION 4: FIRST AID MEASURES

4.1. Description of first aid measures

General Advice If symptoms persist, call a physician.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.

Ingestion Clean mouth with water and drink afterwards plenty of water. Do not induce vomiting. Call a physician or Poison Control Center immediately. If vomiting occurs naturally, have victim lean forward.

Inhalation Move to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur. Risk of serious damage to the lungs.

Self-Protection of the First Aider Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.

4.2. Most important symptoms and effects, both acute and delayed

Breathing difficulties. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

4.3. Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically. Symptoms may be delayed.

SECTION 5: FIREFIGHTING MEASURES

5.1. Extinguishing media

Suitable Extinguishing Media
Cool closed containers exposed to fire with water spray.

Extinguishing media which must not be used for safety reasons
Do not use a solid water stream as it may scatter and spread fire.

5.2. Special hazards arising from the substance or mixture

Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back.

Hazardous Combustion Products
None under normal use conditions.

5.3. Advice for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures

Ensure adequate ventilation. Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges.

6.2. Environmental precautions

Do not flush into surface water or sanitary sewer system.

6.3. Methods and material for containment and cleaning up

Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Take precautionary measures against static discharges. Use spark-proof tools and explosion-proof equipment.

6.4. Reference to other sections

Refer to protective measures listed in Sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for safe handling

Wear personal protective equipment. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Use explosion-proof equipment. Take precautionary measures against static discharges.

Hygiene Measures
Handle in accordance with good industrial hygiene and safety practice. Keep away from food, drink and animal feeding stuffs. Do not eat, drink or smoke when using this product. Remove and wash contaminated clothing before re-use. Wash hands before breaks and at the end of workday.

7.2. Conditions for safe storage, including any incompatibilities

Keep away from heat and sources of ignition. Flammables area. Keep container tightly closed in a dry and well-ventilated place.

7.3. Specific end use(s)

Use in laboratories

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters

Exposure limits
List source(s): **EU** - Commission Directive 2006/15/EC of 7 February 2006 establishing a second list of indicative occupational exposure limit values in implementation of Council Directive 98/24/EC and amending Directives 91/322/EEC and 2000/39/EC on the protection of the health and safety of workers from the risks related to chemical agents at work. **UK** - EH40/2005 Containing the workplace exposure limits (WELs) for use with the Control of Substances Hazardous to Health Regulations (COSHH) 2002 (as amended). Updated by September 2006 official press release and October 2007 Supplement. **IRE -** 2010 Code of Practice for the

Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001. Published by the Health and Safety Authority.

Component	The United Kingdom	European Union	Ireland
Xylenes (o-, m-, p- isomers)	STEL: 100 ppm 15 min STEL: 441 mg/m³ 15 min TWA: 50 ppm 8 hr TWA: 220 mg/m³ 8 hr Skin	TWA: 50 ppm 8 hr TWA: 221 mg/m³ 8 hr STEL: 100 ppm 15 min STEL: 442 mg/m³ 15 min Possibility of significant uptake through the skin	TWA: 50 ppm 8 hr. TWA: 221 mg/m³ 8 hr. STEL: 100 ppm 15 min STEL: 442 mg/m³ 15 min Skin

Biological limit values
List source(s): **UK** - Biological Monitoring Guidance Values provided by the UK's Health and Safety Executive (HSE) Control of Substances Hazardous to Health Regulations (COSHH) 2002 (as amended) and EH40/2005.

Component	United Kingdom	European Union
Xylenes (o-, m-, p- isomers)	Methyl hippuric acid: 650 mmol/mol creatinine urine post shift	

Monitoring methods
BS EN 14042:2003 Title Identifier: Workplace atmospheres. Guide for the application and use of procedures for the assessment of exposure to chemical and biological agents.
MDHS70 General methods for sampling airborne gases and vapours
MDHS 88 Volatile organic compounds in air. Laboratory method using diffusive samplers, solvent desorption and gas chromatography
MDHS 96 Volatile organic compounds in air - Laboratory method using pumped solid sorbent tubes, solvent desorption and gas chromatography

Derived No Effect Level (DNEL) No information available

Route of exposure	Acute effects (local)	Acute effects (systemic)	Chronic effects (local)	Chronic effects (systemic)
Oral				
Dermal				
Inhalation				

Predicted No Effect Concentration (PNEC) No information available.

8.2. Exposure controls

Engineering Measures
Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting/equipment.
Wherever possible, engineering control measures such as the isolation or enclosure of the process, the introduction of process or equipment changes to minimise release or contact, and the use of properly designed ventilation systems, should be adopted to control hazardous materials at source

Personal protective equipment

Eye Protection Goggles (European standard - EN 166)

Hand Protection Protective gloves

Glove material	Breakthrough time	Glove thickness	EU standard	Glove comments
Viton (R)	See manufacturers recommendations	-	EN 374	(minimum requirement)

Skin and body protection Long sleeved clothing

Inspect gloves before use.
Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. (Refer to manufacturer/supplier for information)

Ensure gloves are suitable for the task: Chemical compatability, Dexterity, Operational conditions, User susceptibility, e.g. sensitisation effects, also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion.
Remove gloves with care avoiding skin contamination.

Respiratory Protection	When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. To protect the wearer, respiratory protective equipment must be the correct fit and be used and maintained properly
Large scale/emergency use	Use a NIOSH/MSHA or European Standard EN 136 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced **Recommended Filter type:** Organic gases and vapours filter Type A Brown conforming to EN14387
Small scale/Laboratory use	Use a NIOSH/MSHA or European Standard EN 149:2001 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced. **Recommended half mask:-** Valve filtering: EN405; or; Half mask: EN140; plus filter, EN 141 When RPE is used a face piece Fit Test should be conducted
Environmental exposure controls	Prevent product from entering drains. Do not allow material to contaminate ground water system. Local authorities should be advised if significant spillages cannot be contained.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on basic physical and chemical properties

Appearance		
Physical State	Liquid	
Odor	No information available	
Odor Threshold	No data available	
pH	No information available	
Melting Point/Range	-34 °C / -29.2 °F	
Softening Point	No data available	
Boiling Point/Range	136 - 140 °C / 276.8 - 284 °F	@ 760 mmHg
Flash Point	23 °C / 73.4 °F	**Method -** No information available
Evaporation Rate	No data available	
Flammability (solid,gas)	Not applicable	Liquid
Explosion Limits	No data available	
Vapor Pressure	No data available	
Vapor Density	No data available	(Air = 1.0)
Specific Gravity / Density	0.865	
Bulk Density	Not applicable	Liquid
Water Solubility	Insoluble	
Solubility in other solvents	No information available	
Partition Coefficient (n-octanol/water)		
Component	**log Pow**	
Xylenes (o-, m-, p- isomers)	3.15	
Autoignition Temperature	No data available	
Decomposition Temperature	No data available	
Viscosity	No data available	
Explosive Properties	No information available	explosive air/vapour mixtures possible
Oxidizing Properties	No information available	

9.2. Other information

Molecular Formula	C8 H10

Molecular Weight 106.17

SECTION 10: STABILITY AND REACTIVITY

10.1. Reactivity

None known, based on information available

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

Hazardous Polymerization No information available.
Hazardous Reactions None under normal processing.

10.4. Conditions to avoid

Keep away from open flames, hot surfaces and sources of ignition.

10.5. Incompatible materials

None known.

10.6. Hazardous decomposition products

None under normal use conditions.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Product Information

(a) acute toxicity;
Oral Based on available data, the classification criteria are not met
Dermal Category 4
Inhalation Category 4

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Xylenes (o-, m-, p- isomers)	LD50 = 3500 mg/kg (Rat)		29.08 mg/L [MOE Risk Assessment Vol.1, 2002]

(b) skin corrosion/irritation; Category 2

(c) serious eye damage/irritation; Category 2

(d) respiratory or skin sensitization;
Respiratory Based on available data, the classification criteria are not met
Skin Based on available data, the classification criteria are not met

(e) germ cell mutagenicity; Based on available data, the classification criteria are not met

(f) carcinogenicity; Based on available data, the classification criteria are not met

There are no known carcinogenic chemicals in this product

(g) reproductive toxicity; Based on available data, the classification criteria are not met

(h) STOT-single exposure; Category 3

Results / Target organs Respiratory system.

(i) STOT-repeated exposure; Category 2

Target Organs No information available.

(j) aspiration hazard; Category 1

Symptoms / effects,both acute and delayed Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

SECTION 12: ECOLOGICAL INFORMATION

12.1. Toxicity

Ecotoxicity effects The product contains following substances which are hazardous for the environment. Contains a substance which is:. Very toxic to aquatic organisms.

Component	Freshwater Fish	Water Flea	Freshwater Algae	Microtox
Xylenes (o-, m-, p- isomers)	LC50: 13.1 - 16.5 mg/L, 96h flow-through (Lepomis macrochirus) LC50: = 19 mg/L, 96h (Lepomis macrochirus) LC50: 7.711 - 9.591 mg/L, 96h static (Lepomis macrochirus) LC50: 23.53 - 29.97 mg/L, 96h static (Pimephales promelas) LC50: = 780 mg/L, 96h semi-static (Cyprinus carpio) LC50: > 780 mg/L, 96h (Cyprinus carpio) LC50: 30.26 - 40.75 mg/L, 96h static (Poecilia reticulata) LC50: 13.5 - 17.3 mg/L, 96h (Oncorhynchus mykiss) LC50: = 13.4 mg/L, 96h flow-through (Pimephales promelas) LC50: 2.661 - 4.093 mg/L, 96h static (Oncorhynchus mykiss)	EC50: = 3.82 mg/L, 48h (water flea) LC50: = 0.6 mg/L, 48h (Gammarus lacustris)		EC50 = 0.0084 mg/L 24 h

12.2. Persistence and degradability

Persistence Persistence is unlikely.

Degradation in sewage treatment plant Contains substances known to be hazardous to the environment or not degradable in waste water treatment plants.

12.3. Bioaccumulative potential Bioaccumulation is unlikely

Component	log Pow	Bioconcentration factor (BCF)
Xylenes (o-, m-, p- isomers)	3.15	0.6 - 15

12.4. Mobility in soil Spillage unlikely to penetrate soil The product is insoluble and floats on water Is not likely mobile in the environment due its low water solubility.

12.5. Results of PBT and vPvB assessment No data available for assessment.

12.6. Other adverse effects

Endocrine Disruptor Information This product does not contain any known or suspected endocrine disruptors
Persistent Organic Pollutant This product does not contain any known or suspected substance
Ozone Depletion Potential This product does not contain any known or suspected substance

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

Waste from Residues / Unused Products Waste is classified as hazardous. Dispose of in accordance with the European Directives on waste and hazardous waste. Dispose of in accordance with local regulations.

Contaminated Packaging Dispose of this container to hazardous or special waste collection point. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep product and empty container away from heat and sources of ignition.

European Waste Catalogue (EWC) According to the European Waste Catalogue, Waste Codes are not product specific, but application specific.

Other Information Do not dispose of waste into sewer. Waste codes should be assigned by the user based on the application for which the product was used. Can be incinerated, when in compliance with local regulations. Do not let this chemical enter the environment. Do not empty into drains.

SECTION 14: TRANSPORT INFORMATION

IMDG/IMO

14.1. UN number UN1307
14.2. UN proper shipping name XYLENES
14.3. Transport hazard class(es) 3
14.4. Packing group III

ADR

14.1. UN number UN1307
14.2. UN proper shipping name XYLENES
14.3. Transport hazard class(es) 3
14.4. Packing group III

IATA

14.1. UN number UN1307
14.2. UN proper shipping name XYLENES
14.3. Transport hazard class(es) 3
14.4. Packing group III

14.5. Environmental hazards No hazards identified

14.6. Special precautions for user No special precautions required

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code Not applicable, packaged goods

SECTION 15: REGULATORY INFORMATION

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

International Inventories X = listed.

Component	EINECS	ELINCS	NLP	TSCA	DSL	NDSL	PICCS	ENCS	IECSC	AICS	KECL
Xylenes (o-, m-, p- isomers)	215-535-7	-		X	X	-	X	X	X	X	X

National Regulations

Component	Germany - Water Classification (VwVwS)	Germany - TA-Luft Class
Xylenes (o-, m-, p- isomers)	WGK 2	

Component	France - INRS (Tables of occupational diseases)
Xylenes (o-, m-, p- isomers)	Tableaux des maladies professionnelles (TMP) - RG 4bis,RG 84

Take note of Control of Substances Hazardous to Health Regulations (COSHH) 2002 and 2005 Amendment.

15.2. Chemical safety assessment

A Chemical Safety Assessment/Report (CSA/CSR) has not been conducted

SECTION 16: OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3

H304 - May be fatal if swallowed and enters airways
H312 - Harmful in contact with skin
H332 - Harmful if inhaled
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H335 - May cause respiratory irritation
H373 - May cause damage to organs through prolonged or repeated exposure
H412 - Harmful to aquatic life with long lasting effects
H226 - Flammable liquid and vapor

Legend

CAS - Chemical Abstracts Service

EINECS/ELINCS - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

IECSC - Chinese Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

ENCS - Japanese Existing and New Chemical Substances

AICS - Australian Inventory of Chemical Substances

NZIoC - New Zealand Inventory of Chemicals

WEL - Workplace Exposure Limit

ACGIH - American Conference of Governmental Industrial Hygienists

DNEL - Derived No Effect Level

RPE - Respiratory Protective Equipment

LC50 - Lethal Concentration 50%

NOEC - No Observed Effect Concentration

PBT - Persistent, Bioaccumulative, Toxic

TWA - Time Weighted Average

IARC - International Agency for Research on Cancer

PNEC - Predicted No Effect Concentration

LD50 - Lethal Dose 50%

EC50 - Effective Concentration 50%

POW - Partition coefficient Octanol:Water

vPvB - very Persistent, very Bioaccumulative

ADR - European Agreement Concerning the International Carriage of Dangerous Goods by Road
IMO/IMDG - International Maritime Organization/International Maritime Dangerous Goods Code
OECD - Organisation for Economic Co-operation and Development
BCF - Bioconcentration factor
ICAO/IATA - International Civil Aviation Organization/International Air Transport Association
MARPOL - International Convention for the Prevention of Pollution from Ships
ATE - Acute Toxicity Estimate
VOC - Volatile Organic Compounds

Key literature references and sources for data
Suppliers safety data sheet, Chemadvisor - LOLI, Merck index, RTECS

Training Advice
Chemical hazard awareness training, incorporating labelling, Safety Data Sheets (SDS), Personal Protective Equipment (PPE) and hygiene.
Use of personal protective equipment, covering appropriate selection, compatibility, breakthrough thresholds, care, maintenance, fit and standards.
First aid for chemical exposure, including the use of eye wash and safety showers.
Chemical incident response training.
Fire prevention and fighting, identifying hazards and risks, static electricity, explosive atmospheres posed by vapours and dusts.

Creation Date	31-May-2018
Revision Date	04-Jun-2018
Revision Summary	SDS sections updated, 2, 3.

End of Safety Data Sheet

SAFETY DATA SHEET

Creation Date 26-Sep-2009 **Revision Date** 23-Jan-2018 **Revision Number** 4

1. Identification

Product Name **m-Xylene**

Cat No. : **AC610470000; AC610471000**

CAS-No 108-38-3
Synonyms 1,3-Dimethylbenzene

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 3
Acute dermal toxicity	Category 4
Acute Inhalation Toxicity - Vapors	Category 4
Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2

Label Elements

Signal Word
Warning

Hazard Statements
Flammable liquid and vapor
Harmful in contact with skin
Causes skin irritation
Causes serious eye irritation
Harmful if inhaled

Precautionary Statements
Prevention
Wear protective gloves/protective clothing/eye protection/face protection
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wash face, hands and any exposed skin thoroughly after handling
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Skin
Call a POISON CENTER or doctor/physician if you feel unwell
If skin irritation occurs: Get medical advice/attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store in a well-ventilated place. Keep cool
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
m-Xylene	108-38-3	>95

4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Move to fresh air. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required. If not breathing, give artificial respiration.

Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms and effects	Breathing difficulties. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray.
Unsuitable Extinguishing Media	No information available
Flash Point	25 °C / 77 °F
Method -	No information available
Autoignition Temperature	465 °C / 869 °F

Explosion Limits

Upper	7.0%
Lower	1.1%
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO_2)
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
2	3	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges.
Environmental Precautions	Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. Take precautionary measures against static discharges.

7. Handling and storage

Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Take precautionary measures against static discharges.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Flammables area. Keep away from heat and sources of ignition.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
m-Xylene	TWA: 100 ppm STEL: 150 ppm		IDLH: 900 ppm TWA: 100 ppm TWA: 435 mg/m³ STEL: 150 ppm STEL: 655 mg/m³	TWA: 100 ppm TWA: 435 mg/m³ STEL: 150 ppm STEL: 655 mg/m³

Legend

ACGIH *- American Conference of Governmental Industrial Hygienists*
NIOSH IDLH: *The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health*

Engineering Measures Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting/equipment.

Personal Protective Equipment

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

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

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

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	aromatic
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-48 °C / -54.4 °F
Boiling Point/Range	139 - 139 °C / 282.2 - 282.2 °F
Flash Point	25 °C / 77 °F
Evaporation Rate	0.7
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	7.0%
Lower	1.1%
Vapor Pressure	8 mbar @ 20 °C
Vapor Density	3.66
Specific Gravity	0.864
Solubility	slightly soluble
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	465 °C / 869 °F
Decomposition Temperature	No information available
Viscosity	0.62 mPa.s at 20 °C
Molecular Formula	C8 H10
Molecular Weight	106.17

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition.

Incompatible Materials Strong oxidizing agents, Strong acids

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
m-Xylene	LD50 = 5 g/kg (Rat)	LD50 = 12.18 g/kg (Rabbit) LD50 = 14100 µL/kg (Rabbit)	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
m-Xylene	108-38-3	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

The product contains following substances which are hazardous for the environment. Contains a substance which is:. Toxic to aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
m-Xylene	EC50: = 4.9 mg/L, 72h static (Pseudokirchneriella subcapitata)	LC50: = 8.4 mg/L, 96h semi-static (Oncorhynchus mykiss) LC50: 14.3 - 18 mg/L, 96h flow-through (Pimephales promelas) LC50: = 12.9 mg/L, 96h semi-static (Poecilia reticulata)	EC50 = 0.0084 mg/L 24 h	EC50: 2.81 - 5.0 mg/L, 48h Static (Daphnia magna)

Persistence and Degradability Persistence is unlikely

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility. Is not likely mobile in the environment due its low water solubility.

Component	log Pow
m-Xylene	3.2

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No UN1307
Proper Shipping Name XYLENES
Hazard Class 3
Packing Group III

TDG

UN-No UN1307
Proper Shipping Name XYLENES
Hazard Class 3
Packing Group III

IATA

UN-No UN1307
Proper Shipping Name XYLENES
Hazard Class 3
Packing Group III

IMDG/IMO

UN-No UN1307
Proper Shipping Name XYLENES
Hazard Class 3
Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
m-Xylene	X	X	-	203-576-3	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated

polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
m-Xylene	108-38-3	>95	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
m-Xylene	X	-	-	-

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
m-Xylene	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
m-Xylene	1000 lb	-

California Proposition 65 This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
m-Xylene	X	X	X	X	-

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Creation Date	26-Sep-2009
Revision Date	23-Jan-2018
Print Date	23-Jan-2018
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 26-Sep-2009 **Revision Date** 26-Jan-2018 **Revision Number** 6

1. Identification

Product Name **Mesitylene**

Cat No. : **AC125580000; AC125580010; AC125580025; AC125580050; AC125582500**

CAS-No 108-67-8
Synonyms 1,3,5-Trimethylbenzene

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 3
Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system, Central nervous system (CNS).	
Aspiration Toxicity	Category 1

Label Elements

Signal Word
Danger

Hazard Statements
Flammable liquid and vapor
May be fatal if swallowed and enters airways
Causes skin irritation
Causes serious eye irritation
May cause respiratory irritation
May cause drowsiness or dizziness

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Keep cool
Response
Get medical attention/advice if you feel unwell
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Skin
If skin irritation occurs: Get medical advice/attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Ingestion
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
Do NOT induce vomiting
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Toxic to aquatic life with long lasting effects

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
1,3,5-Trimethylbenzene	108-67-8	97-99

4. First-aid measures

General Advice If symptoms persist, call a physician.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get

	medical attention.
Skin Contact	Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Obtain medical attention.
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention. Risk of serious damage to the lungs.
Ingestion	Clean mouth with water and drink afterwards plenty of water. Do not induce vomiting. Call a physician or Poison Control Center immediately. If vomiting occurs naturally, have victim lean forward.
Most important symptoms and effects	. Breathing difficulties. Vapors may cause drowsiness and dizziness: Symptoms may be delayed: Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray.
Unsuitable Extinguishing Media	No information available
Flash Point	44 °C / 111.2 °F
Method -	No information available
Autoignition Temperature	550 °C / 1022 °F
Explosion Limits	
Upper	6.00%
Lower	1.00%
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO_2)
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
3	2	0	N/A

6. Accidental release measures

Personal Precautions	Ensure adequate ventilation. Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges.
Environmental Precautions	Do not flush into surface water or sanitary sewer system. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. Take precautionary measures against static discharges.

7. Handling and storage

Handling Wear personal protective equipment. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Take precautionary measures against static discharges. Use explosion-proof equipment.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition. Flammables area.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
1,3,5-Trimethylbenzene			TWA: 25 ppm TWA: 125 mg/m^3	

Legend

NIOSH IDLH: *The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health*

Engineering Measures Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location. Use explosion-proof electrical/ventilating/lighting/equipment.

Personal Protective Equipment

Eye/face Protection Tightly fitting safety goggles. Face-shield.

Skin and body protection Long sleeved clothing.

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

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	aromatic
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-45 °C / -49 °F
Boiling Point/Range	163 - 166 °C / 325.4 - 330.8 °F @ 760 mmHg
Flash Point	44 °C / 111.2 °F
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	6.00%
Lower	1.00%
Vapor Pressure	2.5 mbar @ 20 °C
Vapor Density	4.1 (Air = 1.0)
Specific Gravity	0.868
Solubility	slightly soluble
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	550 °C / 1022 °F
Decomposition Temperature	No information available

Viscosity	No information available
Molecular Formula	C9 H12
Molecular Weight	120.19

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition.

Incompatible Materials Strong oxidizing agents, Nitric acid

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information No acute toxicity information is available for this product

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
1,3,5-Trimethylbenzene	LD50 = 5000 mg/kg (Rat)	Not listed	LC50 = 24 g/m³ (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes, respiratory system and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
1,3,5-Trimethylbenzene	108-67-8	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects Not mutagenic in AMES Test

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system Central nervous system (CNS)

STOT - repeated exposure None known

Aspiration hazard Category 1

Symptoms / effects,both acute and delayed Vapors may cause drowsiness and dizziness: Symptoms may be delayed: Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
1,3,5-Trimethylbenzene	Not listed	LC50: = 3.48 mg/L, 96h (Pimephales promelas)	Not listed	EC50: = 50 mg/L, 24h (Daphnia magna)

Persistence and Degradability Soluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

- **UN-No** UN2325
- **Proper Shipping Name** 1,3,5-TRIMETHYLBENZENE
- **Hazard Class** 3
- **Packing Group** III

TDG

- **UN-No** UN2325
- **Proper Shipping Name** 1,3,5-TRIMETHYLBENZENE
- **Hazard Class** 3
- **Packing Group** III

IATA

- **UN-No** UN2325
- **Proper Shipping Name** 1,3,5-TRIMETHYLBENZENE
- **Hazard Class** 3
- **Packing Group** III

IMDG/IMO

- **UN-No** UN2325
- **Proper Shipping Name** 1,3,5-TRIMETHYLBENZENE
- **Hazard Class** 3
- **Packing Group** III

15. Regulatory information

All of the components in the product are on the following Inventory lists: Australia Complete Regulatory Information contained in following SDS's X = listed China Canada The product is classified and labeled according to EC directives or corresponding national laws The product is classified and labeled in accordance with Directive 1999/45/EC Europe TSCA Korea Philippines Japan U.S.A. (TSCA) Canada (DSL/NDSL) Europe (EINECS/ELINCS/NLP) Australia (AICS) Korea (ECL) China (IECSC) Japan (ENCS) Philippines (PICCS)

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
1,3,5-Trimethylbenzene	X	X	-	203-604-4	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313 Not applicable

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act) Not applicable

Clean Air Act Not applicable

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA Not applicable

California Proposition 65 This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
1,3,5-Trimethylbenzene	X	-	-	-	-

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade Moderate risk, Grade 2

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 26-Sep-2009
Revision Date 26-Jan-2018
Print Date 26-Jan-2018
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

Safety Data Sheet

Prepared in accordance with Commission Regulation (EU) 2015/830

Stock Number: 31275
Revision Date: 24-04-2018
This document replaces SDS dated: 06-01-2017
2 Letter ISO country code/language code: UK/EN

Chrysene Standard

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier: **Chrysene Standard**
Stock Number: 31275

Other means of identification:
Synonyms: None Known
REACH Registration No.: None Known

1.2 Relevant identified uses of the substance or mixture and uses advised against:
Relevant identified uses: For Laboratory use only
Uses advised against: Uses other than recommended use.

1.3 Details of the Supplier of the Safety Data Sheet:	**Manufacturer**	**Supplier**
	Restek Corporation 110 Benner Circle Bellefonte, Pa. 16823 USA 00 1 814-353-1300 00 1 814-353-1309 sds@restek.com	Thames Restek UK LTD Units 8-16, Ministry Wharf Wycombe Road, Saunderton Buckinghamshire United Kingdom HP14 4HW 01494 563377 sales@thamesrestek.co.uk
1.4 Emergency telephone number:	00 1 800-424-9300 (CHEMTREC within the US) 00 1 703-741-5970 (Outside USA)	0870-8200418 (CHEMTREC within the UK) +1 703-741-5970 (CHEMTREC International)

Poison Centre contact information: National Poisons Information Service (NPIS)
Email: director.birmingham.unit@npis.org
Website: http://www.npis.org/

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture:

Classification according to Regulation (EC) No 1272/2008 [CLP]:
Carcinogenicity Category 1B
Flammable Liquid Category 2
Serious Eye Damage/Eye Irritation Category 2

Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 3

2.2 Label elements:

Labelling according to Regulation (EC) No 1272/2008 [CLP]:

Hazard pictograms:

Signal Word: Danger

Hazard Statements:
H225 - Highly flammable liquid and vapour
H319 - Causes serious eye irritation
H336 - May cause drowsiness or dizziness
H350 - May cause cancer.

Precautionary Statements:
P201 - Obtain special instructions before use.

P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

P280 - Wear protective gloves/protective clothing/eye protection/face protection.

P303+P361+P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.

P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.

P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Supplemental Hazard information (EU): None Known

2.3 Other hazards: This substance does not meet the PBT or vPvB criteria of REACH, Annex XIII

SECTION 3: Composition/information on ingredients

3.1 Substances:
Not applicable

3.2 Mixtures:

Chemical Name	%	CAS #	EC No. REACH Registration No.	Classification (EC) No 1272/2008	M Factor	SCL	Acute Toxicity Estimates
chrysene	0.1	218-01-9	205-923-4 None Known	Aquatic Acute 1; H400 Aquatic Chronic 1; H410 Carc. 1B; H350 Muta. 2; H341	No data available	No data available	Not determined
Acetone	99.9	67-64-1	200-662-2 None Known	Eye Irrit. 2; H319 Flam. Liq. 2; H225 STOT SE 3; H336 EUH066	No data available	No data available	Not determined

For full text of H-statements see Section 16.

SECTION 4: First aid measures

4.1 Description of first aid measures:

Inhalation: Remove to fresh air. If breathing is difficult, have a trained individual administer oxygen. If not breathing, give artificial respiration and have a trained individual administer oxygen. Get medical attention immediately

Eye contact: Flush eyes with plenty of water for at least 20 minutes retracting eyelids often. Tilt the head to prevent chemical from transferring to the uncontaminated eye. Get immediate medical attention.

Skin Contact: Wash with soap and water. Remove contaminated clothing and launder. Get medical attention if irritation develops or persists.

Ingestion: Do not induce vomiting and seek medical attention immediately. Drink two glasses of water or milk to dilute. Provide medical care provider with this SDS.

Self protection of the first aider: No data available

4.2 Most important symptoms and effects, both acute and delayed: Causes serious eye irritation May cause drowsiness or dizziness

4.3 Indication of any immediate medical attention and special treatment needed: No additional first aid information available

SECTION 5: Firefighting measures

5.1 Extinguishing media:

Suitable extinguishing media: Use alcohol resistant foam, carbon dioxide, or dry chemical extinguishing agents. Water spray or fog may also be effective for extinguishing if swept across the base of the fire. Water can also be used to absorb heat and keep exposed material from being damaged by fire.

Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

Unsuitable extinguishing media: None Known

5.2 Special hazards arising from the substance or mixture: Vapors may be ignited by heat, sparks, flames or other sources of ignition at or above the low flash point giving rise to a Class B fire. Vapors are heavier than air and may travel to a source of ignition and flash back

Hazardous Combustion Products: Carbon dioxide, Carbon monoxide

5.3 Advice for firefighters: Do not enter fire area without proper protection including self-contained toxic breathing apparatus and full protective equipment. Fight fire from a safe distance and a protected location due to the potential of hazardous vapors and decomposition products. Flammable component(s) of this material may be lighter than water and burn while floating on the surface. Use water spray/fog for cooling. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:

Non-emergency personnel: Non-emergency personnel should be kept clear of the area

Emergency responders: Exposure to the spilled material may be irritating or harmful. Follow personal protective equipment recommendations found in Section 8 of this SDS. Additional precautions may be necessary based on special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred. Also consider the expertise of employees in the area responding to the spill.

6.2 Environmental precautions: No data available

6.3 Methods and material for containment and cleaning up:

Small spills: Refer to information provided for large spills

Large spills: Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike

with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal evaluation.

6.4 Reference to other sections: Refer to section 13 for disposal information

SECTION 7: Handling and storage

7.1 Precautions for safe handling: Harmful or irritating material. Avoid contacting and avoid breathing the material. Use only in a well ventilated area. Use spark-proof tools and explosion-proof equipment

7.2 Conditions for safe storage, including any incompatibilities:

Conditions for safe storage: Store in a cool dry ventilated location. Isolate from incompatible materials and conditions. Keep container(s) closed. Keep away from sources of ignition

Materials to Avoid/Chemical Incompatibility: Strong oxidizing agents, Strong acids

7.3 Specific end use(s): For Laboratory use only

SECTION 8: Exposure controls/personal protection

8.1 Control parameters:

Occupational Exposure limit values:

Chemical Name	United Kingdom - Workplace Exposure Limits (WELs) - TWAs	United Kingdom - Workplace Exposure Limits (WELs) - STELs	United Kingdom - Biological Monitoring Guidance Values
Acetone	500 ppm TWA; 1210 mg/m3 TWA	1500 ppm STEL; 3620 mg/m3 STEL	No data available

DNEL: None Known

PNEC: None Known

8.2 Exposure controls:

Appropriate engineering controls: Local exhaust ventilation is recommended when generating excessive levels of vapours from handling or thermal processing.

Individual protection measures, such as personal protective equipment:

Eye and face protection: Wear chemically resistant safety glasses with side shields when handling this product. Do not wear contact lenses.

Skin Protection:

Hand protection: Nitrile Neoprene

Other skin protection: Wear protective gloves. Inspect gloves for chemical break-through and

	replace at regular intervals. Clean protective equipment regularly. Wash hands and other exposed areas with mild soap and water before eating, drinking, and when leaving work
Respiratory Protection:	No respiratory protection required under normal conditions of use. Provide general room exhaust ventilation if symptoms of overexposure occur as explained Section 3. A respirator is not normally required.
Respirator Type(s):	Not normally required.
Thermal Hazards:	Not applicable
Environmental exposure controls:	No data available

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties:

Appearance:	No data available
Colour:	Depends upon product selection
Odour:	Strong
Odour threshold:	ND
pH:	Not applicable
Melting Point/Freezing Point (°C):	
Melting point (°C):	-95
Freezing point (°C):	No data available
Initial boiling point and boiling range (°C):	56
Flash point (°C):	-20
Evaporation Rate (water = 1):	No data available
Flammability (solid, gas):	No data available
Upper/lower flammability or explosive limits:	
Upper flammable or explosive limit, % in air:	No data available
Lower flammable or explosive limit, % in air:	No data available
Vapour pressure:	No data available
Vapor Density (Air=1):	2
Relative density (water = 1):	0.791
Solubility(ies):	Complete; 100%

Partition coefficient: n-octanol/water:	No data available
Auto-ignition temperature (°C):	465
Decomposition temperature (°C):	No data available
Viscosity:	No data available
Explosive properties:	No data available
Oxidizing properties:	No data available

9.2 Other information:

Volatile Organic Chemicals:	0
Bulk density:	6.601

SECTION 10: Stability and reactivity

10.1 Reactivity:	Not expected to be reactive
10.2 Chemical stability:	Stable under normal conditions.
10.3 Possibility of hazardous reactions:	None expected under standard conditions of storage
10.4 Conditions to avoid:	No data available
10.5 Incompatible materials:	Strong oxidizing agents, Strong acids
10.6 Hazardous decomposition products:	Carbon dioxide, Carbon monoxide

SECTION 11: Toxicological information

11.1 Information on toxicological effects:

Acute toxicity:

Chemical Name	ORAL LD50 (rat)	DERMAL LD50 (rabbit)	INHALATION LC50 (rat)
Acetone	ORAL LD50 Rat 5800 mg/kg	DERMAL LD50 Rabbit > 15700 mg/kg	INHALATION LC50-8H Rat 50100 MG/M3

Based on available data, the classification criteria are not met.

Skin corrosion/irritation:
Based on available data, the classification criteria are not met.

Serious eye damage/irritation:

pH	Not applicable

Classification is based on pH and the components listed in Section 3.

Respiratory or skin sensitisation:
Based on available data, the classification criteria are not met.

Germ cell mutagenicity:
Based on available data, the classification criteria are not met.

Carcinogenicity:
Classification has been based on toxicological information of the components in Section 3.

Reproductive toxicity:
Based on available data, the classification criteria are not met.

STOT-single exposure:
Classification has been based on toxicological information of the components in Section 3.

STOT-repeated exposure:
Based on available data, the classification criteria are not met.

Aspiration hazard:
Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1 Toxicity: This material is not expected to be harmful to the ecology.

Ecological Toxicity Data:

Chemical Name	CAS #	Aquatic EC50 Crustacea	Aquatic ERC50 Algae	Aquatic LC50 Fish
No data available				

12.2 Persistence and degradability: No data
No data

12.3 Bioaccumulative potential: No data

12.4 Mobility in soil: No data

12.5 Results of PBT and vPvB assessment: No data available

12.6 Other adverse effects: None Known

12.7 Additional information: No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods:

Disposal methods: Spent or discarded material is a hazardous waste. Dispose of by incineration following Federal, State, Local, or Provincial regulations.

Waste codes / waste designations according to LoW: No data available

SECTION 14: Transport information

International carriage of dangerous goods by road (ADR), rail or inland waterways:

14.1 UN number: UN1090

14.2 UN proper shipping name: Acetone

14.3 Transport hazard class(es): 3

14.4 Packing group: II

International carriage of dangerous goods by air (IATA):

14.1 UN number: UN1090

14.2 UN proper shipping name: Acetone

14.3 Transport hazard class(es): 3

14.4 Packing group: II

14.5 Environmental hazards: No

14.6 Special precautions for user: No data available

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code: No data available

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:

Chemical Name	EINECS	SVHC
Acetone	Yes	No
chrysene	Yes	No

15.2 Chemical Safety Assessment No Chemical Safety Assessment has been carried out for this

substance/mixture by the supplier.

SECTION 16: Other information

Revision Date: 24-04-2018

Indication of changes: Any changes to the SDS compared to previous versions are marked by a vertical line in front of the concerned paragraph.

Abbreviations and acronyms:

CAS = Chemical Abstract Service
DNEL= Derivative No Effect Level
EC= European Community
EINECS = European Inventory of Existing Chemical Substances
MSHA = Mine Safety Health Administration
NIOSH = National Institute of Occupational Safety & Health
OEL = Occupational Exposure Limit
PBT= Persistent, Bioaccumulative, Toxic
PNEC= Predicted No Effect Concentration
SCOEL= Scientific Committee on Occupational Exposure Limits
TLV = Threshold Limit Value
TWA= Time Weighted Average
vPvB= Very Persistent, Very Bioaccumulative
Wt.% = Weight Percent

Key literature references and sources for data: No data available

Hazard phrase(s) referenced in section 3

H341 - Suspected of causing genetic defects.

H350 - May cause cancer.

H225 - Highly flammable liquid and vapour

H319 - Causes serious eye irritation

H336 - May cause drowsiness or dizziness

H410 - Very toxic to aquatic life with long lasting effects

Precautionary Statements:

Prevention:

P201 - Obtain special instructions before use.

P202 - Do not handle until all safety precautions have been read and understood.

P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

	P240 - Ground/bond container and receiving equipment.
	P241 - Use explosion-proof electrical/ventilating/lighting equipment.
	P242 - Use only non-sparking tools.
	P243 - Take precautionary measures against static discharge.
	P261 - Avoid breathing dust/fume/gas/mist/vapours/spray.
	P264 - Wash thoroughly after handling.
	P271 - Use only outdoors or in a well-ventilated area.
	P280 - Wear protective gloves/protective clothing/eye protection/face protection.
Response:	P303+P361+P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
	P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.
	P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
	P308+P313 - IF exposed or concerned: Get medical advice/ attention.
	P312 - Call a POISON CENTER/doctor if you feel unwell.
	P337+P313 - If eye irritation persists: Get medical advice/attention.
	P370+P378 - In case of fire: Use an appropriate extinguisher (see section 5) to extinguish.
Storage:	P403+P233 - Store in a well-ventilated place. Keep container tightly closed.
	P403+P235 - Store in a well-ventilated place. Keep cool.
	P405 - Store locked up.
Disposal:	P501 - Dispose of contents/container to a suitable disposal site in accordance with local/national/international regulations.

Disclaimer of Liability:

Restek Corporation provides the descriptions, data and information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. It is provided for your guidance only. Because many factors may affect processing or application/use, Restek Corporation recommends you perform an assessment to determine the suitability of a product for your particular purpose prior to use. No warranties of any kind, either expressed or implied, including fitness for a particular purpose, are made regarding products described, data or information set forth. In no case shall the descriptions, information, or data provided be considered a part of our terms and conditions of sale. Further, the descriptions, data and information furnished hereunder are given gratis. No obligation or liability for the description, data and information given are

assumed. All such being given and accepted at your risk.

Safety Data Sheet

Revision Date: 08/13/18
www.restek.com

2 Letter ISO country code/language code: US/EN

1. IDENTIFICATION

Catalog Number / Product Name:	**31272 / Benzo(b)fluoranthene Standard**
Company:	Restek Corporation
Address:	110 Benner Circle Bellefonte, Pa. 16823
Phone#:	814-353-1300
Fax#:	814-353-1309
Emergency#:	800-424-9300 (CHEMTREC) 703-527-3887 (Outside the US)
Email:	www.restek.com
Revision Number:	10
Intended use:	For Laboratory use only

2. HAZARD(S)IDENTIFICATION

Emergency Overview:

GHS Hazard Symbols:

GHS Classification:
Carcinogenicity Category 1B
Flammable Liquid Category 2
Serious Eye Damage/Eye Irritation Category 2
Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 3

GHS Signal Word:
Danger

GHS Hazard:
Highly flammable liquid and vapour.
Causes serious eye irritation.
May cause drowsiness or dizziness.
May cause cancer.

GHS Precautions:

Safety Precautions:
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat/sparks/open flames/hot surfaces. – No smoking.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilation and lighting equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Avoid breathing dust/fume/gas/mist/vapours/spray.
Wash hands and skin thoroughly after handling.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/protective clothing/eye protection/face protection.

First Aid Measures:
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
IF exposed or concerned: Get medical advice/attention.
Call a POISON CENTER or doctor/physician if you feel unwell.
If eye irritation persists: Get medical advice/attention.
In case of fire: Use extinguishing media in section 5 for extinction.

Storage: Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.

Disposal: Dispose of contents/container according to section 13 of the SDS.

Single Exposure Target Organs: Specific target organ toxicity - Single exposure - STOT SE 3: H336 May cause drowsiness or dizziness.

Repeated Exposure Target Organs: No data available

3. COMPOSITION / INFORMATION ON INGREDIENT

Chemical Name	CAS #	EINEC #	% Composition
Acetone	67-64-1	200-662-2	99.9
benzo (b) fluoranthene	205-99-2	205-911-9	0.1

4. FIRST-AID MEASURES

Inhalation: Remove to fresh air. If breathing is difficult, have a trained individual administer oxygen. If not breathing, give artificial respiration and have a trained individual administer oxygen. Get medical attention immediately

Eyes: Flush eyes with plenty of water for at least 20 minutes retracting eyelids often. Tilt the head to prevent chemical from transferring to the uncontaminated eye. Get immediate medical attention.

Skin Contact: Wash with soap and water. Remove contaminated clothing and launder. Get medical attention if irritation develops or persists.

Ingestion: Do not induce vomiting and seek medical attention immediately. Drink two glasses of water or milk to dilute. Provide medical care provider with this SDS.

5. FIRE- FIGHTING MEASURES

Extinguishing Media: Use alcohol resistant foam, carbon dioxide, or dry chemical extinguishing agents. Water spray or fog may also be effective for extinguishing if swept across the base of the fire. Water can also be used to absorb heat and keep exposed material from being damaged by fire. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

Fire and/or Explosion Hazards: Vapors may be ignited by heat, sparks, flames or other sources of ignition at or above the low flash point giving rise to a Class B fire. Vapors are heavier than air and may travel to a source of ignition and flash back

Fire Fighting Methods and Protection: Do not enter fire area without proper protection including self-contained toxic breathing apparatus and full protective equipment. Fight fire from a safe distance and a protected location due to the potential of hazardous vapors and decomposition products. Flammable component(s) of this material may be lighter than water and burn while floating on the surface. Use water spray/fog for cooling. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

Hazardous Combustion Products: Carbon dioxide, Carbon monoxide

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions and Equipment: Exposure to the spilled material may be irritating or harmful. Follow personal protective equipment recommendations found in Section 8 of this SDS. Additional precautions may be necessary based on special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred. Also consider the expertise of employees in the area responding to the spill.

Methods for Clean-up: Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal

evaluation.

7. HANDLING AND STORAGE

Handling Technical Measures and Precautions:	Harmful or irritating material. Avoid contacting and avoid breathing the material. Use only in a well ventilated area. Use spark-proof tools and explosion-proof equipment
Storage Technical Measures and Conditions:	Store in a cool dry ventilated location. Isolate from incompatible materials and conditions. Keep container(s) closed. Keep away from sources of ignition

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

United States:

Chemical Name	CAS No.	IDLH	ACGIH STEL	ACGIH TLV-TWA	OSHA Exposure Limit
Acetone	67-64-1	2500 ppm IDLH (10% LEL)	750 ppm STEL; 1782 mg/m3 STEL	500 ppm TWA; 1188 mg/m3 TWA	1000 ppm TWA; 2400 mg/m3 TWA
benzo (b) fluoranthene	205-99-2	Not established	None Known	Not established	No data available

Personal Protection:

Engineering Measures:	Local exhaust ventilation is recommended when generating excessive levels of vapours from handling or thermal processing.
Respiratory Protection:	No respiratory protection required under normal conditions of use. Provide general room exhaust ventilation if symptoms of overexposure occur as explained Section 3. A respirator is not normally required.
Eye Protection:	Wear chemically resistant safety glasses with side shields when handling this product. Do not wear contact lenses.
Skin Protection:	Wear protective gloves. Inspect gloves for chemical break-through and replace at regular intervals. Clean protective equipment regularly. Wash hands and other exposed areas with mild soap and water before eating, drinking, and when leaving work
Medical Conditions Aggravated By Exposure:	Respiratory disease including asthma and bronchitis

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance, color:	Depends upon product selection
Odor:	Strong
Physical State:	No data available
pH:	Not applicable
Vapor Pressure:	No data available
Vapor Density:	2.0 (air = 1)
Boiling Point (°C):	56.05 °C at 1013.25 hPa
Melting Point (°C):	-95.4 °C Melting Point
Flash Point (°F):	39
Flammability:	Highly Flammable
Upper Flammable/Explosive Limit, % in air:	No data available
Lower Flammable/Explosive Limit, % in air:	No data available
Autoignition Temperature (°C):	465 deg C
Decomposition Temperature (°C):	No data available
Specific Gravity:	0.7845 g/cm3 at 25 °C
Evaporation Rate:	No data available
Odor Threshold:	ND
Solubility:	Complete; 100%
Partition Coefficient: n-octanol in water:	No data available
VOC % by weight:	0
Molecular Weight:	58.08

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions.
Conditions to Avoid:	None known.
Materials to Avoid / Chemical Incompatiability:	Strong oxidizing agents Strong acids
Hazardous Decomposition Products:	Carbon dioxide Carbon monoxide

11. TOXICOLOGICAL INFORMATION

Routes of Entry:	Inhalation, Skin Contact, Eye Contact, Ingestion

Target Organs Potentially Affected By Exposure: Eyes, Central nervous system stimulation, Respiratory Tract, Skin

Chemical Interactions That Change Toxicity: None Known

Immediate (Acute) Health Effects by Route of Exposure:

Inhalation Irritation: Can cause minor respiratory irritation, dizziness, weakness, fatigue, nausea, and headache.

Skin Contact: Can cause minor skin irritation, defatting, and dermatitis.

Eye Contact: Can cause minor irritation, tearing and reddening.

Ingestion Irritation: May be harmful if swallowed.

Ingestion Toxicity: Harmful if swallowed. May cause systemic poisoning.

Long-Term (Chronic) Health Effects:

Carcinogenicity: Contains a probable or known human carcinogen.

Reproductive and Developmental Toxicity: No data available to indicate product or any components present at greater than 0.1% may cause birth defects.

Inhalation: Upon prolonged and/or repeated exposure, can cause minor respiratory irritation, dizziness, weakness, fatigue, nausea, and headache.

Skin Contact: Upon prolonged or repeated contact, can cause minor skin irritation, defatting, and dermatitis.

Component Toxicological Data:

NIOSH:

Chemical Name	CAS No.	LD50/LC50
Acetone	67-64-1	Dermal LD50 Rabbit >15700 mg/kg; Inhalation LC50 Rat 50100 mg/m3 8 h; Oral LD50 Rat 5800 mg/kg

Component Carcinogenic Data:

OSHA:

Chemical Name	CAS No.	
Benzo(b)fluoranthene	205-99-2	Present

ACGIH:

Chemical Name	CAS No.	
Benzo[b]fluoranthene	205-99-2	A2 - Suspected Human Carcinogen
Acetone	67-64-1	A4 - Not Classifiable as a Human Carcinogen

NIOSH:

Chemical Name	CAS No.
No data available	

NTP:

Chemical Name	CAS No.
No data available	

IARC:

Chemical Name	CAS No.	Group No.
Monograph 92 [2010]; Supplement 7 [1987]; Monograph 32 [1983]	205-99-2	Group 2B

12. ECOLOGICAL INFORMATION

Overview: This material is not expected to be harmful to the ecology.

Mobility: No data

Persistence: No data

Bioaccumulation: No data

Degradability: No data

Ecological Toxicity Data: No data available

13. DISPOSAL CONSIDERATIONS

Waste Description of Spent Product: Spent or discarded material is a hazardous waste.Mixing spent or discarded material with other materials may render the mixture hazardous. Perform a hazardous waste determination on mixtures.

Disposal Methods: Dispose of by incineration following Federal, State, Local, or Provincial regulations.

Waste Disposal of Packaging: Comply with all Local, State, Federal, and Provincial Environmental Regulations.

14. TRANSPORTATION INFORMATION

United States:

DOT Proper Shipping Name: Acetone
UN Number: UN1090
Hazard Class: 3
Packing Group: II

International:

IATA Proper Shipping Name: Acetone
UN Number: UN1090
Hazard Class: 3
Packing Group: II

Marine Pollutant: No

Chemical Name	CAS#	Marine Pollutant	Severe Marine Pollutant
No data available			

15. REGULATORY INFORMATION

United States:

Chemical Name	CAS#	CERCLA	SARA 313	SARA EHS 313	TSCA
Acetone	67-64-1	X	-	-	X
benzo (b) fluoranthene	205-99-2	X	X	-	-

The following chemicals are listed on CA Prop 65:

Chemical Name	CAS #	Regulation
Benzo[b]fluoranthene	205-99-2	Prop 65 Cancer

State Right To Know Listing:

Chemical Name	CAS#	New Jersey	Massachusetts	Pennsylvania	California
Acetone	67-64-1	X	X	X	X
benzo (b) fluoranthene	205-99-2	X	X	X	X

16. OTHER INFORMATION

Prior Version Date: 12/08/16

Other Information: Any changes to the SDS compared to previous versions are marked by a vertical line in front of the concerned paragraph.

References: No data available

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SAFETY DATA SHEET

Version 4.7
Revision Date 12/28/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Lead

Product Number : 695912
Brand : Aldrich

CAS-No. : 7439-92-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Carcinogenicity (Category 2), H351
Reproductive toxicity (Category 2), H361
Specific target organ toxicity - repeated exposure (Category 2), H373
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H302 Harmful if swallowed.
H351 Suspected of causing cancer.
H361 Suspected of damaging fertility or the unborn child.
H373 May cause damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and

	understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Pb
Molecular weight	:	207.20 g/mol
CAS-No.	:	7439-92-1
EC-No.	:	231-100-4

Hazardous components

Component	Classification	Concentration
Lead		
	Acute Tox. 4; Carc. 2; Repr. 2; STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H302, H351, H361, H373, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Lead oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
	Remarks	See 1910.1025		
Lead	7439-92-1	TWA	0.05 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Confirmed animal carcinogen with unknown relevance to humans		
		TWA	0.05 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Hematologic effects Peripheral Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with unknown relevance to humans		

		TWA	0.05 mg/m3	USA. NIOSH Recommended Exposure Limits
		See Appendix C		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Lead	7439-92-1	Lead	30µg/ 100 ml	In blood	ACGIH - Biological Exposure Indices (BEI)
	Remarks	Not critical			
		Lead	30µg/ 100 ml	In blood	ACGIH - Biological Exposure Indices (BEI)
		Not critical			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: Shot
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 327.4 °C (621.3 °F) - lit.
f)	Initial boiling point and boiling range	1,740 °C (3,164 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Strong acids

10.6 Hazardous decomposition products

Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity

Rat
Cytogenetic analysis

Carcinogenicity

Limited evidence of carcinogenicity in animal studies

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Lead)

NTP: Reasonably anticipated to be a human carcinogen (Lead)

Reasonably anticipated to be a human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Lead)

OSHA: 1910.1025 (Lead)

OSHA specifically regulated carcinogen (Lead)

Reproductive toxicity
Suspected human reproductive toxicant

Reproductive toxicity - Rat - Inhalation
Effects on Newborn: Biochemical and metabolic.

Reproductive toxicity - Rat - Oral
Effects on Newborn: Behavioral.

Reproductive toxicity - Mouse - Oral
Effects on Fertility: Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated). Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea).

Developmental Toxicity - Rat - Inhalation
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow).

Developmental Toxicity - Rat - Oral
Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow). Effects on Newborn: Growth statistics (e.g., reduced weight gain).

Developmental Toxicity - Rat - Oral
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Developmental Toxicity - Mouse - Oral
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: OF7525000

anemia

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	mortality LOEC - Oncorhynchus mykiss (rainbow trout) - 1.19 mg/l - 96.0 h
	LC50 - Micropterus dolomieui - 2.2 mg/l - 96.0 h
	mortality NOEC - Salvelinus fontinalis - 1.7 mg/l - 10.0 d
Toxicity to daphnia and other aquatic invertebrates	mortality LOEC - Daphnia (water flea) - 0.17 mg/l - 24 h
	mortality NOEC - Daphnia (water flea) - 0.099 mg/l - 24 h
Toxicity to algae	mortality EC50 - Skeletonema costatum - 7.94 mg/l - 10 d

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Bioaccumulation: Oncorhynchus kisutch - 2 Weeks - 150 µg/l

Bioconcentration factor (BCF): 12

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Lead)
Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Lead)
Marine pollutant:yes
IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Lead)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Lead	7439-92-1	1994-04-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Lead	7439-92-1	1994-04-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Lead	7439-92-1	1994-04-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Lead	7439-92-1	1994-04-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer. Lead	CAS-No. 7439-92-1	Revision Date 1989-07-10
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Lead	CAS-No. 7439-92-1	Revision Date 1989-07-10

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H302	Harmful if swallowed.
H351	Suspected of causing cancer.
H361	Suspected of damaging fertility or the unborn child.
H373	May cause damage to organs through prolonged or repeated exposure.

H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	1
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	1
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7 Revision Date: 12/28/2015 Print Date: 05/01/2016

SAFETY DATA SHEET

Version 3.12
Revision Date 12/02/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Mercury

Product Number : 215457
Brand : Sigma-Aldrich
Index-No. : 080-001-00-0

CAS-No. : 7439-97-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Inhalation (Category 2), H330
Reproductive toxicity (Category 1B), H360
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H330 Fatal if inhaled.
H360 May damage fertility or the unborn child.
H372 Causes damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.

P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P284	Wear respiratory protection.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Hg
Molecular weight	:	200.59 g/mol
CAS-No.	:	7439-97-6
EC-No.	:	231-106-7
Index-No.	:	080-001-00-0

Hazardous components

Component	Classification	Concentration
Mercury		
	Acute Tox. 2; Repr. 1B; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H330, H360, H372, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Mercury/mercury oxides.

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal. In some instances, a mercury spill kit may be used. Please consult with your site EHS representative to determine the most appropriate clean up method.Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Store under inert gas.
Storage class (TRGS 510): Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Mercury	7439-97-6	C	0.1 mg/m3	USA. NIOSH Recommended Exposure Limits
	Remarks	Potential for dermal absorption		

		CEIL	1.0mg/10m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		TWA	0.05 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		Skin notation		
		TWA	0.025 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen Danger of cutaneous absorption		
		TWA	0.05 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential for dermal absorption		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Mercury	7439-97-6	Mercury	0.0400 mg/g	In urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	Prior to shift (16 hours after exposure ceases)			
		Mercury	15.0000 µg/l	In blood	ACGIH - Biological Exposure Indices (BEI)
		End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: silver, white
b)	Odour	odourless
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: -38.87 °C (-37.97 °F) - lit.
f)	Initial boiling point and boiling range	356.6 °C (673.9 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	< 0.01 hPa (< 0.01 mmHg) at 20 °C (68 °F) 1 hPa (1 mmHg) at 126 °C (259 °F)
l)	Vapour density	6.93 - (Air = 1.0)
m)	Relative density	13.55 g/cm3 at 25 °C (77 °F)
n)	Water solubility	0.00006 g/l at 25 °C (77 °F)
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

Relative vapour density	6.93 - (Air = 1.0)

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents, Ammonia, Azides, Nitrates, Chlorates, Copper

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

LC50 Inhalation - Rat - male - 2 h - < 27 mg/m3

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC:	3 - Group 3: Not classifiable as to its carcinogenicity to humans (Mercury)
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
Presumed human reproductive toxicant

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: OV4550000

Mercury accumulates in almost all tissues, especially in the:, Kidney, Effects due to ingestion may include:, Nausea, Vomiting, Diarrhoea, intestinal bleeding

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	mortality LC50 - Cyprinus carpio (Carp) - 0.160 mg/l - 96 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation	Carassius auratus (goldfish) - 1,789 d - 0.25 µg/l
	Bioconcentration factor (BCF): 155,986

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2809 Class: 8 (6.1) Packing group: III
Proper shipping name: A,W Mercury
Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 2809 Class: 8 (6.1) Packing group: III EMS-No: F-A, S-B
Proper shipping name: MERCURY
Marine pollutant:yes

IATA
UN number: 2809 Class: 8 (6.1) Packing group: III
Proper shipping name: Mercury

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Mercury	7439-97-6	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Mercury	7439-97-6	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Mercury	7439-97-6	2007-07-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Mercury	7439-97-6	2013-12-20

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H330	Fatal if inhaled.
H360	May damage fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
Repr.	Reproductive toxicity

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 3.12 Revision Date: 12/02/2015 Print Date: 05/01/2016

SAFETY DATA SHEET

Version 4.7
Revision Date 05/23/2016
Print Date 06/23/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name	:	Arsenic
Product Number	:	202657
Brand	:	Aldrich
Index-No.	:	033-001-00-X
CAS-No.	:	7440-38-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses	:	Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #	:	(314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 3), H331
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)

H302	Harmful if swallowed.
H331	Toxic if inhaled.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.

P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. Rinse mouth.
P304 + P340 + P311	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	As
Molecular weight	:	74.92 g/mol
CAS-No.	:	7440-38-2
EC-No.	:	231-148-6
Index-No.	:	033-001-00-X

Hazardous components

Component	Classification	Concentration
Arsenic		
	Acute Tox. 4; Acute Tox. 3; Aquatic Acute 1; Aquatic Chronic 1; H302, H331, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Arsenic	7440-38-2	TWA	0.01 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Lung cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed human carcinogen		
		C	0.0020 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A 15 minute ceiling value		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Arsenic	7440-38-2	inorganic arsenic plus methylated metabolites	35µg As/l	In urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of the workweek (After four or five consecutive working days			

		with exposure)			
		inorganic arsenic plus methylated metabolites	35µg As/l	Urine	ACGIH - Biological Exposure Indices (BEI)
		End of the workweek (After four or five consecutive working days with exposure)			

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N99 (US) or type P2 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: Pieces Colour: grey
b)	Odour	No data available
c)	Odour Threshold	No data available

d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 817 °C (1,503 °F) - lit.
f)	Initial boiling point and boiling range	613 °C (1,135 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	5.727 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
Heat Exposure to air may affect product quality.

10.5 Incompatible materials
Oxidizing agents, Halogens, Palladium undergoes a violent reaction with arsenic, Zinc, Platinum oxide, Nitrogen trichloride, Bromine azide

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Arsenic oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 763 mg/kg
Remarks: Behavioral:Ataxia. Diarrhoea

LD50 Oral - Mouse - 145 mg/kg
Remarks: Behavioral:Ataxia. Diarrhoea

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

IARC:	1 - Group 1: Carcinogenic to humans (Arsenic)
NTP:	Known to be human carcinogen (Arsenic)
	Known to be human carcinogen (Arsenic)
OSHA:	OSHA specifically regulated carcinogen (Arsenic)

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: CG0525000

Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 9.9 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 3.8 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1558 Class: 6.1 Packing group: II
Proper shipping name: Arsenic
Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 1558 Class: 6.1 Packing group: II EMS-No: F-A, S-A
Proper shipping name: ARSENIC
Marine pollutant:yes

IATA
UN number: 1558 Class: 6.1 Packing group: II
Proper shipping name: Arsenic

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Arsenic	7440-38-2	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Arsenic	7440-38-2	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Arsenic	7440-38-2	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Arsenic	7440-38-2	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Arsenic	7440-38-2	2008-10-10

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H302	Harmful if swallowed.
H331	Toxic if inhaled.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7 Revision Date: 05/23/2016 Print Date: 06/23/2016

SAFETY DATA SHEET

Version 4.7
Revision Date 12/28/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Nickel

Product Number : 268259
Brand : Aldrich
Index-No. : 028-002-00-7

CAS-No. : 7440-02-0

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Skin sensitisation (Category 1), H317
Carcinogenicity (Category 2), H351
Specific target organ toxicity - repeated exposure, Inhalation (Category 1), H372
Acute aquatic toxicity (Category 3), H402
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H317 May cause an allergic skin reaction.
H351 Suspected of causing cancer.
H372 Causes damage to organs through prolonged or repeated exposure if inhaled.
H412 Harmful to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and

	understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P272	Contaminated work clothing should not be allowed out of the workplace.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P333 + P313	If skin irritation or rash occurs: Get medical advice/ attention.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Ni
Molecular weight	:	58.69 g/mol
CAS-No.	:	7440-02-0
EC-No.	:	231-111-4
Index-No.	:	028-002-00-7

Hazardous components

Component	Classification	Concentration
Nickel		
	Skin Sens. 1; Carc. 2; STOT RE 1; Aquatic Acute 3; Aquatic Chronic 3; H317, H351, H372, H412	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Nickel/nickel oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Nickel	7440-02-0	TWA	1.500000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Dermatitis Pneumoconiosis Not suspected as a human carcinogen		
		TWA	1.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.015000 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		

		TWA	1.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.015000 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		
		TWA	1.5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Dermatitis Pneumoconiosis Not suspected as a human carcinogen		
		TWA	1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.015 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: Foil Colour: white, silver, metallic
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 1,453 °C (2,647 °F) - lit.
f)	Initial boiling point and boiling range	2,732 °C (4,950 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	1 hPa (1 mmHg) at 1,810 °C (3,290 °F)
l)	Vapour density	No data available
m)	Relative density	8.9 g/mL at 25 °C (77 °F)
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
acids, Oxidizing agents, Sulphur compounds, Hydrogen gas, Oxygen, Methanol, organic solvents, Aluminium, Fluorine, Ammonia

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
May cause sensitisation by skin contact.

Germ cell mutagenicity
No data available

Carcinogenicity

Limited evidence of carcinogenicity in animal studies

IARC:	2B - Group 2B: Possibly carcinogenic to humans (Nickel)
	1 - Group 1: Carcinogenic to humans (Nickel)
	2B - Group 2B: Possibly carcinogenic to humans (Nickel)
IARC:	2B - Group 2B: Possibly carcinogenic to humans (Nickel)
	1 - Group 1: Carcinogenic to humans (Nickel)
	2B - Group 2B: Possibly carcinogenic to humans (Nickel)
NTP:	Reasonably anticipated to be a human carcinogen (Nickel)
	Reasonably anticipated to be a human carcinogen (Nickel)
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Inhalation - Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: QR5950000

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Cyprinus carpio (Carp) - 1.3 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 1 mg/l - 48 h

12.2 Persistence and degradability
Not applicable

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Nickel	7440-02-0	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Nickel	7440-02-0	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Nickel	7440-02-0	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Nickel	7440-02-0	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Nickel	7440-02-0	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H317	May cause an allergic skin reaction.
H351	Suspected of causing cancer.
H372	Causes damage to organs through prolonged or repeated exposure if inhaled.
H402	Harmful to aquatic life.
H412	Harmful to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7 Revision Date: 12/28/2015 Print Date: 05/01/2016

SAFETY DATA SHEET
Calcium Standard

Revision: 04/16/2015
Supersedes Revision: 06/09/2011

according to Regulation (EC) No. 1907/2006 as amended by (EC) No. 1272/2008

Section 1. Identification of the Substance/Mixture and of the Company/Undertaking

1.1 Product Code: 700552
Product Name: Calcium Standard

1.2 Relevant identified uses of the substance or mixture and uses advised against:
Relevant identified uses: For research use only, not for human or veterinary use.

1.3 Details of the Supplier of the Safety Data Sheet:

Company Name: Cayman Chemical Company
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
Web site address: www.caymanchem.com
Information: Cayman Chemical Company +1 (734)971-3335

1.4 Emergency telephone number:
Emergency Contact: CHEMTREC Within USA and Canada: +1 (800)424-9300
CHEMTREC Outside USA and Canada: +1 (703)527-3887

Section 2. Hazards Identification

2.1 Classification of the Substance or Mixture:

2.1.1 Classification according to Regulation (EC) No 1272/2008 [CLP]:

Skin Corrosion/Irritation, Category 3

2.2 Label Elements:

2.2.1 Labeling according to Regulation (EC) No 1272/2008 [CLP]:

GHS Signal Word: **Warning**

GHS Hazard Phrases:

H316: Causes mild skin irritation.

GHS Precaution Phrases:

No phrases apply.

GHS Response Phrases:

P332+313: If skin irritation occurs, get medical advice/attention.

GHS Storage and Disposal Phrases:

Please refer to Section 7 for Storage and Section 13 for Disposal information.

2.3 Adverse Human Health Effects and Symptoms: Causes mild skin irritation.
Material may be irritating to the mucous membranes and upper respiratory tract.
May be harmful by inhalation, ingestion, or skin absorption.
May cause eye or respiratory system irritation.
To the best of our knowledge, the toxicological properties have not been thoroughly investigated.

Section 3. Composition/Information on Ingredients

CAS # / RTECS #	Hazardous Components (Chemical Name)/ REACH Registration No.	Concentration	EC No./ EC Index No.	GHS Classification
471-34-1 FF9335000	Calcium carbonate	2.0 %	207-439-9 NA	No data available.
77-86-1 TY2900000	Trizma base	1.21 %	201-064-4 NA	Skin Corr. 2: H315 Eye Damage 2: H319 STOT (SE) 3: H335 H336
7732-18-5	Water	96.79 %	231-791-2	No data available.

ZC0110000			NA	

Section 4. First Aid Measures

4.1 Description of First Aid Measures: No data available.

In Case of Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Get immediate medical attention.

In Case of Skin Contact: Immediately wash skin with soap and plenty of water for at least 15 minutes. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

In Case of Eye Contact: Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Have eyes examined and tested by medical personnel.

In Case of Ingestion: Wash out mouth with water provided person is conscious. Never give anything by mouth to an unconscious person. Get medical attention. Do NOT induce vomiting unless directed to do so by medical personnel.

Section 5. Fire Fighting Measures

5.1 Suitable Extinguishing Media: Use alcohol-resistant foam, carbon dioxide, water, or dry chemical spray.
Use water spray to cool fire-exposed containers.

Unsuitable Extinguishing Media: A solid water stream may be inefficient.

5.2 Flammable Properties and Hazards: No data available.

Flash Pt: No data.

Explosive Limits: LEL: No data. UEL: No data.

Autoignition Pt: No data.

5.3 Fire Fighting Instructions: As in any fire, wear self-contained breathing apparatus pressure-demand (NIOSH approved or equivalent), and full protective gear to prevent contact with skin and eyes.

Section 6. Accidental Release Measures

6.1 Protective Precautions, Protective Equipment and Emergency Procedures: Avoid breathing vapors and provide adequate ventilation.
As conditions warrant, wear a NIOSH approved self-contained breathing apparatus, or respirator, and appropriate personal protection (rubber boots, safety goggles, and heavy rubber gloves).

6.2 Environmental Precautions: Take steps to avoid release into the environment, if safe to do so.

6.3 Methods and Material For Containment and Cleaning Up: Contain spill and collect, as appropriate.
Transfer to a chemical waste container for disposal in accordance with local regulations.

Section 7. Handling and Storage

7.1 Precautions To Be Taken in Handling: Avoid breathing dust/fume/gas/mist/vapours/spray.
Avoid prolonged or repeated exposure.

7.2 Precautions To Be Taken in Storing: Keep container tightly closed.
Store in accordance with information listed on the product insert.

Section 8. Exposure Controls/Personal Protection

8.1 Exposure Parameters:

CAS #	Partial Chemical Name	Britain EH40	France VL	Europe
471-34-1	Calcium carbonate	No data.	TWA: 10 mg/m3	No data.
77-86-1	Trizma base	No data.	No data.	No data.
7732-18-5	Water	No data.	No data.	No data.

CAS #	Partial Chemical Name	OSHA TWA	ACGIH TWA	Other Limits
471-34-1	Calcium carbonate	No data.	TLV: 10 mg/m3 (E)	No data.
77-86-1	Trizma base	No data.	No data.	No data.
7732-18-5	Water	No data.	No data.	No data.

8.2 Exposure Controls:

8.2.1 Engineering Controls (Ventilation etc.): Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

8.2.2 Personal protection equipment:

Eye Protection: Safety glasses

Protective Gloves: Compatible chemical-resistant gloves

Other Protective Clothing: Lab coat

Respiratory Equipment (Specify Type): NIOSH approved respirator, as conditions warrant.

Work/Hygienic/Maintenance Practices: Do not take internally.
Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.
Wash thoroughly after handling.
No data available.

Section 9. Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Physical States: [ ] Gas [X] Liquid [ ] Solid

Appearance and Odor: Solution

pH: 7.0

Melting Point: No data.

Boiling Point: No data.

Flash Pt: No data.

Evaporation Rate: No data.

Explosive Limits: LEL: No data. UEL: No data.

Vapor Pressure (vs. Air or mm Hg): No data.

Vapor Density (vs. Air = 1): No data.

Specific Gravity (Water = 1): No data.

Solubility in Water: No data.

Autoignition Pt: No data.

9.2 Other Information

Percent Volatile: No data.

Section 10. Stability and Reactivity

10.1 Reactivity: No data available.

10.2 Stability: Unstable [ ] Stable [X]

10.3 Stability Note(s): Stable if stored in accordance with information listed on the product insert.

Polymerization: Will occur [ ] Will not occur [X]

10.4 Conditions To Avoid: No data available.

10.5 Incompatibility - Materials To Avoid: No data available.

10.6 Hazardous Decomposition Or Byproducts: No data available.

Section 11. Toxicological Information

11.1 Information on Toxicological Effects: The toxicological effects of this product have not been thoroughly studied.

Carcinogenicity: NTP? No IARC Monographs? No OSHA Regulated? No

CAS #	Hazardous Components (Chemical Name)	NTP	IARC	ACGIH	OSHA
471-34-1	Calcium carbonate	n.a.	n.a.	n.a.	n.a.
77-86-1	Trizma base	n.a.	n.a.	n.a.	n.a.
7732-18-5	Water	n.a.	n.a.	n.a.	n.a.

Section 12. Ecological Information

12.1 Toxicity: Avoid release into the environment.
Runoff from fire control or dilution water may cause pollution.

12.2 Persistence and Degradability: No data available.

12.3 Bioaccumulative Potential: No data available.

12.4 Mobility in Soil: No data available.

12.5 Results of PBT and vPvB assessment: No data available.

12.6 Other adverse effects: No data available.

Section 13. Disposal Considerations

13.1 Waste Disposal Method: Dispose in accordance with local, state, and federal regulations.

Section 14. Transport Information

14.1 LAND TRANSPORT (US DOT):

DOT Proper Shipping Name: Not dangerous goods.

DOT Hazard Class:

UN/NA Number:

14.1 LAND TRANSPORT (European ADR/RID):

ADR/RID Shipping Name: Not dangerous goods.

UN Number:

Hazard Class:

14.3 AIR TRANSPORT (ICAO/IATA):

ICAO/IATA Shipping Name: Not dangerous goods.

Additional Transport Information: Transport in accordance with local, state, and federal regulations.

Section 15. Regulatory Information

EPA SARA (Superfund Amendments and Reauthorization Act of 1986) Lists

CAS #	Hazardous Components (Chemical Name)	S. 302 (EHS)	S. 304 RQ	S. 313 (TRI)
471-34-1	Calcium carbonate	No	No	No
77-86-1	Trizma base	No	No	Yes-Cat. N106
7732-18-5	Water	No	No	No

CAS #	Hazardous Components (Chemical Name)	Other US EPA or State Lists
471-34-1	Calcium carbonate	CAA HAP,ODC: No; CWA NPDES: No; TSCA: Yes - Inventory; CA PROP.65: No
77-86-1	Trizma base	CAA HAP,ODC: HAP; CWA NPDES: No; TSCA: Yes - Inventory; CA PROP.65: No
7732-18-5	Water	CAA HAP,ODC: No; CWA NPDES: No; TSCA: Yes - Inventory; CA PROP.65: No

Regulatory Information Statement: This SDS was prepared in accordance with 29 CFR 1910.1200 and Regulation (EC) No.1272/2008.

Section 16. Other Information

Revision Date: 04/16/2015

Additional Information About This Product: No data available.

Company Policy or Disclaimer: DISCLAIMER: This information is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

SAFETY DATA SHEET

Version 4.10
Revision Date 12/29/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name	:	Cadmium
Product Number	:	414891
Brand	:	Aldrich
Index-No.	:	048-002-00-0
CAS-No.	:	7440-43-9

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses	:	Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #	:	(314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Inhalation (Category 2), H330
Germ cell mutagenicity (Category 2), H341
Carcinogenicity (Category 1B), H350
Reproductive toxicity (Category 2), H361
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)

H330	Fatal if inhaled.
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H361	Suspected of damaging fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P284	Wear respiratory protection.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Cd
Molecular weight	:	112.41 g/mol
CAS-No.	:	7440-43-9
EC-No.	:	231-152-8
Index-No.	:	048-002-00-0

Hazardous components

Component	Classification	Concentration
Cadmium Included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH)		
	Acute Tox. 2; Muta. 2; Carc. 1B; Repr. 2; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H330, H341, H350, H361, H372, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Cadmium/cadmium oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Air sensitive.
Storage class (TRGS 510): Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Cadmium	7440-43-9	TWA	0.010000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section)		

		Suspected human carcinogen		
		TWA	0.002000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen		
		Substance listed; for more information see OSHA document 1910.1027		
		TWA	0.100000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.300000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.600000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		TWA	0.100000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.300000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		Potential Occupational Carcinogen See Appendix A		
		TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.600000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		PEL	0.005000 mg/m3	OSHA Specifically Regulated Chemicals/Carcinogens
		1910.1027 This standard applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the Occupational Safety and Health Act, except the construction-related industries, which are covered under 29 CFR 1926.63. OSHA specifically regulated carcinogen		

		Potential Occupational Carcinogen See Appendix A		
		Potential Occupational Carcinogen See Appendix A		
		TWA	0.010000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies		
		TWA	0.002000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies		
		PEL	0.005000 mg/m3	OSHA Specifically Regulated Chemicals/Carcinogens
		1910.1027 This standard applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the Occupational Safety and Health Act, except the construction-related industries, which are covered under 29 CFR 1926.63. OSHA specifically regulated carcinogen		
		TWA	0.1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.3 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.6 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		Substance listed; for more information see OSHA document 1910.1027		
		Potential Occupational Carcinogen See Appendix A		
		TWA	0.01 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies		

		TWA	0.002 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies		
		PEL	0.005 mg/m3	OSHA Specifically Regulated Chemicals/Carcinogens
		1910.1027 This standard applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the Occupational Safety and Health Act, except the construction-related industries, which are covered under 29 CFR 1926.63. OSHA specifically regulated carcinogen		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Cadmium	7440-43-9	cadmium	0.0050 mg/g	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	Not critical			
		cadmium	5.0000 µg/l	In blood	ACGIH - Biological Exposure Indices (BEI)
		Not critical			
		cadmium	5 µg/l	In blood	ACGIH - Biological Exposure Indices (BEI)
		Not critical			
		cadmium	5µg/g creatinine	Urine	ACGIH - Biological Exposure Indices (BEI)
		Not critical			

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: granular Colour: light grey
b)	Odour	odourless
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 320.9 °C (609.6 °F) - lit.
f)	Initial boiling point and boiling range	765 °C (1,409 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	8.65 g/cm3 at 25 °C (77 °F)
n)	Water solubility	0.0023 g/l at 20 °C (68 °F)
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents, acids

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 2,330 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC:	1 - Group 1: Carcinogenic to humans (Cadmium)
NTP:	Known to be human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Cadmium)
OSHA:	OSHA specifically regulated carcinogen (Cadmium)

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: EU9800000

Damage to the lungs., Kidney injury may occur., prolonged or repeated exposure can cause:, Vomiting, Diarrhoea, Lung irritation

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 0.001 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.024 mg/l - 48 h
Toxicity to algae	static test EC50 - Selenastrum capricornutum (green algae) - 0.023 mg/l - 72 h (OECD Test Guideline 201)

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Bioaccumulation: Oncorhynchus mykiss (rainbow trout) - 72 d - 1.27 µg/l

Bioconcentration factor (BCF): 55

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3288 Class: 6.1 Packing group: II
Proper shipping name: Toxic solid, inorganic, n.o.s. (Cadmium)
Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3288 Class: 6.1 Packing group: II EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, INORGANIC, N.O.S. (Cadmium)
Marine pollutant:yes

IATA
UN number: 3288 Class: 6.1 Packing group: II

Proper shipping name: Toxic solid, inorganic, n.o.s. (Cadmium)

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer. Cadmium	CAS-No. 7440-43-9	Revision Date 2009-02-01
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Cadmium	CAS-No. 7440-43-9	Revision Date 2009-02-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H330	Fatal if inhaled.
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H361	Suspected of damaging fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	4
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	4
Fire Hazard:	0

Reactivity Hazard: 0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.10 Revision Date: 12/29/2015 Print Date: 05/01/2016

SAFETY DATA SHEET

Version 4.7
Revision Date 02/27/2015
Print Date 05/24/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Copper

Product Number : 12816
Brand : Aldrich

CAS-No. : 7440-50-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Not a hazardous substance or mixture.

2.2 GHS Label elements, including precautionary statements

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula : Cu
Molecular weight : 63.55 g/mol
CAS-No. : 7440-50-8
EC-No. : 231-159-6

Hazardous components

Component	Classification	Concentration
Copper		
		<= 100 %

4. FIRST AID MEASURES

4.1 Description of first aid measures

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration.

In case of skin contact
Wash off with soap and plenty of water.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Copper oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Avoid dust formation. Avoid breathing vapours, mist or gas.
For personal protection see section 8.

6.2 Environmental precautions
No special environmental precautions required.

6.3 Methods and materials for containment and cleaning up
Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Store under inert gas. Air sensitive.
Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Copper	7440-50-8	TWA	1.000000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Irritation Gastrointestinal metal fume fever		
		TWA	0.200000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Irritation Gastrointestinal metal fume fever		
		TWA	1.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	1.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	1.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	1.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.100000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants

8.2 Exposure controls

Appropriate engineering controls
General industrial hygiene practice.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
No special environmental precautions required.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: Foil Colour: light red
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 1,083.4 °C (1,982.1 °F)
f)	Initial boiling point and boiling range	2,567 °C (4,653 °F)
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	8.940 g/cm3
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong acids, Strong oxidizing agents, Acid chlorides, Halogens

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

LD50 Intraperitoneal - Mouse - 3.5 mg/kg

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: GL5325000

Symptoms of systemic copper poisoning may include: capillary damage, headache, cold sweat, weak pulse, and kidney and liver damage, central nervous system excitation followed by depression, jaundice, convulsions, paralysis, and coma. Death may occur from shock or renal failure. Chronic copper poisoning is typified by hepatic cirrhosis, brain damage and demyelination, kidney defects, and copper deposition in the cornea as exemplified by humans with Wilson's disease. It has also been reported that copper poisoning has lead to hemolytic anemia and accelerates arteriosclerosis.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Copper)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Copper)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Copper	7440-50-8	1989-08-11

New Jersey Right To Know Components

	CAS-No.	Revision Date
Copper	7440-50-8	1989-08-11

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7 Revision Date: 02/27/2015 Print Date: 05/24/2016

SAFETY DATA SHEET

Version 5.8
Revision Date 10/12/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Zinc

Product Number : 96454
Brand : Sigma-Aldrich

CAS-No. : 7440-66-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Combustible dust,
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)

May form combustible dust concentrations in air
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P273 Avoid release to the environment.
P391 Collect spillage.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Combustible dust

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

Formula : Zn
Molecular weight : 65.39 g/mol

Hazardous components

Component		Classification	Concentration
Zinc powder (stabilized)			
CAS-No. EC-No. Index-No.	7440-66-6 231-175-3 030-001-01-9	Aquatic Acute 1; Aquatic Chronic 1; H410	<= 100 %
Zinc oxide			
CAS-No. EC-No. Index-No.	1314-13-2 215-222-5 030-013-00-7	Aquatic Acute 1; Aquatic Chronic 1; H410	>= 5 - < 10 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Special powder against metal fire Dry sandUse water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable extinguishing media
Water

5.2 Special hazards arising from the substance or mixture

Zinc/zinc oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.
Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Zinc oxide	1314-13-2	TWA	2.000000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	metal fume fever		
		STEL	10.000000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		metal fume fever		

		TWA	5.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	5.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	10.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		C	15.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	15.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: grey
b)	Odour	odourless
c)	Odour Threshold	No data available
d)	pH	Not applicable
e)	Melting point/freezing point	Melting point/range: 420 °C (788 °F) - lit.
f)	Initial boiling point and boiling range	907 °C (1,665 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	May form combustible dust concentrations in air
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	Not applicable
l)	Vapour density	No data available
m)	Relative density	7.133 g/mL at 25 °C (77 °F)
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	Not applicable
p)	Auto-ignition temperature	does not ignite
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	During processing, dust may form explosive mixture in air.
t)	Oxidizing properties	No data available

9.2 Other safety information

Bulk density	1.8 - 3.2 kg/m3

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Dust may form explosive mixture in air.

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents, Acids and bases

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available (Zinc powder (stabilized))

Inhalation: No data available (Zinc powder (stabilized))

Dermal: No data available (Zinc powder (stabilized))

No data available (Zinc powder (stabilized))

Skin corrosion/irritation
No data available (Zinc powder (stabilized))

Serious eye damage/eye irritation
No data available (Zinc powder (stabilized))

Respiratory or skin sensitisation
Did not cause sensitisation on laboratory animals. (Zinc powder (stabilized))

Germ cell mutagenicity
No data available (Zinc powder (stabilized))

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available (Zinc powder (stabilized))

No data available (Zinc powder (stabilized))

Specific target organ toxicity - single exposure
No data available (Zinc powder (stabilized))

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available (Zinc powder (stabilized))

Additional Information
RTECS: ZG8600000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Effects due to ingestion may include:, chills, dry throat, sweet taste, Fever, Cough, Nausea, Vomiting, Weakness, Contact with eyes or skin may cause:, Irritation (Zinc powder (stabilized))

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Cyprinus carpio (Carp) - 450 µg/l - 96 h (Zinc powder (stabilized))
Toxicity to daphnia and other aquatic invertebrates	LC50 - Daphnia magna (Water flea) - 0.068 mg/l - 48 h (Zinc powder (stabilized))
	mortality NOEC - Daphnia (water flea) - 0.101 - 0.14 mg/l - 7 d (Zinc powder (stabilized))

12.2 Persistence and degradability

The methods for determining the biological degradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential

Bioaccumulation	Algae - 7 d at 16 °C - 5 µg/l (Zinc powder (stabilized))
	Bioconcentration factor (BCF): 466

12.4 Mobility in soil

No data available (Zinc powder (stabilized))

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Zinc powder (stabilized))
Reportable Quantity (RQ): 1020 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Zinc powder (stabilized))
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Zinc powder (stabilized))

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Zinc oxide	1314-13-2	2007-03-01
Zinc powder (stabilized)	7440-66-6	1993-04-24

SARA 311/312 Hazards
No SARA Hazards

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Zinc powder (stabilized)	7440-66-6	1993-04-24
Zinc oxide	1314-13-2	2007-03-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Zinc powder (stabilized)	7440-66-6	1993-04-24
Zinc oxide	1314-13-2	2007-03-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Zinc powder (stabilized)	7440-66-6	1993-04-24
Zinc oxide	1314-13-2	2007-03-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

	May form combustible dust concentrations in air
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.8 Revision Date: 10/12/2015 Print Date: 05/01/2016

Safety Data Sheet

Revision Date: 08/13/18
www.restek.com

2 Letter ISO country code/language code: US/EN

1. IDENTIFICATION

Catalog Number / Product Name:	**31272 / Benzo(b)fluoranthene Standard**
Company:	Restek Corporation
Address:	110 Benner Circle Bellefonte, Pa. 16823
Phone#:	814-353-1300
Fax#:	814-353-1309
Emergency#:	800-424-9300 (CHEMTREC) 703-527-3887 (Outside the US)
Email:	www.restek.com
Revision Number:	10
Intended use:	For Laboratory use only

2. HAZARD(S)IDENTIFICATION

Emergency Overview:

GHS Hazard Symbols:

GHS Classification:
Carcinogenicity Category 1B
Flammable Liquid Category 2
Serious Eye Damage/Eye Irritation Category 2
Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 3

GHS Signal Word:
Danger

GHS Hazard:
Highly flammable liquid and vapour.
Causes serious eye irritation.
May cause drowsiness or dizziness.
May cause cancer.

GHS Precautions:

Safety Precautions:
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat/sparks/open flames/hot surfaces. – No smoking.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilation and lighting equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Avoid breathing dust/fume/gas/mist/vapours/spray.
Wash hands and skin thoroughly after handling.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/protective clothing/eye protection/face protection.

First Aid Measures:
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
IF exposed or concerned: Get medical advice/attention.
Call a POISON CENTER or doctor/physician if you feel unwell.
If eye irritation persists: Get medical advice/attention.
In case of fire: Use extinguishing media in section 5 for extinction.

Storage: Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.

Disposal: Dispose of contents/container according to section 13 of the SDS.

Single Exposure Target Organs: Specific target organ toxicity - Single exposure - STOT SE 3: H336 May cause drowsiness or dizziness.

Repeated Exposure Target Organs: No data available

3. COMPOSITION / INFORMATION ON INGREDIENT

Chemical Name	CAS #	EINEC #	% Composition
Acetone	67-64-1	200-662-2	99.9
benzo (b) fluoranthene	205-99-2	205-911-9	0.1

4. FIRST-AID MEASURES

Inhalation: Remove to fresh air. If breathing is difficult, have a trained individual administer oxygen. If not breathing, give artificial respiration and have a trained individual administer oxygen. Get medical attention immediately

Eyes: Flush eyes with plenty of water for at least 20 minutes retracting eyelids often. Tilt the head to prevent chemical from transferring to the uncontaminated eye. Get immediate medical attention.

Skin Contact: Wash with soap and water. Remove contaminated clothing and launder. Get medical attention if irritation develops or persists.

Ingestion: Do not induce vomiting and seek medical attention immediately. Drink two glasses of water or milk to dilute. Provide medical care provider with this SDS.

5. FIRE- FIGHTING MEASURES

Extinguishing Media: Use alcohol resistant foam, carbon dioxide, or dry chemical extinguishing agents. Water spray or fog may also be effective for extinguishing if swept across the base of the fire. Water can also be used to absorb heat and keep exposed material from being damaged by fire. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

Fire and/or Explosion Hazards: Vapors may be ignited by heat, sparks, flames or other sources of ignition at or above the low flash point giving rise to a Class B fire. Vapors are heavier than air and may travel to a source of ignition and flash back

Fire Fighting Methods and Protection: Do not enter fire area without proper protection including self-contained toxic breathing apparatus and full protective equipment. Fight fire from a safe distance and a protected location due to the potential of hazardous vapors and decomposition products. Flammable component(s) of this material may be lighter than water and burn while floating on the surface. Use water spray/fog for cooling. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

Hazardous Combustion Products: Carbon dioxide, Carbon monoxide

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions and Equipment: Exposure to the spilled material may be irritating or harmful. Follow personal protective equipment recommendations found in Section 8 of this SDS. Additional precautions may be necessary based on special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred. Also consider the expertise of employees in the area responding to the spill.

Methods for Clean-up: Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal

evaluation.

7. HANDLING AND STORAGE

Handling Technical Measures and Precautions:	Harmful or irritating material. Avoid contacting and avoid breathing the material. Use only in a well ventilated area. Use spark-proof tools and explosion-proof equipment
Storage Technical Measures and Conditions:	Store in a cool dry ventilated location. Isolate from incompatible materials and conditions. Keep container(s) closed. Keep away from sources of ignition

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

United States:

Chemical Name	CAS No.	IDLH	ACGIH STEL	ACGIH TLV-TWA	OSHA Exposure Limit
Acetone	67-64-1	2500 ppm IDLH (10% LEL)	750 ppm STEL; 1782 mg/m3 STEL	500 ppm TWA; 1188 mg/m3 TWA	1000 ppm TWA; 2400 mg/m3 TWA
benzo (b) fluoranthene	205-99-2	Not established	None Known	Not established	No data available

Personal Protection:

Engineering Measures:	Local exhaust ventilation is recommended when generating excessive levels of vapours from handling or thermal processing.
Respiratory Protection:	No respiratory protection required under normal conditions of use. Provide general room exhaust ventilation if symptoms of overexposure occur as explained Section 3. A respirator is not normally required.
Eye Protection:	Wear chemically resistant safety glasses with side shields when handling this product. Do not wear contact lenses.
Skin Protection:	Wear protective gloves. Inspect gloves for chemical break-through and replace at regular intervals. Clean protective equipment regularly. Wash hands and other exposed areas with mild soap and water before eating, drinking, and when leaving work
Medical Conditions Aggravated By Exposure:	Respiratory disease including asthma and bronchitis

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance, color:	Depends upon product selection
Odor:	Strong
Physical State:	No data available
pH:	Not applicable
Vapor Pressure:	No data available
Vapor Density:	2.0 (air = 1)
Boiling Point (°C):	56.05 °C at 1013.25 hPa
Melting Point (°C):	-95.4 °C Melting Point
Flash Point (°F):	39
Flammability:	Highly Flammable
Upper Flammable/Explosive Limit, % in air:	No data available
Lower Flammable/Explosive Limit, % in air:	No data available
Autoignition Temperature (°C):	465 deg C
Decomposition Temperature (°C):	No data available
Specific Gravity:	0.7845 g/cm3 at 25 °C
Evaporation Rate:	No data available
Odor Threshold:	ND
Solubility:	Complete; 100%
Partition Coefficient: n-octanol in water:	No data available
VOC % by weight:	0
Molecular Weight:	58.08

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions.
Conditions to Avoid:	None known.
Materials to Avoid / Chemical Incompatiability:	Strong oxidizing agents Strong acids
Hazardous Decomposition Products:	Carbon dioxide Carbon monoxide

11. TOXICOLOGICAL INFORMATION

Routes of Entry:	Inhalation, Skin Contact, Eye Contact, Ingestion

Target Organs Potentially Affected By Exposure: Eyes, Central nervous system stimulation, Respiratory Tract, Skin

Chemical Interactions That Change Toxicity: None Known

Immediate (Acute) Health Effects by Route of Exposure:

Inhalation Irritation: Can cause minor respiratory irritation, dizziness, weakness, fatigue, nausea, and headache.

Skin Contact: Can cause minor skin irritation, defatting, and dermatitis.

Eye Contact: Can cause minor irritation, tearing and reddening.

Ingestion Irritation: May be harmful if swallowed.

Ingestion Toxicity: Harmful if swallowed. May cause systemic poisoning.

Long-Term (Chronic) Health Effects:

Carcinogenicity: Contains a probable or known human carcinogen.

Reproductive and Developmental Toxicity: No data available to indicate product or any components present at greater than 0.1% may cause birth defects.

Inhalation: Upon prolonged and/or repeated exposure, can cause minor respiratory irritation, dizziness, weakness, fatigue, nausea, and headache.

Skin Contact: Upon prolonged or repeated contact, can cause minor skin irritation, defatting, and dermatitis.

Component Toxicological Data:

NIOSH:

Chemical Name	CAS No.	LD50/LC50
Acetone	67-64-1	Dermal LD50 Rabbit >15700 mg/kg; Inhalation LC50 Rat 50100 mg/m3 8 h; Oral LD50 Rat 5800 mg/kg

Component Carcinogenic Data:

OSHA:

Chemical Name	CAS No.	
Benzo(b)fluoranthene	205-99-2	Present

ACGIH:

Chemical Name	CAS No.	
Benzo[b]fluoranthene	205-99-2	A2 - Suspected Human Carcinogen
Acetone	67-64-1	A4 - Not Classifiable as a Human Carcinogen

NIOSH:

Chemical Name	CAS No.
No data available	

NTP:

Chemical Name	CAS No.
No data available	

IARC:

Chemical Name	CAS No.	Group No.
Monograph 92 [2010]; Supplement 7 [1987]; Monograph 32 [1983]	205-99-2	Group 2B

12. ECOLOGICAL INFORMATION

Overview: This material is not expected to be harmful to the ecology.

Mobility: No data

Persistence: No data

Bioaccumulation: No data

Degradability: No data

Ecological Toxicity Data: No data available

13. DISPOSAL CONSIDERATIONS

Waste Description of Spent Product: Spent or discarded material is a hazardous waste.Mixing spent or discarded material with other materials may render the mixture hazardous. Perform a hazardous waste determination on mixtures.

Disposal Methods: Dispose of by incineration following Federal, State, Local, or Provincial regulations.

Waste Disposal of Packaging: Comply with all Local, State, Federal, and Provincial Environmental Regulations.

14. TRANSPORTATION INFORMATION

United States:

DOT Proper Shipping Name: Acetone
UN Number: UN1090
Hazard Class: 3
Packing Group: II

International:

IATA Proper Shipping Name: Acetone
UN Number: UN1090
Hazard Class: 3
Packing Group: II

Marine Pollutant: No

Chemical Name	CAS#	Marine Pollutant	Severe Marine Pollutant
No data available			

15. REGULATORY INFORMATION

United States:

Chemical Name	CAS#	CERCLA	SARA 313	SARA EHS 313	TSCA
Acetone	67-64-1	X	-	-	X
benzo (b) fluoranthene	205-99-2	X	X	-	-

The following chemicals are listed on CA Prop 65:

Chemical Name	CAS #	Regulation
Benzo[b]fluoranthene	205-99-2	Prop 65 Cancer

State Right To Know Listing:

Chemical Name	CAS#	New Jersey	Massachusetts	Pennsylvania	California
Acetone	67-64-1	X	X	X	X
benzo (b) fluoranthene	205-99-2	X	X	X	X

16. OTHER INFORMATION

Prior Version Date: 12/08/16

Other Information: Any changes to the SDS compared to previous versions are marked by a vertical line in front of the concerned paragraph.

References: No data available

Disclaimer: Restek Corporation provides the descriptions, data and information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. It is provided for your guidance only. Because many factors may affect processing or application/use, Restek Corporation recommends you perform an assessment to determine the suitability of a product for your particular purpose prior to use. No warranties of any kind, either expressed or implied, including fitness for a particular purpose, are made regarding products described, data or information set forth. In no case shall the descriptions, information, or data provided be considered a part of our terms and conditions of sale. Further, the descriptions, data and information furnished hereunder are given gratis. No obligation or liability for the description, data and information given are assumed. All such being given and accepted at your risk.

Safety Data Sheet

Revision Date: 06/15/18
www.restek.com

2 Letter ISO country code/language code: US/EN

1. IDENTIFICATION

Catalog Number / Product Name:	**31274 / Benzo(k)fluoranthene Standard**
Company:	Restek Corporation
Address:	110 Benner Circle Bellefonte, Pa. 16823
Phone#:	814-353-1300
Fax#:	814-353-1309
Emergency#:	800-424-9300 (CHEMTREC) 703-527-3887 (Outside the US)
Email:	www.restek.com
Revision Number:	11
Intended use:	For Laboratory use only

2. HAZARD(S)IDENTIFICATION

Emergency Overview:

GHS Hazard Symbols:

GHS Classification:
Carcinogenicity Category 1B
Flammable Liquid Category 2
Serious Eye Damage/Eye Irritation Category 2
Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 3

GHS Signal Word:
Danger

GHS Hazard:
Highly flammable liquid and vapour.
Causes serious eye irritation.
May cause drowsiness or dizziness.
May cause cancer.

GHS Precautions:

Safety Precautions:
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat/sparks/open flames/hot surfaces. – No smoking.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilation and lighting equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Avoid breathing dust/fume/gas/mist/vapours/spray.
Wash hands and skin thoroughly after handling.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/protective clothing/eye protection/face protection.

First Aid Measures:
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
IF exposed or concerned: Get medical advice/attention.
Call a POISON CENTER or doctor/physician if you feel unwell.
If eye irritation persists: Get medical advice/attention.
In case of fire: Use extinguishing media in section 5 for extinction.

Storage: Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.

Disposal: Dispose of contents/container according to section 13 of the SDS.

Single Exposure Target Organs: Specific target organ toxicity - Single exposure - STOT SE 3: H336 May cause drowsiness or dizziness.

Repeated Exposure Target Organs: No data available

3. COMPOSITION / INFORMATION ON INGREDIENT

Chemical Name	CAS #	EINEC #	% Composition
Acetone	67-64-1	200-662-2	99.9
benzo (k) fluoranthene	207-08-9	205-916-6	0.1

4. FIRST-AID MEASURES

Inhalation: Remove to fresh air. If breathing is difficult, have a trained individual administer oxygen. If not breathing, give artificial respiration and have a trained individual administer oxygen. Get medical attention immediately

Eyes: Flush eyes with plenty of water for at least 20 minutes retracting eyelids often. Tilt the head to prevent chemical from transferring to the uncontaminated eye. Get immediate medical attention.

Skin Contact: Wash with soap and water. Remove contaminated clothing and launder. Get medical attention if irritation develops or persists.

Ingestion: Do not induce vomiting and seek medical attention immediately. Drink two glasses of water or milk to dilute. Provide medical care provider with this SDS.

5. FIRE- FIGHTING MEASURES

Extinguishing Media: Use alcohol resistant foam, carbon dioxide, or dry chemical extinguishing agents. Water spray or fog may also be effective for extinguishing if swept across the base of the fire. Water can also be used to absorb heat and keep exposed material from being damaged by fire. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

Fire and/or Explosion Hazards: Vapors may be ignited by heat, sparks, flames or other sources of ignition at or above the low flash point giving rise to a Class B fire. Vapors are heavier than air and may travel to a source of ignition and flash back

Fire Fighting Methods and Protection: Do not enter fire area without proper protection including self-contained toxic breathing apparatus and full protective equipment. Fight fire from a safe distance and a protected location due to the potential of hazardous vapors and decomposition products. Flammable component(s) of this material may be lighter than water and burn while floating on the surface. Use water spray/fog for cooling. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

Hazardous Combustion Products: Carbon dioxide, Carbon monoxide

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions and Equipment: Exposure to the spilled material may be irritating or harmful. Follow personal protective equipment recommendations found in Section 8 of this SDS. Additional precautions may be necessary based on special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred. Also consider the expertise of employees in the area responding to the spill.

Methods for Clean-up: Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal

evaluation.

7. HANDLING AND STORAGE

Handling Technical Measures and Precautions:	Harmful or irritating material. Avoid contacting and avoid breathing the material. Use only in a well ventilated area. Use spark-proof tools and explosion-proof equipment
Storage Technical Measures and Conditions:	Store in a cool dry ventilated location. Isolate from incompatible materials and conditions. Keep container(s) closed. Keep away from sources of ignition

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

United States:

Chemical Name	CAS No.	IDLH	ACGIH STEL	ACGIH TLV-TWA	OSHA Exposure Limit
Acetone	67-64-1	2500 ppm IDLH (10% LEL)	750 ppm STEL; 1782 mg/m3 STEL	500 ppm TWA; 1188 mg/m3 TWA	1000 ppm TWA; 2400 mg/m3 TWA
benzo (k) fluoranthene	207-08-9	Not established	None Known	Not established	No data available

Personal Protection:

Engineering Measures:	Local exhaust ventilation is recommended when generating excessive levels of vapours from handling or thermal processing.
Respiratory Protection:	No respiratory protection required under normal conditions of use. Provide general room exhaust ventilation if symptoms of overexposure occur as explained Section 3. A respirator is not normally required.
Eye Protection:	Wear chemically resistant safety glasses with side shields when handling this product. Do not wear contact lenses.
Skin Protection:	Wear protective gloves. Inspect gloves for chemical break-through and replace at regular intervals. Clean protective equipment regularly. Wash hands and other exposed areas with mild soap and water before eating, drinking, and when leaving work
Medical Conditions Aggravated By Exposure:	Respiratory disease including asthma and bronchitis

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance, color:	Depends upon product selection
Odor:	Strong
Physical State:	No data available
pH:	Not applicable
Vapor Pressure:	No data available
Vapor Density:	2.0 (air = 1)
Boiling Point (°C):	480 °C 56.05 °C at 1013.25 hPa
Melting Point (°C):	-95.4 °C Melting Point
Flash Point (°F):	39
Flammability:	Highly Flammable
Upper Flammable/Explosive Limit, % in air:	No data available
Lower Flammable/Explosive Limit, % in air:	No data available
Autoignition Temperature (°C):	465 deg C
Decomposition Temperature (°C):	No data available
Specific Gravity:	0.7845 g/cm3 at 25 °C
Evaporation Rate:	No data available
Odor Threshold:	ND
Solubility:	Complete; 100%
Partition Coefficient: n-octanol in water:	No data available
VOC % by weight:	0
Molecular Weight:	58.08

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions.
Conditions to Avoid:	None known.
Materials to Avoid / Chemical Incompatiability:	Strong oxidizing agents Strong acids
Hazardous Decomposition Products:	Carbon dioxide Carbon monoxide

11. TOXICOLOGICAL INFORMATION

Routes of Entry:	Inhalation, Skin Contact, Eye Contact, Ingestion

Target Organs Potentially Affected By Exposure: Eyes, Central nervous system stimulation, Respiratory Tract, Skin

Chemical Interactions That Change Toxicity: None Known

Immediate (Acute) Health Effects by Route of Exposure:

Inhalation Irritation: Can cause minor respiratory irritation, dizziness, weakness, fatigue, nausea, and headache.

Skin Contact: Can cause minor skin irritation, defatting, and dermatitis.

Eye Contact: Can cause minor irritation, tearing and reddening.

Ingestion Irritation: May be harmful if swallowed.

Ingestion Toxicity: Harmful if swallowed. May cause systemic poisoning.

Long-Term (Chronic) Health Effects:

Carcinogenicity: Contains a probable or known human carcinogen.

Reproductive and Developmental Toxicity: No data available to indicate product or any components present at greater than 0.1% may cause birth defects.

Inhalation: Upon prolonged and/or repeated exposure, can cause minor respiratory irritation, dizziness, weakness, fatigue, nausea, and headache.

Skin Contact: Upon prolonged or repeated contact, can cause minor skin irritation, defatting, and dermatitis.

Component Toxicological Data:

NIOSH:

Chemical Name	CAS No.	LD50/LC50
Acetone	67-64-1	Dermal LD50 Rabbit >15700 mg/kg; Inhalation LC50 Rat 50100 mg/m3 8 h; Oral LD50 Rat 5800 mg/kg

Component Carcinogenic Data:

OSHA:

Chemical Name	CAS No.	
Benzo(k)fluoranthene	207-08-9	Present

ACGIH:

Chemical Name	CAS No.	
Acetone	67-64-1	A4 - Not Classifiable as a Human Carcinogen

NIOSH:

Chemical Name	CAS No.
No data available	

NTP:

Chemical Name	CAS No.
No data available	

IARC:

Chemical Name	CAS No.	Group No.
Monograph 92 [2010]; Supplement 7 [1987]; Monograph 32 [1983]	207-08-9	Group 2B

12. ECOLOGICAL INFORMATION

Overview: This material is not expected to be harmful to the ecology.

Mobility: No data

Persistence: No data

Bioaccumulation: No data

Degradability: No data

Ecological Toxicity Data: No data available

13. DISPOSAL CONSIDERATIONS

Waste Description of Spent Product: Spent or discarded material is a hazardous waste.Mixing spent or discarded material with other materials may render the mixture hazardous. Perform a hazardous waste determination on mixtures.

Disposal Methods: Dispose of by incineration following Federal, State, Local,

or Provincial regulations.

Waste Disposal of Packaging: Comply with all Local, State, Federal, and Provincial Environmental Regulations.

14. TRANSPORTATION INFORMATION

United States:

DOT Proper Shipping Name: Acetone
UN Number: UN1090
Hazard Class: 3
Packing Group: II

International:

IATA Proper Shipping Name: Acetone
UN Number: UN1090
Hazard Class: 3
Packing Group: II

Marine Pollutant: No

Chemical Name	CAS#	Marine Pollutant	Severe Marine Pollutant
No data available			

15. REGULATORY INFORMATION

United States:

Chemical Name	CAS#	CERCLA	SARA 313	SARA EHS 313	TSCA
Acetone	67-64-1	X	-	-	X
benzo (k) fluoranthene	207-08-9	X	X	-	-

The following chemicals are listed on CA Prop 65:

Chemical Name	CAS #	Regulation
Benzo[k]fluoranthene	207-08-9	Prop 65 Cancer

State Right To Know Listing:

Chemical Name	CAS#	New Jersey	Massachusetts	Pennsylvania	California
Acetone	67-64-1	X	X	X	X
benzo (k) fluoranthene	207-08-9	X	X	X	X

16. OTHER INFORMATION

Prior Version Date: 12/30/16

Other Information: Any changes to the SDS compared to previous versions are marked by a vertical line in front of the concerned paragraph.

References: No data available

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Material Safety Data Sheet

Benzo[a]pyrene, 98%

MSDS# 37175

Section 1 - Chemical Product and Company Identification

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

Company Identification:	Acros Organics BVBA Janssen Pharmaceuticalaan 3a 2440 Geel, Belgium
Company Identification: (USA)	Acros Organics One Reagent Lane Fair Lawn, NJ 07410
For information in the US, call:	800-ACROS-01
For information in Europe, call:	+32 14 57 52 11
Emergency Number, Europe:	+32 14 57 52 99
Emergency Number US:	201-796-7100
CHEMTREC Phone Number, US:	800-424-9300
CHEMTREC Phone Number, Europe:	703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#:	50-32-8
Chemical Name:	Benzo[a]pyrene
%:	>96
EINECS#:	200-028-5

Hazard Symbols: T N

Risk Phrases: 45 46 60 61 43 50/53

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

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

Potential Health Effects

Eye:	May cause eye irritation.
Skin:	May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.
Ingestion:	May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated. May be harmful if swallowed.
Inhalation:	May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.

Chronic: May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion: Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

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

Notes to Physician:

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Autoignition Temperature: Not available.

Flash Point: Not available

Explosion Limits: Lower: Not available

Explosion Limits: Upper: Not available

NFPA Rating: health: 2; flammability: 0; instability: 0;

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Benzo[a]pyrene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA	0.2 mg/m3 TWA (benzene soluble fraction) (listed under Coal tar pitches).

OSHA Vacated PELs: Benzo[a]pyrene: 0.2 mg/m3 TWA (benzene soluble fraction) (listed under Coal tar pitches)

Engineering Controls:

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

Exposure Limits

Personal Protective Equipment

Eyes:	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin:	Wear appropriate protective gloves to prevent skin exposure.
Clothing:	Wear appropriate protective clothing to prevent skin exposure.
Respirators:	A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State:	Powder
Color:	yellow to brown
Odor:	faint aromatic odor
pH:	Not available
Vapor Pressure:	Not available
Vapor Density:	Not available
Evaporation Rate:	Not available
Viscosity:	Not available
Boiling Point:	495 deg C @ 760 mm Hg (923.00°F)
Freezing/Melting Point:	175 - 179 deg C
Decomposition Temperature:	Not available
Solubility in water:	1.60x10-3 mg/l @25°C
Specific Gravity/Density:	
Molecular Formula:	C20H12
Molecular Weight:	252.31

Section 10 - Stability and Reactivity

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

Section 11 - Toxicological Information

RTECS#:	CAS# 50-32-8: DJ3675000
LD50/LC50:	RTECS: Not available.
Carcinogenicity:	Benzo[a]pyrene - ACGIH: A1 - Confirmed Human Carcinogen (Coal tar pitches). California: carcinogen, initial date 7/1/87 NTP: Suspect carcinogen IARC: Group 1 carcinogen
Other:	The toxicological properties have not been fully investigated.

Section 12 - Ecological Information

Not available

Section 13 - Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.

Section 14 - Transport Information

US DOT
Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOL (Benzo{a} pyrene)
Hazard Class: 9
UN Number: UN3077
Packing Group: III
Canada TDG
Shipping Name: Not available
Hazard Class:
UN Number:
Packing Group:

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

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T N

Risk Phrases:

R 45 May cause cancer.

R 46 May cause heritable genetic damage.

R 61 May cause harm to the unborn child.

R 43 May cause sensitization by skin contact.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

R 60 May impair fertility.

Safety Phrases:

S 53 Avoid exposure - obtain special instructions before use.

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

S 60 This material and its container must be disposed of as hazardous waste.

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

WGK (Water Danger/Protection)

CAS# 50-32-8: Not available

Canada

CAS# 50-32-8 is listed on Canada's DSL List

Canadian WHMIS Classifications: D2A, D2B

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

CAS# 50-32-8 is listed on Canada's Ingredient Disclosure List

US Federal

TSCA

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

Section 16 - Other Information

MSDS Creation Date: 9/02/1997

Revision #8 Date 7/20/2009

Safety Data Sheet

Prepared in accordance with Commission Regulation (EU) 2015/830

Stock Number: 31270
Revision Date: 13-08-2018
This document replaces SDS dated: 08-12-2016
2 Letter ISO country code/language code: UK/EN

Benzo(a)anthracene Standard

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier: **Benzo(a)anthracene Standard**

Stock Number: 31270

Other means of identification:

Synonyms: None Known

REACH Registration No.: None Known

Molecular formula: CH3OH

1.2 Relevant identified uses of the substance or mixture and uses advised against:

Relevant identified uses: For Laboratory use only

Uses advised against: Uses other than recommended use.

1.3 Details of the Supplier of the Safety Data Sheet:	**Manufacturer**	**Supplier**
	Restek Corporation 110 Benner Circle Bellefonte, Pa. 16823 USA 00 1 814-353-1300 00 1 814-353-1309 sds@restek.com	Thames Restek UK LTD Units 8-16, Ministry Wharf Wycombe Road, Saunderton Buckinghamshire United Kingdom HP14 4HW 01494 563377 sales@thamesrestek.co.uk
1.4 Emergency telephone number:	00 1 800-424-9300 (CHEMTREC within the US) 00 1 703-741-5970 (Outside USA)	0870-8200418 (CHEMTREC within the UK) +1 703-741-5970 (CHEMTREC International)

Poison Centre contact information: National Poisons Information Service (NPIS)
Email: director.birmingham.unit@npis.org
Website: http://www.npis.org/

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture:

Classification according to Regulation (EC) No 1272/2008 [CLP]: Carcinogenicity Category 1B
Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 1

Flammable Liquid Category 2
Hazardous to the aquatic environment - Chronic Category 2
Acute Toxicity - Dermal Category 3
Acute Toxicity - Oral Category 3

2.2 Label elements:

Labelling according to Regulation (EC) No 1272/2008 [CLP]:

Hazard pictograms:

Signal Word: Danger

Hazard Statements:
H225 - Highly flammable liquid and vapour
H301+H311 - Toxic if swallowed or in contact with skin
H350 - May cause cancer.
H370 - Causes damage to organs
H411 - Toxic to aquatic life with long lasting effects

Precautionary Statements:
P201 - Obtain special instructions before use.
P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P233 - Keep container tightly closed.
P260 - Do not breathe dust/fume/gas/mist/vapours/spray.
P280 - Wear protective gloves/protective clothing/eye protection/face protection.
P301+P310 - IF SWALLOWED: Immediately call a POISON CENTER/doctor.

Supplemental Hazard information (EU): None Known

2.3 Other hazards: This substance does not meet the PBT or vPvB criteria of REACH, Annex XIII

SECTION 3: Composition/information on ingredients

3.1 Substances:
Not applicable

3.2 Mixtures:

Chemical Name	%	CAS #	EC No. REACH Registration No.	Classification (EC) No 1272/2008	M Factor	SCL	Acute Toxicity Estimates
benz (a) anthracene	0.1	56-55-3	200-280-6 None Known	Aquatic Acute 1; H400 Aquatic Chronic 1; H410 Carc. 1B; H350	AQUATIC CHRONIC 1: M = 100 AQUATIC ACUTE 1: M = 100	No data available	Not determined
methanol	99.9	67-56-1	200-659-6 None Known	Acute Tox. 3 (Dermal); H311 Acute Tox. 3 (Inh Dust/Mist); H331 Acute Tox. 3 (Oral); H301 Flam. Liq. 2; H225 STOT SE 1; H370	No data available	STOT SE 2: 3%<10% STOT SE 1: 10%	Not determined

For full text of H-statements see Section 16.

SECTION 4: First aid measures

4.1 Description of first aid measures:

Inhalation: Remove to fresh air. If breathing is difficult, have a trained individual administer oxygen. If not breathing, give artificial respiration and have a trained individual administer oxygen. Get medical attention immediately

Eye contact: Flush eyes with plenty of water for at least 20 minutes retracting eyelids often. Tilt the head to prevent chemical from transferring to the uncontaminated eye. Get immediate medical attention.

Skin Contact: Wash with soap and water. Remove contaminated clothing and launder. Get medical attention if irritation develops or persists.

Ingestion: Do not induce vomiting and seek medical attention immediately. Drink two glasses of water or milk to dilute. Provide medical care provider with this SDS.

Self protection of the first aider: No data available

4.2 Most important symptoms and Coma and death

effects, both acute and delayed:

4.3 Indication of any immediate medical attention and special treatment needed: IF exposed or concerned: Get medical advice/ attention. IF exposed or concerned: Call a POISON CENTER/doctor. Call a POISON CENTER/doctor if you feel unwell.

SECTION 5: Firefighting measures

5.1 Extinguishing media:

Suitable extinguishing media: Use alcohol resistant foam, carbon dioxide, or dry chemical extinguishing agents. Water may be ineffective but water spray can be used extinguish a fire if swept across the base of the flames. Water can absorb heat and keep exposed material from being damaged by fire.

Unsuitable extinguishing media: None Known

5.2 Special hazards arising from the substance or mixture: Vapors may be ignited by sparks, flames or other sources of ignition if material is above the flash point giving rise to a fire (Class B). Vapors are heavier than air and may travel to a source of ignition and flash back.

Hazardous Combustion Products: Carbon dioxide, Carbon monoxide

5.3 Advice for firefighters: Do not enter fire area without proper protection including self-contained breathing apparatus and full protective equipment. Fight fire from a safe distance and a protected location due to the potential of hazardous vapors and decomposition products. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:

Non-emergency personnel: Non-emergency personnel should be kept clear of the area

Emergency responders: Exposure to the spilled material may be severely irritating or toxic. Follow personal protective equipment recommendations found in Section 8 of this SDS. Personal protective equipment needs must be evaluated based on information provided on this sheet and the special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred, and the expertise of employees in the area responding to the spill. Never exceed any occupational exposure limits.

6.2 Environmental precautions: No data available

6.3 Methods and material for containment and cleaning up:

Small spills: Refer to information provided for large spills

Large spills: Prevent the spread of any spill to minimize harm to human health and the

environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal evaluation.

6.4 Reference to other sections: Refer to section 13 for disposal information

SECTION 7: Handling and storage

7.1 Precautions for safe handling: Toxic or severely irritating material. Avoid contacting and avoid breathing the material. Use only in a well ventilated area. Use spark-proof tools and explosion-proof equipment

7.2 Conditions for safe storage, including any incompatibilities:

Conditions for safe storage: Store in a cool dry ventilated location. Isolate from incompatible materials and conditions. Keep container(s) closed. Keep away from sources of ignition

Materials to Avoid/Chemical Incompatibility: Strong oxidizing agents

7.3 Specific end use(s): For Laboratory use only

SECTION 8: Exposure controls/personal protection

8.1 Control parameters:

Occupational Exposure limit values:

Chemical Name	United Kingdom - Workplace Exposure Limits (WELs) - TWAs	United Kingdom - Workplace Exposure Limits (WELs) - STELs	United Kingdom - Biological Monitoring Guidance Values
methanol	200 ppm TWA; 266 mg/m3 TWA	250 ppm STEL; 333 mg/m3 STEL	No data available

DNEL: None Known

PNEC: None Known

8.2 Exposure controls:

Appropriate engineering controls: Local exhaust ventilation is recommended when generating excessive levels of vapours from handling or thermal processing.

Individual protection measures, such as personal protective equipment:

Eye and face protection: Wear chemically resistant safety glasses with side shields when handling this product. Do not wear contact lenses.

Skin Protection:

Hand protection: No information available

Other skin protection:	Wear protective gloves. Inspect gloves for chemical break-through and replace at regular intervals. Clean protective equipment regularly. Wash hands and other exposed areas with mild soap and water before eating, drinking, and when leaving work
Respiratory Protection:	If an exposure limit is exceeded or if an operator is experiencing symptoms of inhalation overexposure as explained in Section 3, provide respiratory protection. Respiratory protection may be required to avoid overexposure when handling this product. General or local exhaust ventilation is the preferred means of protection. Use a respirator if general room ventilation is not available or sufficient to eliminate symptoms.
Respirator Type(s):	None required where adequate ventilation is provided. If airborne concentrations are above the applicable exposure limits, use NIOSH/MSHA approved respiratory protection.
Thermal Hazards:	Not applicable
Environmental exposure controls:	No data available

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties:

Appearance:	No data available
Colour:	No data available
Odour:	Mild
Odour threshold:	No data available
pH:	Not applicable
Melting Point/Freezing Point (°C):	
Melting point (°C):	No data available
Freezing point (°C):	No data available
Initial boiling point and boiling range (°C):	65
Flash point (°C):	11
Evaporation Rate (water = 1):	No data available
Flammability (solid, gas):	No data available
Upper/lower flammability or explosive limits:	
Upper flammable or explosive limit, % in air:	36
Lower flammable or explosive limit, %	6

in air:	
Vapour pressure:	No data available
Vapor Density (Air=1):	1.1
Relative density (water = 1):	0.800
Solubility(ies):	Moderate; 50-99%
Partition coefficient: n-octanol/water:	No data available
Auto-ignition temperature (°C):	464
Decomposition temperature (°C):	No data available
Viscosity:	No data available
Explosive properties:	No data available
Oxidizing properties:	No data available

9.2 Other information:

Volatile Organic Chemicals:	0
Bulk density:	6.676

SECTION 10: Stability and reactivity

10.1 Reactivity:	Not expected to be reactive
10.2 Chemical stability:	Stable under normal conditions.
10.3 Possibility of hazardous reactions:	None expected under standard conditions of storage
10.4 Conditions to avoid:	No data available
10.5 Incompatible materials:	Strong oxidizing agents
10.6 Hazardous decomposition products:	Carbon dioxide, Carbon monoxide

SECTION 11: Toxicological information

11.1 Information on toxicological effects:

Acute toxicity:

Chemical Name	ORAL LD50 (rat)	DERMAL LD50 (rabbit)	INHALATION LC50 (rat)
methanol	No data available	No data available	INHALATION LC50-8H Rat 22500 ppm

Classification has been based on toxicological information of the components in Section 3.

Skin corrosion/irritation:
Based on available data, the classification criteria are not met.

Serious eye damage/irritation:
Based on available data, the classification criteria are not met.

Respiratory or skin sensitisation:
Based on available data, the classification criteria are not met.

Germ cell mutagenicity:
Based on available data, the classification criteria are not met.

Carcinogenicity:
Classification has been based on toxicological information of the components in Section 3.

Reproductive toxicity:
Based on available data, the classification criteria are not met.

STOT-single exposure:
Classification has been based on toxicological information of the components in Section 3.

STOT-repeated exposure:
Based on available data, the classification criteria are not met.

Aspiration hazard:
Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1 Toxicity: Moderate ecological hazard. This product may be dangerous to plants and/or wildlife.

Ecological Toxicity Data:

Chemical Name	CAS #	Aquatic EC50 Crustacea	Aquatic ERC50 Algae	Aquatic LC50 Fish
No data available				

12.2 Persistence and degradability: Biodegrades slowly.
12.3 Bioaccumulative potential: No data available
12.4 Mobility in soil: No data available
12.5 Results of PBT and vPvB assessment: No data available

12.6 Other adverse effects: None Known

12.7 Additional information: No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods:

Disposal methods: Spent or discarded material is a hazardous waste.
Dispose of by incineration following Federal, State, Local, or Provincial regulations.

Waste codes / waste designations according to LoW: No data available

SECTION 14: Transport information

International carriage of dangerous goods by road (ADR), rail or inland waterways:

14.1 UN number: UN1230

14.2 UN proper shipping name: Methanol

14.3 Transport hazard class(es): 3(6.1)

14.4 Packing group: II

International carriage of dangerous goods by air (IATA):

14.1 UN number: UN1230

14.2 UN proper shipping name: Methanol

14.3 Transport hazard class(es): 3(6.1)

14.4 Packing group: II

14.5 Environmental hazards: Yes

14.6 Special precautions for user: No data available

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code: No data available

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:

Chemical Name	EINECS	SVHC
methanol	Yes	No

benz (a) anthracene	Yes	No

15.2 Chemical Safety Assessment No Chemical Safety Assessment has been carried out for this substance/mixture by the supplier.

SECTION 16: Other information

Revision Date: 13-08-2018

Indication of changes: Any changes to the SDS compared to previous versions are marked by a vertical line in front of the concerned paragraph.

Abbreviations and acronyms:

CAS = Chemical Abstract Service
DNEL= Derivative No Effect Level
EC= European Community
EINECS = European Inventory of Existing Chemical Substances
MSHA = Mine Safety Health Administration
NIOSH = National Institute of Occupational Safety & Health
OEL = Occupational Exposure Limit
PBT= Persistent, Bioaccumulative, Toxic
PNEC= Predicted No Effect Concentration
SCOEL= Scientific Committee on Occupational Exposure Limits
TLV = Threshold Limit Value
TWA= Time Weighted Average
vPvB= Very Persistent, Very Bioaccumulative
Wt.% = Weight Percent

Key literature references and sources for data: No data available

Hazard phrase(s) referenced in section 3

H350 - May cause cancer.
H225 - Highly flammable liquid and vapour
H301+H311+H331 - Toxic if swallowed, in contact with skin or if inhaled
H370 - Causes damage to organs
H410 - Very toxic to aquatic life with long lasting effects

Precautionary Statements:

Prevention:

P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.

	P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
	P233 - Keep container tightly closed.
	P240 - Ground/bond container and receiving equipment.
	P241 - Use explosion-proof electrical/ventilating/lighting equipment.
	P242 - Use only non-sparking tools.
	P243 - Take precautionary measures against static discharge.
	P260 - Do not breathe dust/fume/gas/mist/vapours/spray.
	P264 - Wash thoroughly after handling.
	P270 - Do not eat, drink or smoke when using this product.
	P273 - Avoid release to the environment.
	P280 - Wear protective gloves/protective clothing/eye protection/face protection.
Response:	P301+P310 - IF SWALLOWED: Immediately call a POISON CENTER/doctor.
	P302+P352 - If on skin: Wash with plenty of water.
	P303+P361+P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
	P308+P311 - IF exposed or concerned: Call a POISON CENTER/doctor.
	P308+P313 - IF exposed or concerned: Get medical advice/ attention.
	P312 - Call a POISON CENTER/doctor if you feel unwell.
	P321 - Specific treatment (see Sections 4 to 8 on this SDS and any additional information on this label).
	P330 - Rinse mouth.
	P361+P364 - Take off immediately all contaminated clothing and wash it before reuse.
	P370+P378 - In case of fire: Use an appropriate extinguisher (see section 5) to extinguish.
	P391 - Collect spillage.
Storage:	P233 - Keep container tightly closed.
	P403+P235 - Store in a well-ventilated place. Keep cool.
	P405 - Store locked up.
Disposal:	P501 - Dispose of contents/container to a suitable disposal site in accordance with local/national/international regulations.

Disclaimer of Liability: Restek Corporation provides the descriptions, data and information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. It is provided for your guidance only.

Because many factors may affect processing or application/use, Restek Corporation recommends you perform an assessment to determine the suitability of a product for your particular purpose prior to use. No warranties of any kind, either expressed or implied, including fitness for a particular purpose, are made regarding products described, data or information set forth. In no case shall the descriptions, information, or data provided be considered a part of our terms and conditions of sale. Further, the descriptions, data and information furnished hereunder are given gratis. No obligation or liability for the description, data and information given are assumed. All such being given and accepted at your risk.

Material Safety Data Sheet
Chrysene, 98%

ACC# 95251

Section 1 - Chemical Product and Company Identification

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

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

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

Section 2 - Composition, Information on Ingredients

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

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

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

Potential Health Effects

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

Section 4 - First Aid Measures

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

Section 5 - Fire Fighting Measures

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

Section 6 - Accidental Release Measures

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

Section 7 - Handling and Storage

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

Section 8 - Exposure Controls, Personal Protection

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

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

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

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance: very light beige
Odor: Not available.
pH: Not available.
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 448 deg C @ 760 mm Hg
Freezing/Melting Point:250-255 deg C
Decomposition Temperature: Not available.
Solubility: insoluble
Specific Gravity/Density: Not available.
Molecular Formula:C18H12
Molecular Weight:228.29

Section 10 - Stability and Reactivity

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

Section 11 - Toxicological Information

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

Carcinogenicity:
CAS# 218-01-9:

- **ACGIH:** A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans
- **California:** carcinogen, initial date 1/1/90
- **NTP:** Known carcinogen (listed as Coal tar pitches).
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

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

Section 12 - Ecological Information

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

Section 13 - Disposal Considerations

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

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	DOT regulated - small quantity provisions apply (see 49CFR173.4)	No information available.
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 218-01-9 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 218-01-9: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
Section 313
This material contains Chrysene (CAS# 218-01-9, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:

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

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 218-01-9 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

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

STATE

CAS# 218-01-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

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

WARNING: This product contains Chrysene, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 218-01-9: 0.35 æg/day NSRL (oral)

European / International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T

Risk Phrases:

R 45 May cause cancer.
R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.
S 60 This material and its container must be disposed of as hazardou s waste.
S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger / Protection)

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

Canada - DSL / NDSL

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

Canada - WHMIS

This product has a WHMIS classification of D2A.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

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

Section 16 - Additional Information

MSDS Creation Date: 6/30/1999
Revision #5 Date: 11/20/2008

SAFETY DATA SHEET (SDS)

MSDS: Magnesium WIRE AND RODS
REVISED 5-2018
SDS Number: 014- MAG

For Welding Consumables and Related Products
Conforms to the criteria of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS),
OSHA Hazard Communication Standard 29CFR 1910.1200
Standard Must Be Consulted for Specific Requirements

SECTION I – IDENTIFICATION of Product and Company

Manufacturer/Supplier: Washington Alloy Company	Recommended use:	Restriction on use:	Telephone No: 704-598-1325
Address: 7010-G Reames Rd, Charlotte, NC 28216	Welding, Filler Metal, Brazing	Not Known	Emergency No: 704-598-1325
Trade Name of Magnesium: AZ61A, AZ92A, AZ101A			Specification: AWS A5.19

SECTION II – COMPOSITION / INFORMATION ON INGREDIENTS

GHS Hazard Classification: STOT SE 3 (H336, H335), (H372), Aquatic Acute 1 (H400)/ **Label Elements** - Hazard symbol and Signal word =

GHS07 GHS08 GHS09

Danger

Hazard statement and Precautionary statement =

Very toxic to aquatic life, Causes damage to organs through prolonged or repeated exposure, May cause drowsiness or dizziness, May cause respiratory irritation.; Wash thoroughly after handling. Do not eat, drink or smoke when using this product Do not breathe dust/fume/gas/mist/vapors/spray. Avoid breathing dust/fume/gas/mist/vapor/spray.. Use only outdoors or in a well-ventilated area. Avoid release to the environment. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell. Get medical advice and attention if you feel unwell. Collect spillage. Store in a well-ventilated place; Keep container tightly closed. Store locked up. Dispose of contents/container in accordance with local/ regional/ national/ international regulations. Manganese and Manganese compounds above safe exposure limits can affect or cause irreversible damage to the central nervous system, including the brain: symptoms may result in impaired speech and movement, lack of energy, stiffness in legs, feet, toes, muscular weakness as well as psychological disturbances. Reports of bronchitis and lung fibrosis have also been noted.

Other Hazards which do not result in GHS classification and Overview: Electric shock can kill. Wear approved head, hand and body protection, which help to prevent injury from radiation, sparks and electrical shock. Welding arc and sparks can ignite combustibles or flammable materials. See ANSI Z-49.1. This would include wearing welder's gloves and a protective face shield and may include arm protectors, apron, hats, shoulder protection, as well as dark substantial clothing. Welders should be trained not to allow electrically live parts to contract the skin or wet clothing and gloves. The welders should insulate themselves from the work and ground. Arc Rays can injure eyes and burn skin. Read and understand the manufacturer's instructions and precautionary label on this product and your employer's safety practices. See Section XIII.

As shipped these are odorless, solid rods that are nonflammable, non-explosive, non-reactive and non –hazardous with a metallic luster.

Substance: Welding fumes and gases cannot be classified simply. The composition and quantity of these fumes and gases are dependent upon the metal being welded, the procedures followed, and the electrodes used. Fumes may affect eyes, skin, respiratory system as well as pancreas and liver.

Workers should be aware that the composition and quantity of fumes and gases to which they may be exposed, are influenced by: coatings which may be present on the metal being welded (such as paint, plating, or galvanizing), the number of welders in operation and the volume of the work area, the quality and amount of ventilation, the position of the welder's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing procedure). When the electrode is consumed, the fumes and gas decomposition products generated are different in percent and form from the ingredients listed in Section III, The composition of these fumes and gases are the concerning matter and not the composition of the electrode itself. Decomposition products include those originating from the volatilization, reaction, or oxidation of the ingredients shown in Section III, plus those from the base metal, coating and the other factors noted above. Reasonable expected fume constituents of this product would include: Complex oxides or compounds of chromium, magnesium, manganese, silicon, copper, aluminum, zinc and may be present. (Other complex oxides may be present when using fluxes).

Ingredients listed in Section III

Chemical Identity	CAS No.	EINECS#
Carbon dioxide	124-38-9	204-696-9
Carbon monoxide	630-8-0	211-128-3
Nitrogen dioxide	10102-44-0	-
Ozone	10028-15-6	233-069-2
Manganese (Mn)	7439-96-5	231-105-1

SECTION III – COMPOSITION / INFORMATION ON INGREDIENTS

*The term "HAZARDOUS MATERIALS" should be interpreted as a term required and defined in OSHA HAZARD COMMUNICATION STANDARD 29 CFR 1910.1200 however the use of this term does not necessarily imply the existence of any hazard.

Chemical Identity Ingredients	CAS No.	EINECS#	Composition percent in Weight (%)		
			AZ61A	AZ92A	AZ101A
Aluminum	7429-90-5	231-072-3	5.8-7.2	8.3-9.7	9.5-10.5
Zinc (Zn) Fume[(1)]	7440-66-6	231-175-3	0.40-1.5	1.7-2.3	0.75-1.25
Beryllium	7440-41-7	231-150-7	0.0002-0.0008		
Copper	7440-50-8	231-159-6	0.05		
Manganese (Mn) (limits as fume) [(1)]	7439-96-5	231-105-1	0.15-0.5		
Iron	7439-89-6	231-096-4	0.005		
Silicon (Si)	7440-21-3	231-130-8	0.05		
Magnesium (Mg)	7439-95-4	231-104-6	Balance		
Nickel (Ni)	7440-02-0	231-111-4	0.005		

Other elements or ingredients may be present but in quantities much less than 1%. [(1)] Subject to reporting requirements of Section 302, 304, 311, 312, and 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and 40CFR 370 and 372; (Resp) = Respiratory/ Respiration: Welding and cutting of products that contain Chromium may produce hexavalent chromium and YOU should read and follow OSHA's final rules Fed Register #:71:10099-10385 dated 02-28-2006. Occupational Safety and Health Administration 29 CFR 1910.1000 Permissible Exposure Limit (PEL). American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV[R]). *Ceiling Limit **Short Term Exposure Limit Single values are maximum

SECTION IV – FIRST AID MEASURES

Contact with skin, eyes, ingestion or injection should not be a source for exposure with proper protection.

Ingestion: Avoid contact with metal fume or powers which may lead to ingestion which may be harmful. Do not induce vomiting unless directed by medical personnel. Rinse mouth with water if conscious. Call a physician or poison control center immediately.

Inhalation: If breathing has stop or difficult move to fresh air and as needed perform artificial respiration. Call medical assistance or physician.

Skin Contact: Remove any contaminated clothing, gloves or other personnel equipment and promptly wash/flush with mild soap and water. For reddish or blistered skin from thermal/arc radiation promptly wash/flush with water. Get medical assistance or physician help as needed.

Eye Contact: Arc radiation can injure eyes and cause an arc flash – if this occurs, move to dark room removing lenses as required and get rest and cover eyes with non-stick dressings (padded dressing) Removal of dust and fumes requires flushing with abundant amounts of clean water for at least 15 minutes. Get medical assistance or physician help as needed or if issues persist.

Most important symptoms/effects, acute and delayed:

Symptoms: Short-term (acute) overexposure to welding fumes may result in discomfort such as metal fume fever, dizziness, nausea, dryness or irritation of nose, throat, or eyes. Pre-existing respiratory issues may be aggregated. Long-term (chronic) over-exposure to welding fumes can lead to siderosis (iron deposits in lung) and is believed to affect pulmonary function. Manganese and Manganese compounds above safe exposure limits can affect or cause irreversible damage to the central nervous system, including the brain: symptoms may result in impaired speech and movement, lack of energy, stiffness in legs, feet, toes, muscular weakness as well as psychological disturbances. Reports of bronchitis and lung fibrosis have also been noted.

Hazards: Welding fumes and gases cannot be classified simply. Refer to Section II under Substance and Section VIII

SECTION V – FIRE-FIGHTING MEASURES

As shipped these are odorless, solid rods that are nonflammable, non-explosive, non-reactive and non –hazardous. Welding arcs and sparks can ignite combustibles or flammable materials Read and understand the manufacturer's instructions and precautionary label on this product and your employer's safety practices. Read and understand: American National Standard ANSI Z49.1 *Safety in Welding, Cutting and Allied Processes*, published by the AMERICAN WELDING SOCIETY, 550 N.W. LeJeune Road, Miami, Florida 33126; OSHA *Safety and Health Standards* are published by the U.S. Government Printing Office, 732 North Capitol Street NW, Washington, DC 20401. Also, National Fire Protection Association NFPA 51B*, Standard for Fire Prevention During Welding, Cutting and other Hot Work; Also See NFPA 651*

Suitable (and unsuitable) extinguishing media: As shipped these items will not burn however in the event use media recommended for the burning materials and fire situation and surroundings. No unsuitable media known at this time. Do not use water or halogenated on molten metals.

Specific hazards arising from the chemicals: Welding arcs and sparks can ignite combustibles or flammable materials

Specific protective equipment and precautions for firefighters: Wear self-contained breathing apparatus and full protective clothing in case of fire or when fumes and vapors are present. Follow general fire-fighting precautions as in the workplace. Do not allow run off to enter drains or water sources.

SECTION VI – ACCIDENTAL RELEASE MEASURES

Personal Precautions, protective equipment and emergency procedures: With airborne dust and fumes, be sure to use adequate engineering ventilation controls and personal protection to prevent overexposure limits recommendations found in Section VIII.

Environment precautions: Control work practices to eliminate environmental release. These products are solid metal rods, with no spill or leak hazards as shipped. If product becomes molten dam up with sand type media until it cools back to a solid and reuse/recycle as scrap.

Methods and Materials for containment and cleaning up: Solid rods can be picked up and placed back in the original container. Clean up immediately while following all safety guidelines as well as using all personal protection safety listed in section VIII. Avoid generating dust and prevent materials from entering and drains, sewers or water sources. Disposal considerations found in Section XIII. When fumes and vapors are present follow general fire-fighting precautions as in the workplace and all applicable regulations

SECTION VII – HANDLING AND STORAGE

Precautions for safe handling: Handle with care wearing gloves and keep formation of airborne dust and fumes to a minimum. If needed use adequate engineering ventilation controls and personal protection to prevent overexposure limits recommendations found in Section VIII. Also read American National Standard ANSI Z49.1 *Safety in Welding, Cutting and Allied Processes*, published by the AMERICAN WELDING SOCIETY, 550 N.W. LeJeune Road, Miami, Florida 33126; OSHA *Safety and Health Standards* are published by the U.S. Government Printing Office, 732 North Capitol Street NW, Washington, DC 20401. Do not eat or drink while using these products and ensure proper ventilation is used. Wash hands after use. **Conditions for safe storage, including any incompatibilities:** All employees who handle these products should be trained to handle it safely. Open packages of these products/containers on a safe stable surface and must be properly labeled at all times. Store products in original closed packages, cool dry place, while avoiding extreme temperatures or incompatible items such as acids, strong bases, oxidizers and halogens. Always follow all regulations in accordance with local/regional/state/national guidelines.

SECTION VIII – EXPOSURE CONTOLS/PERSONAL PROTECTION

Control parameters

Flux or other ingredients	CAS No.	EINECS#	Exposure Limit (mg/m^3)	
			OSHA PEL	ACGIH TLV
Iron (Fe) (limits as oxide fume)	7439-89-6	231-096-4	10	5 (Resp)
Manganese (Mn) (limits as fume) [(1)]	7439-96-5	231-105-1	1 , 3.0** , 5*	0.02 (Resp) 0.1***
Silicon (Si)	7440-21-3	231-130-8	15 (dust) 5 (Resp)	WITHDRAWN
Nickel (Ni) [(1)]	7440-02-0	231-111-4	1	1.5 (inhalable fraction)
Copper (Cu) [(A) (1)]	7440-50-8	231-159-6	1 (dust) 0.1(fume)	1 (dust) 0.2 (fume)
Magnesium (Mg)	7439-95-4	231-105-1	15 (total particulate)	10
Zinc (Zn) Fume[(1)]	7440-66-6	231-175-3	5 mg/m3 5 mg/m3 (Resp) 15 mg/m3 (total dust)	2 (Resp)10**
Beryllium	7440-41-7	239-981-7	0.002, 0.005 Ceiling, 0.025 for 30 minutes	0.00005***
Aluminum (Al) [(1) (2)]	7429-90-5	231-072-3	15 (total dust) 5 (Resp)	10 (dust)1 (Resp)

Other elements or ingredients may be present but in quantities much less than 1%.[(1)] Subject to reporting requirements of Section 302, 304, 311, 312, and 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and 40CFR 370 and 372; (Resp) = Respiratory/ Respiration: Welding and cutting of products that contain Chromium may produce hexavalent chromium and YOU should read and follow OSHA's final rules Fed Register #:71:10099-10385 dated 02-28-2006. Occupational Safety and Health Administration 29 CFR 1910.1000 Permissible Exposure Limit (PEL). American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV[R]). *Ceiling Limit **Short Term Exposure Limit ***Inhalable fraction **ACGIH** - **A**merican **C**onference of **G**overnmental **I**ndustrial **H**ygienists, a professional association which establishes exposure limits used a guideline in control for health hazards but not an indication of safe and dangerous exposure limits **TLV - Threshold Limit Value** - an airborne concentration of a substance, which represents conditions under which it is generally believed that nearly all workers, may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour & **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. **OSHA** - U.S. Occupational Safety and Health Administration. **PEL - Permissible Exposure Limit** - this exposure value means the same as a TLV, except that it is limits guideline by OSHA. **Eye Protection:** Wear a helmet or face shield with a filter lens shade number 12-14 or darker for arc welding. Shield other workers by providing screens and flash goggles. Use face-shield with filter lens of appropriate shade number (per ANSI Z49.1-1988, "Safety in Welding and Cutting"). **Protective Clothing:** Wear approved head, hand and body protection, which help to prevent injury from radiation, sparks and electrical shock. See ANSI Z-49.1. This would include wearing welder's gloves and a protective face shield and may include arm protectors, apron, hats, shoulder protection, as well as dark substantial clothing. Welders should be trained not to allow electrically live parts to contract the skin or wet clothing and gloves. The welders should insulate themselves from the work and ground. **Ventilation:** Use plenty of ventilation and/or local exhaust at the arc, to keep the fumes and gases below the threshold limit value within the worker's breathing zone and the general work area. Welders should be advised to keep their head out of the fumes.

Respiratory Protection: Use respirable fume respirator or air supplied respirator when welding in a confined space or general work area where local exhaust and/or ventilation does not keep exposure below the threshold limit value.

HYGIENE/ WORK PRACTICES: With all chemicals/materials, avoid getting these products ON YOU or IN YOU. Wash hands after handling these products. Do not eat or drink while handling these products. Use ventilation and other engineering controls to minimize potential exposure to these products.

SECTION IX – PHYSICAL AND CHEMICAL PROPERTIES

Appearance / Color / Odor / Physical state / Form: Solid rods that are nonflammable, non-explosive, non-reactive and non –hazardous with a metallic luster. **Odor Threshold / pH / Flash Point / Evaporation Rate / Flammability (Solid, Gas) / Upper & Lower Flammability or Explosive Limits:** No data available **Vapor Pressure & Density / Relative Density / / Partition coefficient (n-octanol/water) / Auto-ignition Decomposition temperature:** No data available **MELTING POINT**: 1112°F (600 °C) SPECIFIC GRAVITY N/A **Solubility(water/other); Insoluble**

SECTION X – STABILITY and REACTIVITY

Chemical stability: These products are considered stable as shipped and under normal conditions
Possibility of hazard reactions: No data and will not occur
Conditions to avoid: Avoid exposure to extreme temperatures, Incompatible materials
Incompatible materials: Incompatible items such as acids, oxidizers, halogens, Strong bases, mineral acids, and halogens.
Hazardous decomposition products: Read Substance in Section II. Welding and cutting of products that contain Chromium may produce hexavalent chromium and YOU should read and follow OSHA's final rules Fed Register #:71:10099-10385 dated 02-28-2006. Occupational Safety and Health Administration 29 CFR 1910.1000 Permissible Exposure Limit (PEL). The best method to determine the actual composition of generated fumes and gases is to take an air sample from inside the welder's helmet if worn or in breathing zone. For additional information, refer to the American Welding Society Publication, "Fumes and Gases in the Welding Environment".

SECTION XI- TOXICOLOGICAL INFORMATION

Oral/Dermal/inhalation: **Acute oral toxicity;** Iron: (Human-child); TDLo: 77 mg/kg. Oral (rat); LD50:30 gm/kg. Intraperitoneal (rabbit); LDLo: 20 mg/kg. Oral (guinea pig); LD50:20 gm/kg. Oral (rat); TDLo: 63 gm/kg/6W-C. Inhalation (rat); 250 mg/m3/6H/4W-I. Intratracheal (rat); TDLo: 450 mg/kg/15W-I. Silicon: Acute oral toxicity (LD50): 3160 mg/kg [Rat]. Manganese: Acute oral toxicity (LD50): 9000 mg/kg [Rat].; TCLo 2300 mg/m3 (inhalation human central nervous); Silicon : Acute oral toxicity (LD50): 3160 mg/kg [Rat].; Copper: Acute oral toxicity (TDLo): 12 mg/kg, gastrointestinal effects; Zinc: (TDLo): 124 mg//m3/50mins, pulmonary effects of skin; **Skin corrosion or irritation / Serious eye damage or irritation / Respiratory or skin sensitization / Germ cell mutagenicity / Reproductive toxicity / Specific target organ toxicity – single exposure / Specific target organ toxicity – repeated exposure**: Not classified **Carcinogenicity:** Overall Evaluation of welding fume and Nickel is listed by IARC as possibly carcinogenic to humans (Group 2B). **National Toxicology Program** (NTP) list Nickel with Reasonably Anticipated to be a Human Carcinogen; Nickel and compounds pose a respiratory cancer risk, and may give skin itch to dermatitis Arc Rays can injure eyes and burn skin. Skin cancer has been reported **Information on the likely routes of exposures: Ingestion** is not a likely route of exposure for this product or expected under normal use. If swallowed call physician immediately! Do not induce vomiting unless directed by medical personnel. Rinse mouth with water if person is conscious. Never give fluids or induce vomiting if person is unconscious, having convulsions, or not breathing. **Inhalation** of welding fumes and gases can be dangerous to your health. **Skin/Eye Contact:** Arc Rays can injure eyes and burn skin. Skin cancer has been reported. **IARC**- has classified welding fumes as a possible carcinogenic to humans (Group 2B) **Symptoms related to physical, chemical and toxicological characteristics: Inhalation:** Short-term(acute) overexposure to welding fumes may result in discomfort such as metal fume fever, dizziness, nausea, dryness or irritation of nose, throat, or eyes. Pre-existing respiratory issues may be aggregated. Long-term (chronic) over-exposure to welding fumes can lead to siderosis (iron deposits in lung) and is believed to affect pulmonary function. Manganese and Manganese compounds above safe exposure limits can affect or cause irreversible damage to the central nervous system, including the brain: symptoms may result in impaired speech and movement, lack of energy, stiffness in legs, feet, toes, muscular weakness as well as psychological disturbances. Reports of bronchitis and lung fibrosis have also been noted. **Delayed and immediate effects and also chronic effects from short and long-term exposure:** There are no immediate health hazards associated with the wire or rod form of this product. Skin, respiratory, pancreas, and liver disorders may be aggravated by prolonged over-exposures to the dusts or fumes generated by these products. Pre-existing respiratory issues may be aggregated. Long-term (chronic) over-exposure to welding fumes can lead to siderosis (iron deposits in lung) and is believed to affect pulmonary function. Manganese and Manganese compounds above safe exposure limits can affect or cause irreversible damage to the central nervous system, including the brain: symptoms may result in impaired speech and movement, lack of energy, stiffness in legs, feet, toes, muscular weakness as well as psychological disturbances. Reports of bronchitis and lung fibrosis have also been noted. Treat symptoms and eliminate overexposure.
Other information during use: **Inhalation acute toxicity**: Carbon dioxide LC Lo (Human, 5 min): 90000 ppm Carbon monoxide LC 50 (Rat, 4 h): 1,300 mg/l Nitrogen dioxide LC 50 (Rat, 4 h): 88 ppm

SECTION XII- TOXICOLOGICAL INFORMATION

Ecotoxicity: Iron = LC50 Channel catfish (Ictalurus punctatus) > 500 mg/l, 96 hours**; Manganese** = EC 50 (Water flea (Daphnia magna), 48 h): 40 mg/l; **Nickel** LC50 Fathead minnows (Pimephales promelas) 2.916 mg/l, 96 hours**,** *EC50 Water flea* (Daphnia obtusa) 1 mg/l, 48 hours **; Aluminum** (Al) LC 50 (Grass carp, white amur (Ctenopharyngodon idella) 96 h): 0.21-0.31 mg/l**: Copper** LC50 Fathead minnows (Pimephales promelas) 1.6 mg/l, 96 hours**,** *EC50 Water flea* (Daphnia obtusa) 0.102 mg/l, 48 hours **; Specified substance(s):** Nickel Zebra mussel (Dreissana polymorpha), Bioconcentration Factor (BCF): 5,000 – 10,000 (lotic) Biocencentration factor calculated using dry weight tissue concentration: Copper and/or copper alloys and compounds (as Cu) Blue-green algae (Anacystis nidulans), Bioconcentration Factor (BCF): 36.01 (Static); **Persistence and Degradability / Bioaccumulative Potential / Mobility in Soil:** No data

Other Adverse Effects: Possibly harmful to aquatic life. Do not allow material to be released to the environment without proper governmental permits. No further relevant information available.

SECTION XIII- DISPOSAL CONCIDERATIONS

Disposal Methods: Avoid or minimize generating waste**.** When possible collect scrap and by-products with proper id for recycling. Waste disposal must be in accordance with appropriate Federal, National, Provincial, State, and local regulations. These products, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority.

SECTION XIV- TRANSPORT INFORMATION

UN Number / UN Proper shipping name / Transport Hazard class (es)/ Packing group / Marine pollutant / Special Precautions: Not Regulated as Dangerous Good or Not Regulated, No international regulations

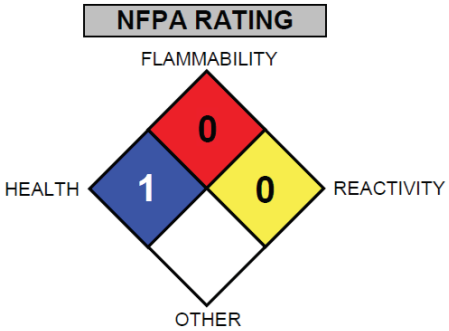
SECTION XV- REGULATORY INFORMATION

United States: TSCA INVENTORY STATUS: The components of these products are listed on the TSCA Inventory; **CERCLA REPORTABLE QUANTITY (RQ):** Beryllium, Nickel, Copper, Manganese, Zinc, Manganese = Reportable quantity: Included in the regulation but with no data values. See regulation (40 CFR 302.4). **EPCRA/SARA Title III 313 Toxic Chemicals** The following metallic components are listed as SARA 313 "Toxic Chemicals" and potential subject to annual SARA 313 reporting. See Section III for weight percent. Ingredient & Disclosure threshold: Aluminum, Chromium, Copper, Manganese, Vanadium, Zinc all @ 1.0% de minimis concentration: Hexavalent chromium compounds 0.1% de minimis concentration N090; Zinc oxide 1.0% de minimis concentration N982
Superfund Amendments and Reauthorization Act 1986 (SARA): As shipped: Immediate (Acute) In use: Immediate delayed (Delayed)

California Proposition 65: **WARNING**: This product may expose you to chemicals including [Cobalt (II) Oxide, Titanium dioxide (airborne, unbound particles of respirable size), Chromium (hexavalent compounds), Nickel, Lead and Lead Compounds, Carbon Black, Cadmium, Beryllium and Beryllium Compounds] which are known to the State of California to cause cancer, and [Chromium (hexavalent compounds), Nickel, Lead and Lead Compounds, Cadmium] which are known to the State of California to cause birth defects and/or other reproductive harm. For more information go to https://www.p65warnings.ca.gov/
Beryllium and Nickel, is on the California Proposition 65 lists. Hexavalent chromium compounds, Beryllium, Nickel, listed in the following- Carcinogens & Reproductive Toxic Listed Substance, Carcinogenic Substance 2/27/1987, Developmental Toxin 12/19/2008, Female Reproductive Toxin 12/19/2008, Male Reproductive Toxin 12/19/2008
US State Regulations list: See Section III for contents and weight percent
Alaska-Designated Toxic and Hazardous Substances: Aluminum Welding Fumes, Manganese,
California-Permissible Exposure Limits for Chemical Contaminants: Aluminum, Aluminum oxide, Beryllium, Nickel, Manganese, Silicon, Magnesium, Magnesium Oxide, Copper, Iron, Iron oxide, Zinc and Zinc oxide
Florida-Substance List: Aluminum, Manganese,
Illinois-Toxic Substance List: Aluminum, Copper, Manganese, and Silicon.
Kansas-Section 302/313 List: Aluminum, Copper, and Manganese.
Massachusetts-Substance List: Aluminum, Aluminum oxide, Beryllium, Nickel, Copper, Magnesium, Magnesium Oxide, Manganese, Iron oxide, Silicon, Zinc, Zinc oxide
Michigan - Critical Materials Register: Copper.
Minnesota-List of Hazardous Substances: Aluminum Welding Fumes, Beryllium, Nickel, Copper, Manganese, and Silicon.
Missouri-Employer Information/Toxic Substance List: Aluminum, Copper, Manganese, Molybdenum, Silicon,
New Jersey-Right to Know Hazardous Substance List Aluminum, Aluminum oxide, Copper, Iron oxide, Magnesium, Magnesium Oxide, Manganese, Silicon, Beryllium, Nickel, Zinc oxide
North Dakota-List of Hazardous Chemicals, Reportable Quantities: Copper.
Pennsylvania-Hazardous Substance List: Aluminum, Aluminum oxide, Copper, Iron oxide, Iron oxide, Magnesium, Manganese, Silicon, Welding Fume, Zinc oxide Beryllium, Nickel,
Rhode Island-Hazardous Substance List: Aluminum Welding Fumes, Manganese, Silicon, and Zirconium.
Texas-Hazardous Substance List: Manganese,
West Virginia-Hazardous Substance List: Manganese,
Wisconsin-Toxic and Hazardous Substances: Manganese,

SECTION XVI- OTHER INFORMATION

Approval Date:5-29-2018 NEW SDS Number: 014-MAG
NFPA CODES: FIRE: 0 HEALTH: 1 REACTIVITY: 0
U.S. DOT = Material is not hazardous and is not considered as a dangerous item.
Washington Alloy Co. Believes that the information contained in this (SDS) Safety Data Sheet is accurate. However, Washington Alloy Co. does not express or implies any warranty with respect to this information.
Download the most current SDS and product information @ www.weldingwire.com



SAFETY DATA SHEET

Creation Date 08-Nov-2010 **Revision Date** 16-Jan-2019 **Revision Number** 6

1. Identification

Product Name **Fluoranthene**

Cat No. : **AC119170000; AC119170250; AC119171000; AC119175000**

CAS-No 206-44-0
Synonyms Benzo[j,k]fluorene

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity	Category 4

Label Elements

Signal Word
Warning

Hazard Statements
Harmful if swallowed

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Very toxic to aquatic life with long lasting effects

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Fluoranthene	206-44-0	>95

4. First-aid measures

General Advice If symptoms persist, call a physician.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.

Inhalation Move to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur.

Ingestion Clean mouth with water and drink afterwards plenty of water. Get medical attention if symptoms occur.

Most important symptoms and effects None reasonably foreseeable.

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable Extinguishing Media No information available

Flash Point Not applicable
Method - No information available

Autoignition Temperature No information available
Explosion Limits
Upper No data available
Lower No data available
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO_2)

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	0	0	N/A

6. Accidental release measures

Personal Precautions Ensure adequate ventilation. Use personal protective equipment. Avoid dust formation.

Environmental Precautions Should not be released into the environment.

Methods for Containment and Clean Up Sweep up or vacuum up spillage and collect in suitable container for disposal. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Ensure adequate ventilation. Wear personal protective equipment. Avoid dust formation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation.

Storage Keep in a dry, cool and well-ventilated place. Keep container tightly closed.

8. Exposure controls / personal protection

Exposure Guidelines This product does not contain any hazardous materials with occupational exposure limitsestablished by the region specific regulatory bodies.

Engineering Measures Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

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

Skin and body protection Long sleeved clothing.

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

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Powder Solid
Appearance	Light green
Odor	Odorless
Odor Threshold	No information available
pH	Not applicable
Melting Point/Range	109 - 111 °C / 228.2 - 231.8 °F
Boiling Point/Range	384 °C / 723.2 °F
Flash Point	Not applicable
Evaporation Rate	No information available
Flammability (solid,gas)	No information available
Flammability or explosive limits	

Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	No information available
Specific Gravity	No information available
Solubility	insoluble
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C16 H10
Molecular Weight	202.25

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products.

Incompatible Materials Strong oxidizing agents

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information No acute toxicity information is available for this product

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Fluoranthene	LD50 = 2 g/kg (Rat)	LD50 = 3180 mg/kg (Rabbit)	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation No information available

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Fluoranthene	206-44-0	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed No information available

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Fluoranthene	Not listed	Oncorhynchus mykiss: LC50=0.0077 mg/L 96h	Not listed	EC50: 0.78 mg/L 20h

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available.

Mobility .

Component	log Pow
Fluoranthene	5.1

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Fluoranthene - 206-44-0	U120	-

14. Transport information

DOT

UN-No	UN3077
Proper Shipping Name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Proper technical name	Fluoranthene
Hazard Class	9
Packing Group	III

TDG

UN-No	UN3077
Proper Shipping Name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Hazard Class	9
Packing Group	III

IATA

UN-No	UN3077
Proper Shipping Name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Hazard Class	9
Packing Group	III

IMDG/IMO

UN-No	UN3077
Proper Shipping Name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Hazard Class	9
Packing Group	III

15. Regulatory information

All of the components in the product are on the following Inventory lists: The product is classified and labeled according to EC directives or corresponding national laws The product is classified and labeled in accordance with Directive 1999/45/EC Europe China Canada TSCA Japan X = listed Australia U.S.A. (TSCA) Canada (DSL/NDSL) Europe (EINECS/ELINCS/NLP) Australia (AICS) Korea (ECL) China (IECSC) Japan (ENCS) Philippines (PICCS) Complete Regulatory Information contained in following SDS's

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Fluoranthene	X	-	X	205-912-4	-		-	X	X	X	-

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Fluoranthene	206-44-0	>95	1.0 0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Fluoranthene	-	-	X	X

Clean Air Act Not applicable

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Fluoranthene	100 lb	-

California Proposition 65 This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Fluoranthene	X	X	X	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	N
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date	08-Nov-2010
Revision Date	16-Jan-2019
Print Date	16-Jan-2019
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

Material Safety Data Sheet
Phenanthrene, 98+%

ACC# 96981

Section 1 - Chemical Product and Company Identification

MSDS Name: Phenanthrene, 98+%
Catalog Numbers: AC130090000, AC130090050, AC130090500, AC130091000, AC130095000
Synonyms:
Company Identification:

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

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

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
85-01-8	Phenanthrene	>98.0	201-581-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: brown.
Warning! Harmful if swallowed. May cause allergic skin reaction. May cause eye, skin, and respiratory tract irritation. Cancer suspect agent.
Target Organs: Skin.

Potential Health Effects

Eye: May cause eye irritation.
Skin: May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.
Ingestion: Harmful if swallowed. May cause irritation of the digestive tract.
Inhalation: May be harmful if inhaled. Inhalation of dust may cause respiratory tract irritation.
Chronic: Limited evidence of a carcinogenic effect.

Section 4 - First Aid Measures

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

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
Extinguishing Media: Use water spray or dry chemical.
Flash Point: Not available.
Autoignition Temperature: Not available.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 2; Flammability: 1; Instability: 0

Section 6 - Accidental Release Measures

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

Section 7 - Handling and Storage

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

Section 8 - Exposure Controls, Personal Protection

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

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

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

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance: brown
Odor: None reported
pH: Not available.
Vapor Pressure: 1 mm Hg @116c
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 340 deg C
Freezing/Melting Point:101 deg C
Decomposition Temperature: Not available.
Solubility: insoluble
Specific Gravity/Density:1.0630g/cm3
Molecular Formula:C14H10
Molecular Weight:178.23

Section 10 - Stability and Reactivity

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

Section 11 - Toxicological Information

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

Carcinogenicity:
CAS# 85-01-8:

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

Epidemiology: No information found
Teratogenicity: No information found
Reproductive Effects: No information found
Mutagenicity: No information found
Neurotoxicity: No information found
Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

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

Section 14 - Transport Information

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

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 85-01-8 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 85-01-8: 5000 lb final RQ; 2270 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 85-01-8: immediate.
Section 313
This material contains Phenanthrene (CAS# 85-01-8, >98.0%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 85-01-8 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

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

California Prop 65

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

European / International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XN N

Risk Phrases:

R 22 Harmful if swallowed.
R 40 Limited evidence of a carcinogenic effect.
R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 29 Do not empty into drains.
S 36/37 Wear suitable protective clothing and gloves.
S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger / Protection)

CAS# 85-01-8: No information available.

Canada - DSL / NDSL

CAS# 85-01-8 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2B.

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

Canadian Ingredient Disclosure List

CAS# 85-01-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 7/14/1998
Revision #5 Date: 5/05/2009

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

The ToxGuide™ is developed to be used as a pocket guide. Tear off at perforation and fold along lines.

Sources of Exposure

General Populations

- The most likely source of exposure is ingestion of contaminated food and drinking water. Exposure can also occur via inadvertent ingestion of contaminated soil/dust or lead-based paint.
- Lead can leach into drinking water from lead-soldered joints or leaded pipes in water distribution systems or individual houses. Lead may also enter foods if they are put into improperly glazed pottery or ceramic dishes.
- Some non-Western folk remedies may contain substantial amounts of lead. Some types of hair dyes and cosmetics may contain lead compounds.
- Other potential sources of exposure are hobbies that use lead: casting ammunition and m fishing weights; soldering with lead solder; making stained glass; using firing ranges. Leaded gasoline is still used in some race cars, airplanes, and off-road vehicles.

Occupational Populations

- Potentially high levels of lead may occur in the following industries: lead smelting and refining industries, battery manufacturing plants, steel welding or cutting operations, construction, rubber products and plastics industries, printing industries, firing ranges, radiator repair shops and other industries requiring flame soldering of lead solder.

Toxicokinetics and Normal Human Levels

Toxicokinetics

- Approximately 95% of deposited inorganic lead that is inhaled is absorbed.
- The extent and rate of gastrointestinal absorption of inorganic lead are influenced by the physiological state of the exposed individual and the species of the lead compound.
- Gastrointestinal absorption of lead is higher in children (40–50%) than in adults (3–10%). The presence of food in the gastrointestinal tract decreases absorption.
- Absorption of lead from soil is less than that of dissolved lead, but is similarly depressed by meals (26% fasted; 2.5% when ingested with a meal).
- In adults, about 94% of the total amount of lead in the body is contained in the bones and teeth versus about 73% in children.
- The elimination half-lives for inorganic lead in blood and bone are approximately 30 days and 27 years, respectively.
- Independent of the route of exposure, absorbed lead is excreted primarily in urine and feces.

Normal Human Levels

- Lead levels in blood (geometric mean, 1999-2002):

  1.9 µg/dL for children 1-5 years
  1.5 µg/dL for adults 20–59 years
- Lead levels in urine (geometric mean, 2001-2002):

  0.677 µg/L for ≥6 years of age

Biomarkers/Environmental Levels

Biomarkers

- Analysis of lead in whole blood is the most common and accurate method of assessing lead exposure. Erythrocyte protoporphyrin (EP) tests can also be used, but are not as sensitive at low blood lead levels (<20 µg/dL). Lead in blood reflects recent exposure.
- Bone lead measurements are an indicator of cumulative exposure.
- Measurements of urinary lead levels and hair have been used to assess lead exposure; however, they are not as reliable.

Environmental Levels

Air

- The concentration of lead in air samples (2002) is <0.05 µg/m^3.

Sediment and Soil

- The natural lead content of soil typically ranges from <10 to 30 µg/g. However, lead levels in the top layers of soil vary widely due to deposition and accumulation of atmospheric particulates from anthropogenic sources.

Water

- Levels of lead in surface water and groundwater in the U.S. range between 5 and 30 µg/L.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Lead. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

ToxGuide™ for Lead

Pb

CAS# 7439-92-1

October 2007

U.S. Department of Health and Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov

Contact Information:
Division of Toxicology
and Environmental Medicine
Applied Toxicology Branch

1600 Clifton Road NE, F-32
Atlanta, GA 30333
1-800-CDC-INFO
1-800-232-4636

www.atsdr.cdc.gov/toxpro2.html

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

The ToxGuide™ is developed to be used as a pocket guide. Tear off at perforation and fold along lines.

Chemical and Physical Information

Lead is a metal

- Lead is a naturally-occurring bluish-gray metal that is rarely found in its elemental form, but occurs in the Earth's crust primarily as the mineral galena (PbS), and to a lesser extent as anglesite ($PbSO_4$) and cerussite ($PbCO_3$).
- Lead is not a particularly abundant element, but its ore deposits are readily accessible and widely distributed throughout the world. Its properties, such as corrosion resistance, density, and low melting point, make it a familiar metal in pipes, solder, weights, and storage batteries.
- Natural lead is a mixture of four stable isotopes, ^{208}Pb (51–53%), ^{206}Pb (23.5–27%), ^{207}Pb (20.5–23%), and ^{204}Pb (1.35–1.5%). Lead isotopes are the stable decay product of three naturally radioactive elements: ^{205}Pb from uranium, ^{207}Pb from actinium, and ^{208}Pb from thorium.

Routes of Exposure

- Inhalation – Primary route for occupational exposure. Larger particles (>2.5 µm) that are deposited in the ciliated airways (nasopharyngeal and tracheobronchial regions) can be transferred by mucociliary transport into the esophagus and swallowed.
- Oral – Primary route of exposure for the general population.
- Dermal – Studies in animals have shown that organic lead is well absorbed through the skin.

Lead in the Environment

- Lead is dispersed throughout the environment primarily as the result of anthropogenic activities. In the air, lead is in the form of particles and is removed by rain or gravitational settling.
- The fate of lead in soil is affected by the adsorption at mineral interfaces, which are dependent upon physical and chemical characteristics of the soil (e.g., pH, soil type, particle size, organic matter content).
- Sources of lead in dust and soil can include lead from weathering and chipping of lead-based paint from buildings, bridges, and other structures.
- The solubility of lead compounds in water is a function of pH, hardness, salinity, and the presence of humic material. Solubility is highest in soft, acidic water.

Relevance to Public Health (Health Effects)

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

Minimal Risk Levels (MRLs)

- MRLs were not derived for lead because a clear threshold for some of the more sensitive effects in humans has not been identified.
- In lieu of MRLs, ATSDR has developed a framework to guide decisions at lead sites. This approach utilizes site-specific exposure data to estimate internal doses as measured by blood lead levels (PbBs) (see Appendix D in the Toxicological Profile).

Health Effects

Hematological

- Decreased activity of several heme biosynthesis enzymes at PbB <10 µg/dL.

Gastrointestinal

- Colic in children – PbB 60–100 µg/dL.

Cardiovascular

- Elevated blood pressure – PbB<10 µg/dL.

Renal

- Decreased glomerular filtration rate at mean PbB <20 µg/dL.

Neurological

- Encephalopathy – PbB100–120 µg/dL (adults) 70–100 µg/dL (children).
- Peripheral neuropathy – PbB40 µg/dL.
- Neurobehavioral and neuropsychological effects in adults – PbB40–80 µg/dL.
- Cognitive and neurobehavioral effects in children at PbB <10 µg/dL.

Reproductive

- Reduced fertility – PbB>40 µg/dL.

Children's Health

- Children are more vulnerable to the effects of lead than adults.
- The most common source of lead exposure for children is lead-based paint.
- Lead exposures during infancy or childhood may result in anemia, neurological impairment, renal alterations, colic, and impaired metabolism of vitamin D.
- Lead exposures either *in utero*, during infancy, or during childhood may result in delays or impairment of neurological development, neurobehavioral deficits including IQ deficits, low birth weight, and low gestational age, growth retardation, and delayed sexual maturation in girls.
- Ensuring a diet that is nutritionally adequate in calcium and iron may decrease the absorbed dose of lead.

Mercury - ToxFAQs™

CAS # 7439-97-6

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is mercury?

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

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

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

What happens to mercury when it enters the environment?

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

How might I be exposed to mercury?

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

How can mercury affect my health?

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

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

Mercury

CAS # 7439-97-6

How likely is mercury to cause cancer?

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

How can mercury affect children?

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

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

How can families reduce the risk of exposure to mercury?

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

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

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for mercury. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Arsenic - ToxFAQs™

CAS # 7440-38-2

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

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

What is arsenic?

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

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

What happens to arsenic when it enters the environment?

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

How might I be exposed to arsenic?

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

How can arsenic affect my health?

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

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

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

Skin contact with inorganic arsenic may cause redness and swelling.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic

CAS # 7440-38-2

compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys.

How likely is arsenic to cause cancer?

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

How can arsenic affect children?

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

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

How can families reduce the risks of exposure to arsenic?

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

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

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

Has the federal government made recommendations to protect human health?

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

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

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic (Update). Atlanta, GA: U.S. Department of Health and Human Services. Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Polychlorinated Biphenyls - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about polychlorinated biphenyls. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls?

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

What happens to PCBs when they enter the environment?

- PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.
- PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.
- PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.
- PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

How might I be exposed to PCBs?

- Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.
- Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.
- Breathing air near hazardous waste sites and drinking contaminated well water.
- In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

How can PCBs affect my health?

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over

several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. PCBs have been classified as probably carcinogenic, and carcinogenic to humans (group 1) by the Environmental Protection Agency (EPA) and International Agency for Research on Cancer (IARC), respectively.

How can PCBs affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

How can families reduce the risks of exposure to PCBs?

- You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.
- Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.
- Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.
- If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

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

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for polychlorinated biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

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ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

http://www.epa.gov/pesticides/factsheets/riskassess.htm
Last updated on Wednesday, May 09, 2012

Pesticides: Topical & Chemical Fact Sheets

Assessing Health Risks from Pesticides

Este Web page está disponible en español

Current as of: April 5, 2007
735-F-99-002

Questions on Pesticides?

- Contact the National Pesticide Information Center (NPIC) 1-800-858-7378

The Federal Government, in cooperation with the States, carefully regulates pesticides to ensure that they do not pose unreasonable risks to human health or the environment. As part of that effort, the Environmental Protection Agency (EPA) requires extensive test data from pesticide producers that demonstrate pesticide products can be used without posing harm to human health and the environment. EPA scientists and analysts carefully review these data to determine whether to register (license) a pesticide product or a use and whether specific restrictions are necessary. This fact sheet is a brief overview of EPA's process for assessing potential risks to human health when evaluating pesticide products.

Background

There are more than 1055 active ingredients registered as pesticides, which are formulated into thousands of pesticide products that are available in the marketplace.

EPA plays a critical role in evaluating these chemicals prior to registration, and in reevaluating older pesticides already on the market, to ensure that they can be used with a reasonable certainty of no harm. The process EPA uses for evaluating the health impacts of a pesticide is called risk assessment.

EPA uses the National Research Council's four-step process for human health risk assessment:

Step One: Hazard Identification
Step Two: Dose-Response Assessment
Step Three: Exposure Assessment
Step Four: Risk Characterization

Step One: Hazard Identification (Toxicology)

The first step in the risk assessment process is to identify potential health effects that may occur from different types of pesticide exposure. EPA considers the full spectrum of a pesticide's potential health effects.

Generally, for human health risk assessments, many toxicity studies are conducted on animals by pesticide companies in independent laboratories and evaluated for acceptability by EPA scientists. EPA evaluates pesticides for a wide range of adverse effects, from eye and skin irritation to cancer and birth defects in laboratory animals. EPA may also consult the public literature or other sources of supporting information on any aspect of the chemical.

Step Two: Dose-Response Assessment

Paracelsus, the Swiss physician and alchemist, the “father” of modern toxicology (1493-1541) said,

> "The dose makes the poison."

In other words, **the amount of a substance a person is exposed to** is as important as **how toxic the chemical might be**. For example, small doses of aspirin can be beneficial to people, but at very high doses, this common medicine can be deadly. In some individuals, even at very low doses, aspirin may be deadly.

Dose-response assessment involves considering the dose levels at which adverse effects were observed in test animals, and using these dose levels to calculate an equal dose in humans.

Step Three: Exposure Assessment

People can be exposed to pesticides in three ways:

1. Inhaling pesticides (inhalation exposure),
2. Absorbing pesticides through the skin (dermal exposure), and
3. Getting pesticides in their mouth or digestive tract (oral exposure).

Depending on the situation, pesticides could enter the body by any one or all of these routes. Typical sources of pesticide exposure include:

- **Food**
  Most of the foods we eat have been grown with the use of pesticides. Therefore, pesticide residues may be present inside or on the surfaces of these foods.
- **Home and Personal Use Pesticides**
  You might use pesticides in and around your home to control insects, weeds, mold, mildew, bacteria, lawn and garden pests and to protect your pets from pests such as fleas. Pesticides may also be used as insect repellants which are directly applied to the skin or clothing.
- **Pesticides in Drinking Water**
  Some pesticides that are applied to farmland or other land structures can make their way in small amounts to the ground water or surface water systems that feed drinking water supplies.
- **Worker Exposure to Pesticides**
  Pesticide applicators, vegetable and fruit pickers and others who work around pesticides can be exposed due to the nature of their jobs. To address the unique risks workers face from occupational exposure, EPA evaluates occupational exposure through a separate program. All pesticides registered by EPA have been shown to be safe when used properly.

Step Four: Risk Characterization

Risk characterization is the final step in assessing human health risks from pesticides. It is the process of combining the hazard, dose-response and exposure assessments to describe the overall risk from a pesticide. It explains the assumptions used in assessing exposure as well as the uncertainties that are built into the dose-response assessment. The strength of the overall database is considered, and broad conclusions are made. EPA’s role is to evaluate both toxicity and exposure and to determine the risk associated with use of the pesticide.

Simply put,

> RISK = TOXICITY x EXPOSURE.

This means that the risk to human health from pesticide exposure depends on both the toxicity of the pesticide and the likelihood of people coming into contact with it. At least *some* exposure and *some* toxicity are required to result in a risk. For example, if the pesticide is very poisonous, but no people are exposed, there is no risk. Likewise, if there is ample exposure but the chemical is non-toxic, there is no risk. However, usually when pesticides are used, there is some toxicity and exposure, which results in a potential risk.

EPA recognizes that effects vary between animals of different species and from person to person. To account for this variability, *uncertainty factors* are built into the risk assessment. These uncertainty factors create an additional margin of safety for protecting people who may be exposed to the pesticides. FQPA requires EPA to use an extra 10-fold safety factor, if necessary, to protect infants and children from effects of the pesticide.

Types of Toxicity Tests EPA Requires for Human Health Risk Assessments

EPA evaluates studies conducted over different periods of time and that measure specific types of effects. These tests are evaluated to screen for potential health effects in infants, children and adults.

Acute Testing: Short-term exposure; a single exposure (dose).

- Oral, dermal (skin), and inhalation exposure
- Eye irritation
- Skin irritation
- Skin sensitization
- Neurotoxicity

Sub-chronic Testing: Intermediate exposure; repeated exposure over a longer period of time (i.e., 30-90 days).

- Oral, dermal (skin), and inhalation
- Neurotoxicity (nerve system damage)

Chronic Toxicity Testing: Long-term exposure; repeated exposure lasting for most of the test animal's life span. Intended to determine the effects of a pesticide after prolonged and repeated exposures.

- Chronic effects (non-cancer)
- Carcinogenicity (cancer)

Developmental and Reproductive Testing: Identify effects in the fetus of an exposed pregnant female (birth defects) and how pesticide exposure affects the ability of a test animal to successfully reproduce.

Mutagenicity Testing: Assess a pesticide's potential to affect the cell's genetic components.

Hormone Disruption: Measure effects for their potential to disrupt the endocrine system. The endocrine system consists of a set of glands and the hormones they produce that help guide the development, growth, reproduction, and behavior of animals including humans.

Risk Management

Once EPA completes the risk assessment process for a pesticide, we use this information to determine if (when used according to label directions), there is a reasonable certainty that the pesticide will not harm a person’s health.

Using the conclusions of a risk assessment, EPA can then make a more informed decision regarding whether to approve a pesticide chemical or use, as proposed, or whether additional protective measures are necessary to limit occupational or non-occupational exposure to a pesticide. For example, EPA may prohibit a pesticide from being used on certain crops because consuming too much food treated with the pesticide may result in an unacceptable risk to consumers. Another example of protective measures is requiring workers to wear personal protective equipment (PPE) such as a respirator or chemical resistant gloves, or not allowing workers to enter treated crop fields until a specific period of time has passed.

If, after considering all appropriate risk reduction measures, the pesticide still does not meet EPA's safety standard, the Agency will not allow the proposed chemical or use. Regardless of the specific measures enforced, EPA's primary goal is to ensure that legal uses of the pesticide are protective of human health, especially the health of children, and the environment.

Human Health Risk Assessment and the Law

Federal law requires detailed evaluation of pesticides to protect human health and the environment. In 1996, Congress made significant changes to strengthen pesticide laws through the Food Quality Protection Act (FQPA). Many of these changes are key elements of the current risk assessment process. FQPA required that EPA consider:

- **A New Safety Standard**: FQPA strengthened the safety standard that pesticides must meet before being approved for use. EPA must ensure with a reasonable certainty that no harm will result from the legal uses of the pesticide.
- **Exposure from All Sources**: In evaluating a pesticide, EPA must estimate the combined risk from that pesticide from all non-occupational sources, such as:
  - Food Sources
  - Drinking Water Sources
  - Residential Sources
- **Cumulative Risk**: EPA is required to evaluate pesticides in light of similar toxic effects that different pesticides may share, or "a common mechanism of toxicity." Read about how EPA evaluates cumulative risk for pesticides.
- **Special Sensitivity of Children to Pesticides**: EPA must ascertain whether there is an increased susceptibility from exposure to the pesticide to infants and children. EPA must build an additional 10-fold safety factor into risk assessments to ensure the protection of infants and children, unless it is determined that a lesser margin of safety will be safe for infants and children.

For More Information

If you would like more information about EPA's pesticide programs, contact the Communication Service Branch at (703) 305-5017 or visit the Pesticides Web site.

For more information on specific pesticides, or to inquire about the symptoms of pesticide poisoning, call the National Pesticide Information Center (NPIC), a toll-free hotline information at: 1-800-858-7378, or visit their Web site EXIT Disclaimer .

Español (https://www.atsdr.cdc.gov/es/index.html)

(https://atsdr.cdc.gov)

ATSDR Agency for Toxic Substances and Disease Registry

Substance Priority List

ATSDR's Substance Priority List

What is the Substance Priority List (SPL)?

2017 Substance Priority List

Click here to view the ATSDR 2017 Substance Priority List

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) section 104 (i), as amended by the Superfund Amendments and Reauthorization Act (SARA), requires ATSDR and the EPA to prepare a list, in order of priority, of substances that are most commonly found at facilities on the National Priorities List (NPL) and which are determined to pose the most significant potential threat to human health due to their known or suspected toxicity and potential for human exposure at these NPL sites. CERCLA also requires this list to be revised periodically to reflect additional information on hazardous substances. In CERCLA, it is called the priority list of hazardous substances that will be candidates for toxicological profiles.
This substance priority list is revised and published on a 2-year basis, with a yearly informal review and revision. (No list was published in 2009 while ATSDR transitioned to a new agency science database.) Each substance on the list is a candidate to become the subject of a toxicological profile prepared by ATSDR. The listing algorithm prioritizes substances based on frequency of occurrence at NPL sites, toxicity, and potential for human exposure to the substances found at NPL sites.

It should be noted that this priority list is not a list of "most toxic" substances, but rather a prioritization of substances based on a combination of their frequency, toxicity, and potential for human exposure at NPL sites.

Thus, it is possible for substances with low toxicity but high NPL frequency of occurrence and exposure to be on this priority list. The objective of this priority list is to rank substances across all NPL hazardous waste sites to provide guidance in selecting which substances will be the subject of toxicological profiles prepared by ATSDR.

Where can I find more information on the Substance Priority List?

Substantial additional information can be found on the SPL Resource page, including:

- Past Substance Priority Lists
- A Support Document describing the algorithm in detail
- A comprehensive SPL spreadsheet with data for all current and past lists, including candidate substances that did not make the top of the list

The ATSDR 2017 Substance Priority List

Hide/Show Table

2017 Rank	Substance Name	Total Points	CAS RN
1	ARSENIC	1674	7440-38-2
2	LEAD	1531	7439-92-1
3	MERCURY	1458	7439-97-6
4	VINYL CHLORIDE	1358	75-01-4
5	POLYCHLORINATED BIPHENYLS	1345	1336-36-3
6	BENZENE	1329	71-43-2
7	CADMIUM	1320	7440-43-9
8	BENZO(A)PYRENE	1306	50-32-8
9	POLYCYCLIC AROMATIC HYDROCARBONS	1279	130498-29-2
10	BENZO(B)FLUORANTHENE	1251	205-99-2
11	CHLOROFORM	1203	67-66-3
12	AROCLOR 1260	1191	11096-82-5
13	DDT, P,P'-	1183	50-29-3
14	AROCLOR 1254	1172	11097-69-1
15	DIBENZO(A,H)ANTHRACENE	1156	53-70-3
16	TRICHLOROETHYLENE	1155	79-01-6
17	CHROMIUM, HEXAVALENT	1148	18540-29-9
18	DIELDRIN	1144	60-57-1
19	PHOSPHORUS, WHITE	1141	7723-14-0
20	HEXACHLOROBUTADIENE	1130	87-68-3
21	DDE, P,P'-	1127	72-55-9
22	CHLORDANE	1126	57-74-9
23	AROCLOR 1242	1126	53469-21-9
24	COAL TAR CREOSOTE	1124	8001-58-9
25	ALDRIN	1116	309-00-2
26	DDD, P,P'-	1114	72-54-8
27	AROCLOR 1248	1105	12672-29-6
28	HEPTACHLOR	1102	76-44-8
29	AROCLOR	1101	12767-79-2

30	BENZIDINE	1093	92-87-5
31	ACROLEIN	1090	107-02-8
32	TOXAPHENE	1089	8001-35-2
33	TETRACHLOROETHYLENE	1078	127-18-4
34	HEXACHLOROCYCLOHEXANE, GAMMA-	1076	58-89-9
35	CYANIDE	1071	57-12-5
36	HEXACHLOROCYCLOHEXANE, BETA-	1054	319-85-7
37	DISULFOTON	1049	298-04-4
38	BENZO(A)ANTHRACENE	1047	56-55-3
39	1,2-DIBROMOETHANE	1043	106-93-4
40	ENDRIN	1039	72-20-8
41	DIAZINON	1038	333-41-5
42	HEXACHLOROCYCLOHEXANE, DELTA-	1036	319-86-8
43	BERYLLIUM	1031	7440-41-7
44	ENDOSULFAN	1029	115-29-7
45	AROCLOR 1221	1028	11104-28-2
46	1,2-DIBROMO-3-CHLOROPROPANE	1027	96-12-8
47	HEPTACHLOR EPOXIDE	1022	1024-57-3
48	ENDOSULFAN, ALPHA	1019	959-98-8
49	CIS-CHLORDANE	1017	5103-71-9
50	CARBON TETRACHLORIDE	1014	56-23-5
51	COBALT	1013	7440-48-4
52	AROCLOR 1016	1012	12674-11-2
53	DDT, O,P'-	1009	789-02-6
54	PENTACHLOROPHENOL	1008	87-86-5
55	METHOXYCHLOR	1007	72-43-5
56	ENDOSULFAN SULFATE	1005	1031-07-8
57	NICKEL	996	7440-02-0
58	DI-N-BUTYL PHTHALATE	995	84-74-2
59	ENDRIN KETONE	993	53494-70-5

60	DIBROMOCHLOROPROPANE	984	67708-83-2
61	BENZO(K)FLUORANTHENE	970	207-08-9
62	TRANS-CHLORDANE	969	5103-74-2
63	ENDOSULFAN, BETA	968	33213-65-9
64	CHLORPYRIFOS	965	2921-88-2
65	XYLENES, TOTAL	964	1330-20-7
66	CHROMIUM(VI) TRIOXIDE	961	1333-82-0
67	AROCLOR 1232	959	11141-16-5
68	ENDRIN ALDEHYDE	959	7421-93-4
69	METHANE	952	74-82-8
70	3,3′-DICHLOROBENZIDINE	942	91-94-1
71	2-HEXANONE	941	591-78-6
72	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	941	1746-01-6
73	BENZOFLUORANTHENE	937	56832-73-6
74	TOLUENE	917	108-88-3
75	ZINC	915	7440-66-6
76	PENTACHLOROBENZENE	907	608-93-5
77	DI(2-ETHYLHEXYL)PHTHALATE	906	117-81-7
78	CHROMIUM	895	7440-47-3
79	AROCLOR 1240	889	71328-89-7
80	2,4,6-TRINITROTOLUENE	879	118-96-7
81	NAPHTHALENE	877	91-20-3
82	1,1-DICHLOROETHENE	876	75-35-4
83	BROMODICHLOROETHANE	868	683-53-4
84	DDD, O,P'-	867	53-19-0
85	2,4,6-TRICHLOROPHENOL	867	88-06-2
86	BIS(2-CHLOROETHYL) ETHER	867	111-44-4
87	HYDRAZINE	862	302-01-2
88	METHYLENE CHLORIDE	860	75-09-2
89	2,4-DINITROPHENOL	859	51-28-5

90	4,4′-METHYLENEBIS(2-CHLOROANILINE)	859	101-14-4
91	1,2-DICHLOROETHANE	852	107-06-2
92	THIOCYANATE	847	302-04-5
93	HEXACHLOROBENZENE	844	118-74-1
94	ASBESTOS	841	1332-21-4
95	RDX (Cyclonite)	833	121-82-4
96	RADIUM-226	833	13982-63-3
97	URANIUM	832	7440-61-1
98	2,4-DINITROTOLUENE	832	121-14-2
99	ETHION	831	563-12-2
100	4,6-DINITRO-O-CRESOL	828	534-52-1
101	RADIUM	827	7440-14-4
102	THORIUM	824	7440-29-1
103	DIMETHYLARSINIC ACID	822	75-60-5
104	CHLORINE	821	7782-50-5
105	1,3,5-TRINITROBENZENE	820	99-35-4
106	RADON	818	10043-92-2
107	HEXACHLOROCYCLOHEXANE, ALPHA-	817	319-84-6
108	RADIUM-228	815	15262-20-1
109	THORIUM-230	813	14269-63-7
110	URANIUM-235	812	15117-96-1
111	THORIUM-228	810	14274-82-9
112	RADON-222	810	14859-67-7
113	URANIUM-234	809	13966-29-5
114	N-NITROSODI-N-PROPYLAMINE	808	621-64-7
115	COAL TARS	808	8007-45-2
116	METHYLMERCURY	808	22967-92-6
117	1,1,1-TRICHLOROETHANE	807	71-55-6
118	COPPER	807	7440-50-8
119	CHRYSOTILE ASBESTOS	806	12001-29-5

120	PLUTONIUM-239	806	15117-48-3
121	POLONIUM-210	805	13981-52-7
122	PLUTONIUM-238	805	13981-16-3
123	LEAD-210	805	14255-04-0
124	AMOSITE ASBESTOS	804	12172-73-5
124	PLUTONIUM	804	7440-07-5
124	STRONTIUM-90	804	10098-97-2
127	RADON-220	804	22481-48-7
128	CHLOROBENZENE	804	108-90-7
129	AMERICIUM-241	804	86954-36-1
130	HYDROGEN CYANIDE	803	74-90-8
131	AZINPHOS-METHYL	803	86-50-0
132	ETHYLBENZENE	802	100-41-4
133	CHLORDECONE	802	143-50-0
134	BARIUM	802	7440-39-3
135	NEPTUNIUM-237	802	13994-20-2
136	PLUTONIUM-240	801	14119-33-6
137	1,2,3-TRICHLOROBENZENE	801	87-61-6
138	FLUORANTHENE	800	206-44-0
139	S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	799	78-48-8
140	MANGANESE	798	7439-96-5
141	CHRYSENE	792	218-01-9
142	2,4,5-TRICHLOROPHENOL	792	95-95-4
143	PERFLUOROOCTANE SULFONIC ACID	788	1763-23-1
144	POLYBROMINATED BIPHENYLS	785	67774-32-7
145	DICOFOL	785	115-32-2
146	SELENIUM	776	7782-49-2
147	1,1,2,2-TETRACHLOROETHANE	776	79-34-5
148	PARATHION	774	56-38-2
149	HEPTACHLORODIBENZO-P-DIOXIN	774	37871-00-4

150	HEXACHLOROCYCLOHEXANE, TECHNICAL GRADE	774	608-73-1
151	TRICHLOROFLUOROETHANE	773	27154-33-2
152	BROMINE	771	7726-95-6
153	AROCLOR 1268	765	11100-14-4
154	1,3-BUTADIENE	762	106-99-0
155	PERFLUOROOCTANOIC ACID	758	335-67-1
156	HEPTACHLORODIBENZOFURAN	756	38998-75-3
157	TRIFLURALIN	755	1582-09-8
158	PERFLUOROHEXANESULFONIC ACID	749	355-46-4
159	1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN	743	39001-02-0
160	AMMONIA	742	7664-41-7
161	2-METHYLNAPHTHALENE	727	91-57-6
162	2,3,4,7,8-PENTACHLORODIBENZOFURAN	724	57117-31-4
163	1,4-DICHLOROBENZENE	724	106-46-7
164	1,1-DICHLOROETHANE	721	75-34-3
165	NALED	721	300-76-5
166	1,1,2-TRICHLOROETHANE	720	79-00-5
167	HEXACHLOROCYCLOPENTADIENE	719	77-47-4
168	1,2-DIPHENYLHYDRAZINE	718	122-66-7
169	PHORATE	716	298-02-2
170	TRICHLOROETHANE	713	25323-89-1
171	ACENAPHTHENE	710	83-32-9
172	TETRACHLOROBIPHENYL	710	26914-33-0
173	PALLADIUM	706	7440-05-3
174	OXYCHLORDANE	705	27304-13-8
175	CRESOL, PARA-	704	106-44-5
176	INDENO(1,2,3-CD)PYRENE	702	193-39-5
177	GAMMA-CHLORDENE	702	56641-38-4
178	TETRACHLOROPHENOL	699	25167-83-3
179	1,2-DICHLOROBENZENE	697	95-50-1

180	1,2-DICHLOROETHENE, TRANS-	691	156-60-5
181	CHLOROETHANE	687	75-00-3
182	P-XYLENE	687	106-42-3
183	ALUMINUM	687	7429-90-5
184	PHENOL	686	108-95-2
185	CARBON MONOXIDE	684	630-08-0
186	CARBON DISULFIDE	682	75-15-0
187	2,4-DIMETHYLPHENOL	680	105-67-9
188	DIBENZOFURAN	676	132-64-9
189	ACETONE	672	67-64-1
190	HEXACHLOROETHANE	671	67-72-1
191	BUTYL METHYL PHTHALATE	668	34006-76-3
192	CHLOROMETHANE	665	74-87-3
193	HEXACHLORODIBENZOFURAN	660	55684-94-1
194	BUTYL BENZYL PHTHALATE	658	85-68-7
195	HYDROGEN SULFIDE	658	7783-06-4
196	DICHLORVOS	656	62-73-7
197	DIBENZOFURANS, CHLORINATED	653	42934-53-2
198	CRESOL, ORTHO-	653	95-48-7
199	HEXACHLORODIBENZO-P-DIOXIN	652	34465-46-8
200	VANADIUM	650	7440-62-2
201	N-NITROSODIMETHYLAMINE	649	62-75-9
202	1,2,4-TRICHLOROBENZENE	647	120-82-1
203	PERFLUORONONANOIC ACID	647	375-95-1
204	ETHOPROP	644	13194-48-4
205	TETRACHLORODIBENZO-P-DIOXIN	641	41903-57-5
206	BROMOFORM	635	75-25-2
207	PENTACHLORODIBENZOFURAN	632	30402-15-4
208	1,3-DICHLOROBENZENE	628	541-73-1
209	PENTACHLORODIBENZO-P-DIOXIN	626	36088-22-9

210	N-NITROSODIPHENYLAMINE	625	86-30-6
211	2,4-DICHLOROPHENOL	619	120-83-2
212	2,3-DIMETHYLNAPHTHALENE	619	581-40-8
213	2,3,7,8-TETRACHLORODIBENZOFURAN	619	51207-31-9
214	1,4-DIOXANE	617	123-91-1
215	FLUORINE	613	7782-41-4
216	NITRITE	610	14797-65-0
217	CESIUM-137	610	10045-97-3
217	CHROMIC ACID	610	7738-94-5
219	2-BUTANONE	608	78-93-3
220	1,2-DICHLOROETHYLENE	608	540-59-0
221	POTASSIUM-40	608	13966-00-2
222	DINITROTOLUENE	607	25321-14-6
223	NITRATE	606	14797-55-8
224	FORMALDEHYDE	605	50-00-0
225	SILVER	605	7440-22-4
226	COAL TAR PITCH	605	65996-93-2
227	THORIUM-227	605	15623-47-9
228	ARSENIC ACID	604	7778-39-4
229	ARSENIC TRIOXIDE	604	1327-53-3
230	BENZOPYRENE	603	73467-76-2
231	CHLORDANE, TECHNICAL	602	12789-03-6
232	STROBANE	602	8001-50-1
233	4-AMINOBIPHENYL	602	92-67-1
233	PYRETHRUM	602	8003-34-7
235	ARSINE	602	7784-42-1
235	DIMETHOATE	602	60-51-5
237	BIS(CHLOROMETHYL) ETHER	602	542-88-1
237	CARBOPHENOTHION	602	786-19-6
239	ALPHA-CHLORDENE	601	56534-02-2

239	IODINE-131	601	10043-66-0
239	MERCURIC CHLORIDE	601	7487-94-7
239	SODIUM ARSENITE	601	7784-46-5
239	URANIUM-233	601	13968-55-3
244	ANTIMONY	601	7440-36-0
245	DIBROMOCHLOROMETHANE	601	124-48-1
246	CRESOLS	598	1319-77-3
247	DICHLOROBENZENE	596	25321-22-6
248	2,4-D	595	94-75-7
249	2-CHLOROPHENOL	591	95-57-8
250	BUTYLATE	591	2008-41-5
251	DIMETHYL FORMAMIDE	585	68-12-2
252	PHENANTHRENE	585	85-01-8
253	4-NITROPHENOL	580	100-02-7
254	DIURON	580	330-54-1
255	TETRACHLOROETHANE	577	25322-20-7
256	DICHLOROETHANE	568	1300-21-6
257	ETHYL ETHER	566	60-29-7
258	DIMETHYLANILINE	563	121-69-7
259	1,3-DICHLOROPROPENE, CIS-	561	10061-01-5
260	PYRENE	561	129-00-0
261	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	559	35822-46-9
262	PHOSPHINE	557	7803-51-2
263	TRICHLOROBENZENE	556	12002-48-1
264	2,6-DINITROTOLUENE	555	606-20-2
265	FLUORIDE ION	550	16984-48-8
266	PENTAERYTHRITOL TETRANITRATE	549	78-11-5
267	1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	549	67562-39-4
268	1,3-DICHLOROPROPENE, TRANS-	548	10061-02-6
269	ACRYLONITRILE	544	107-13-1

270	BIS(2-ETHYLHEXYL)ADIPATE	543	103-23-1
271	CARBAZOLE	541	86-74-8
272	2-CHLOROANILINE	539	95-51-2
273	METOLACHLOR	539	51218-45-2
274	1,2-DICHLOROETHENE, CIS-	539	156-59-2
275	1,2,3-TRICHLOROPROPANE	537	96-18-4

Substances were assigned the same rank when two (or more) substances received equivalent total point scores.

CAS RN= Chemical Abstracts Service Registry Number

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Contact Information

Further information can be obtained by contacting the ATSDR Information Center at:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences
1600 Clifton Road NE, Mailstop F-57
Atlanta, GA 30329
Phone: 1-800-CDC-INFO 888-232-6348 (TTY)
Email: Contact CDC-INFO (https://www.cdc.gov/cdc-info/requestform.html)

Page last reviewed: August 10, 2017

Appendix 7
Community Air Monitoring Plan

COMMUNITY AIR MONITORING PLAN (CAMP)

77-57 Vleigh Place
77-39/63 Vleigh Place a.k.a. 141-15 78th Avenue
Queens, New York
NYSDEC Site Number: C241168

1- Introduction

The Community Air Monitoring Plan (CAMP) has been prepared in accordance with the New York State Department of Health (NYSDOH) Generic CAMP to monitor the air quality during the intrusive activities that may be performed as part of a Site Management Plan (SMP) following closure of remedial activities at the property located at 77-57 Vleigh Place in Queens, New York. Levels of VOCs and dust in the air will be monitored continuously and periodically utilizing a Photo Ionization Detector (PID) and Real-Time Particulate Dust Tracker, respectively. For this investigation, the PID will be calibrated at the beginning of each day to the compound isobutylene, which is published by the manufacturer. The PID has a minimum detection limit of 0.1 parts per million (ppm). The Dust Tracker provides real-time measurement based on 90° light scattering. The Dust Tracker has a minimum detection limit of 0.001 mg/m^3.

Continuous real-time air monitoring for VOCs and particulate levels at the perimeter of the exclusion zone or work area will be performed for all ground intrusive activities. Ground intrusive activities include, but are not limited to the soil excavation, stockpiling, movement, hauling and disposal.

Periodic monitoring for VOCs will be performed during non-intrusive activities such as the collection of end point samples or groundwater samples. For instance, periodic monitoring during sample collection will consist of taking a reading upon arrival at a sample location and taking a reading prior to leaving a sample location. Depending upon the proximity of potentially exposed individuals, continuous monitoring may be performed during sampling activities. Exceedances of action levels observed during performance of the Community Air Monitoring Plan (CAMP) will be reported to the NYSDEC and recorded in a field daily log. A summary of daily logs/reports will be provided in the Periodic Review Report (PRR).

2- VOCs Monitoring, Response Levels And Actions

VOCs will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis during invasive work. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using a PID, which will be calibrated at least daily for to the compound isobutylene. The PID will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.

If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200-feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20-feet - is below 5 ppm over background for the 15-minute average.

Activities will be shut down if the organic vapor level at the perimeter of the work area is above 25 ppm.

All 15-minute readings must be recorded in a daily field log. Instantaneous readings, if any, used for decision purposes will also be recorded.

3- PM Monitoring, Response Levels And Actions

Particulate concentrations will be monitored continuously at the downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring will be performed using a Dust Tracker real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment will be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels are not 150 mcg/m^3 or greater above the upwind level and provided that no visible dust is migrating from the work area.

If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are 150 mcg/m^3 or greater above the upwind level, work will be stopped and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration. All readings will be recorded in a daily field log.

Appendix 8
SVE O&M Manual

SVE OPERATION AND MAINTENANCE PLAN

1.0 INTRODUCTION

This Operation and Maintenance Plan describes the measures necessary to operate, monitor and maintain the mechanical components of the SVE system installed at the Site (interim installation and final installation). This Operation and Maintenance Plan:

- Includes the steps necessary to allow individuals unfamiliar with the site to operate and maintain the SVE system;
- Includes an operation and maintenance contingency plan; and,
- Will be updated periodically to reflect changes in site conditions or the manner in which the SVE system are operated and maintained.

A copy of this Operation and Maintenance Plan, along with the complete SMP, will be kept at the site. This Operation and Maintenance Plan is not to be used as a stand-alone document, but as a component document of the SMP.

1.1 SVE System Scope

The SVE at the Site will operate 24/7 with no maintenance requirements. Periodic inspections will be performed to assure that the system is continuing to operate properly.

1.2 System Start-Up and Testing

Prior to system start-up, the SVE system will be tested for operational integrity and verify the presence of potential pipe vacuum leaks using a smoke pen. The system will then be started with 100% applied vacuum to maximize the flow from SVE sub-slab piping. System parameters including airflow, vacuum and organic vapor concentrations at the effluent will be monitored following start-up. Organic vapor concentrations will be measured with the PID at the effluent. System monitoring will be conducted during the first three days of operation as

follows: hourly for 5 consecutive hours on the first day and once on the second and third days. If system operating parameters are steady for three consecutive days after start-up, an additional monitoring event will be performed 30 days and 45 days after start-up along with a monitoring of the effectiveness of the GAC tanks.

A quantitative SVE system post-start-up diagnostic testing exercise will be performed to verify the zone of influence exercised by the suction blower and the vacuum communication at the pressure test points. For the final SVE system, this test will be conducted at the at six (6) on-site and off-site vacuum monitoring points designated as PT-1 to PT-6. For the interim system, the test will be performed at the two off-site vacuum monitoring points designated as PT-1, PT-2 and PT-7 and three soil vapor probes designated SV-8, SB-9 and SV-KG-1.

1.3 Routine SVE System Operation and Maintenance

The SVE blower system, has a number of parts that will require routine maintenance. Key parts of the SVE blower include motor, switches, gauges and sensor. Maintenance will be performed on the SVE system blower as needed.

In the event that the SVE blower unit fails, the blower will be repaired or replaced and documented in the Periodic Review Report. VP Capital Holding LLC or the new building's owner or new building superintendent will monitor any sudden changes in the system operation and immediately notify a qualified professional. A logbook will be set up to confirm on-going oversight of the SVE system.

SVE system maintenance will be performed in accordance with the manufacturer's recommendations. A qualified professional will be responsible for submitting all manufacturers' product data, manuals, and drawings related to the SVE components including the blower, switches, alarm and pressure gauges to VP Capital Holding LLC or the new building's owner or new building superintendent. Copies of these materials are attached to this Plan and will maintained on-site and available for reference in the event of troubleshooting, adjustments or repairs as necessary.

Following the balance of the SVE, all gauges and flow element settings will be recorded for future comparison purposes if the system is malfunctioning. The manufacturer's recommendations regarding operation of the blower will be followed.

1.4 Non-Routine SVE System Operation and Maintenance

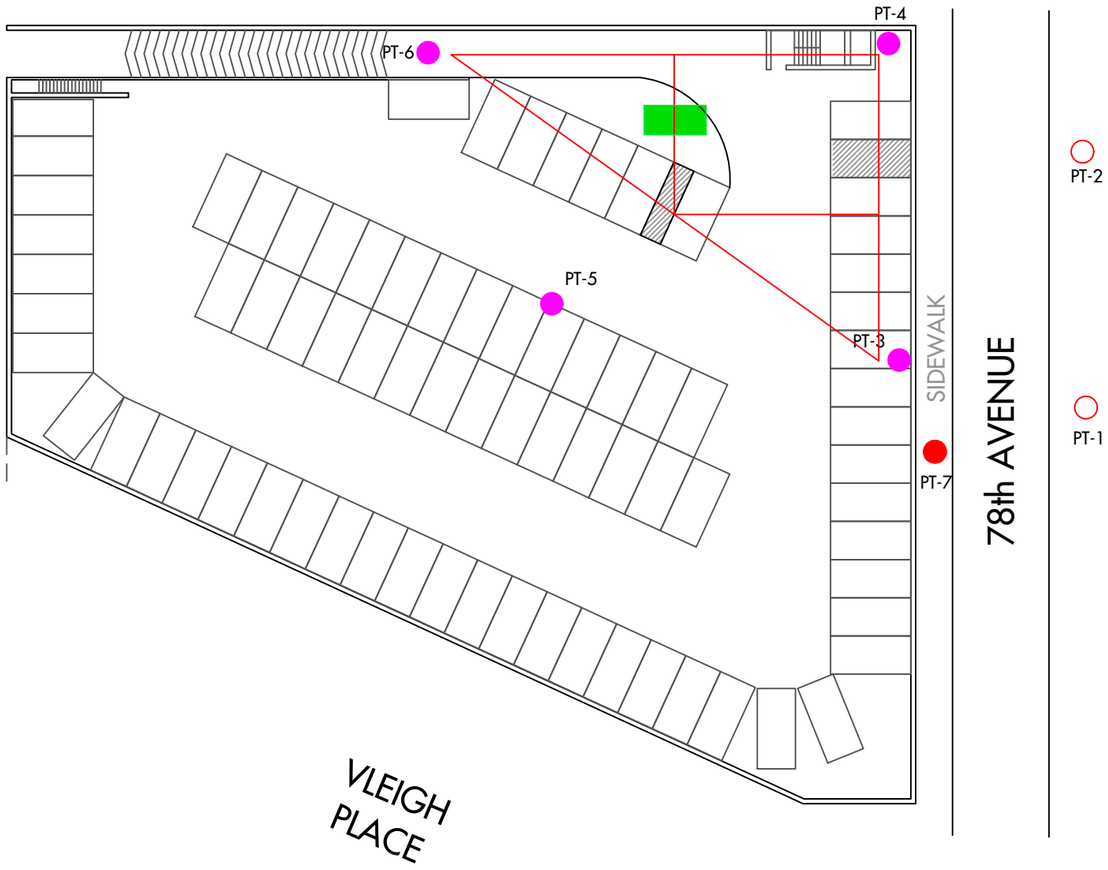
Non-routine maintenance may also be required during the operation of the SVE system including the following situations:

- The general construction contractor, or VP Capital Holdings, or the new building's owner, building superintendent or occupants report that the alarm installed as part of SVE system assembly sounds-off as an indication of vacuum loss or the system is not operating properly;
- The system becomes damaged; and/or;
- The building undergoes renovations that may reduce the effectiveness of the system.

Upon notifying the qualified professional of the problem, a determination for repairs or parts replacements will be made as required in accordance with the component manuals.

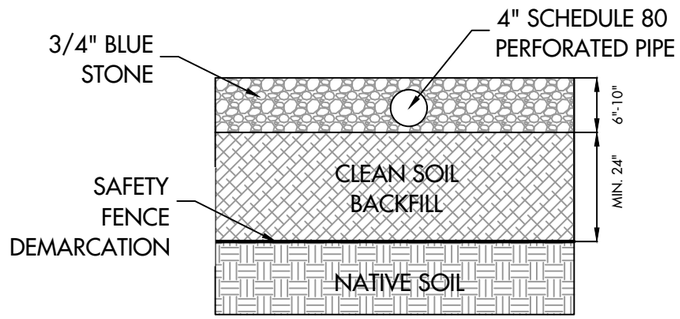
Activities conducted during non-routine maintenance visits will vary depending upon the reason for the SVE system. NYSDEC will be informed of any failure of the SVE System within 48-hours. Repairs or adjustments will be made to the system as appropriate and as per manufacturer guidelines within 15 days of the equipment failure, whenever possible (i.e., pending availability of parts).

SVE SYSTEMS DESIGN AND SPECIFICATIONS



LEGEND:

- ○ EXISTING MONITORING POINTS INSTALLED AS PART OF INTERIM SVE SYSTEM - AUGUST 2018
- ● EXISTING MONITORING POINTS INSTALLED AS PART OF INTERIM SVE SYSTEM - OCTOBER 2019
- ● PROPOSED SUB-SLAB MONITORING POINTS
- — PERFORATED 4" SCHEDULE 80 PIPE
- ▬ PROPOSED LOCATION OF SVE EQUIPMENT TRAILER



SECTION DETAILS

NOTES:

1. THE COMPONENTS OF THE SVE SYSTEM WILL BE LOCATED WITHIN A PORTABLE TRAILER AND CAN BE MOVED FOR SITE ACCESS PURPOSES. THE LOCATION AS SHOWN IS APPROXIMATE.

PROPOSED VACUUM MONITORING POINT DETAILS

EACH VACUUM MONITORING POINT <PT> WILL BE CONSTRUCTED USING A SIX-INCH LONG STAINLESS STEEL SCREENED IMPLANT AT THE TERMINAL END AND A LENGTH OF COMPATIBLE SIZED DIAMETER TEFLON-LINED TUBING RUNNING TO A BUTTERFLY OR BALL VALVE AND BARBED CONNECTION AT THE SURFACE. THE FOLLOWING CONSTRUCTION DETAILS WILL BE FOLLOWED.

1. THE STAINLESS STEEL SCREENED IMPLANTS WILL BE INSTALLED 3 INCHES SUB-SLAB BENEATH THE NEW BUILDING AND AT 5 FEET BGS BENEATH THE SIDEWALK
2. THE ANNULAR SPACE SURROUNDING BOTH STAINLESS STEEL SCREENED IMPLANTS WILL BE FILLED WITH CLEAN #2 SAND TO 1' ABOVE THE TOP OF THE SCREEN
3. BENTONITE CHIPS FOLLOWED BY CONCRETE TO GRADE WILL BE USED TO SEAL EACH VMP LOCATION TO ENSURE NO AMBIENT AIR INTERFERENCES
4. EACH TUBING PROBE WILL BE CAPPED WITH A BUTTERFLY OR BALL VALVE AND BARBED CONNECTION FOR VOC TESTING VIA A PHOTOIONIZATION DETECTOR
5. A PROTECTIVE FLUSH MOUNTED COVER WILL BE PROVIDED FOR EACH PROBE AT THE SURFACE

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

77-57 VLEIGH PLACE
QUEENS, NY 11367

PROJECT FIGURE

PROPOSED SVE SYSTEM BENEATH NEW BUILDING SLAB

PROJECT NO.	DATE
180120	10/29/2019
DRAWN BY: G.T.	REVIEWED BY: P.M.
SCALE (11X17): NOT TO SCALE	APPROVED BY: P.M.

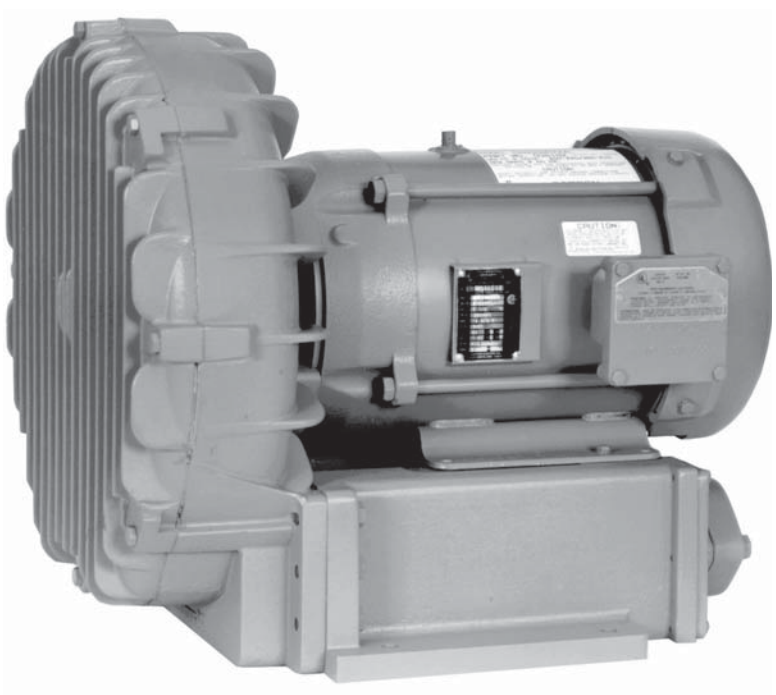
EN 707 & CP 707 Three-Phase Sealed Regenerative Blower w/Explosion-Proof Motor

FEATURES
- Manufactured in the USA – ISO 9001 compliant
- Maximum flow: 295 SCFM
- Maximum pressure: 85 IWG
- Maximum vacuum: 87 IWG
- Standard motor: 5.0 HP, explosion-proof
- Cast aluminum blower housing, cover, impeller & manifold; cast iron flanges (threaded); teflon lip seal
- UL & CSA approved motor with permanently sealed ball bearings for explosive gas atmospheres Class I Group D minimum
- Sealed blower assembly
- Quiet operation within OSHA standards

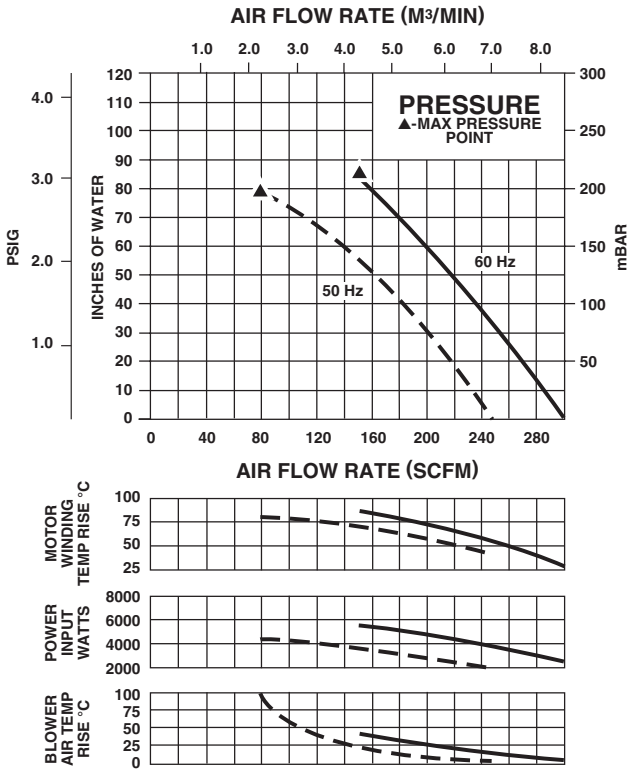
MOTOR OPTIONS
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

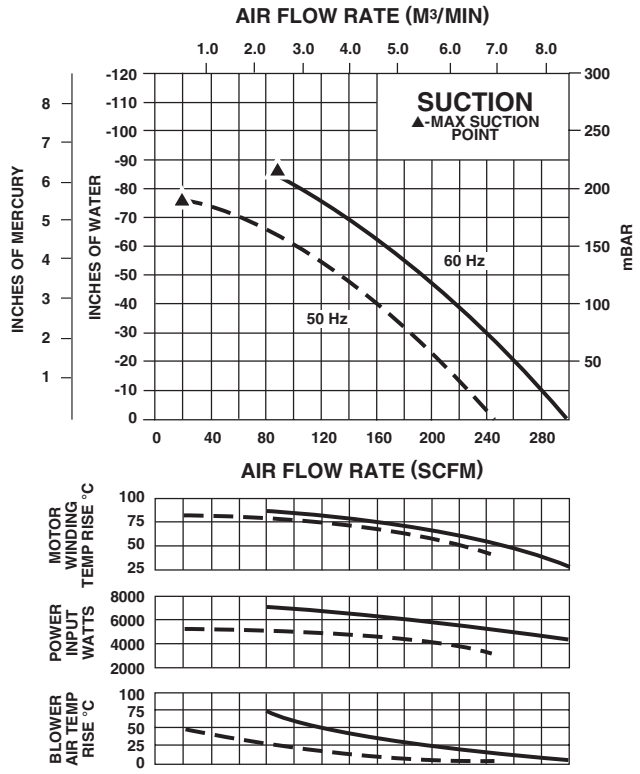
BLOWER OPTIONS
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

ACCESSORIES (See Catalog Accessory Section)
- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges & relief valves
- Switches – air flow, pressure, vacuum or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package



BLOWER PERFORMANCE AT STANDARD CONDITIONS



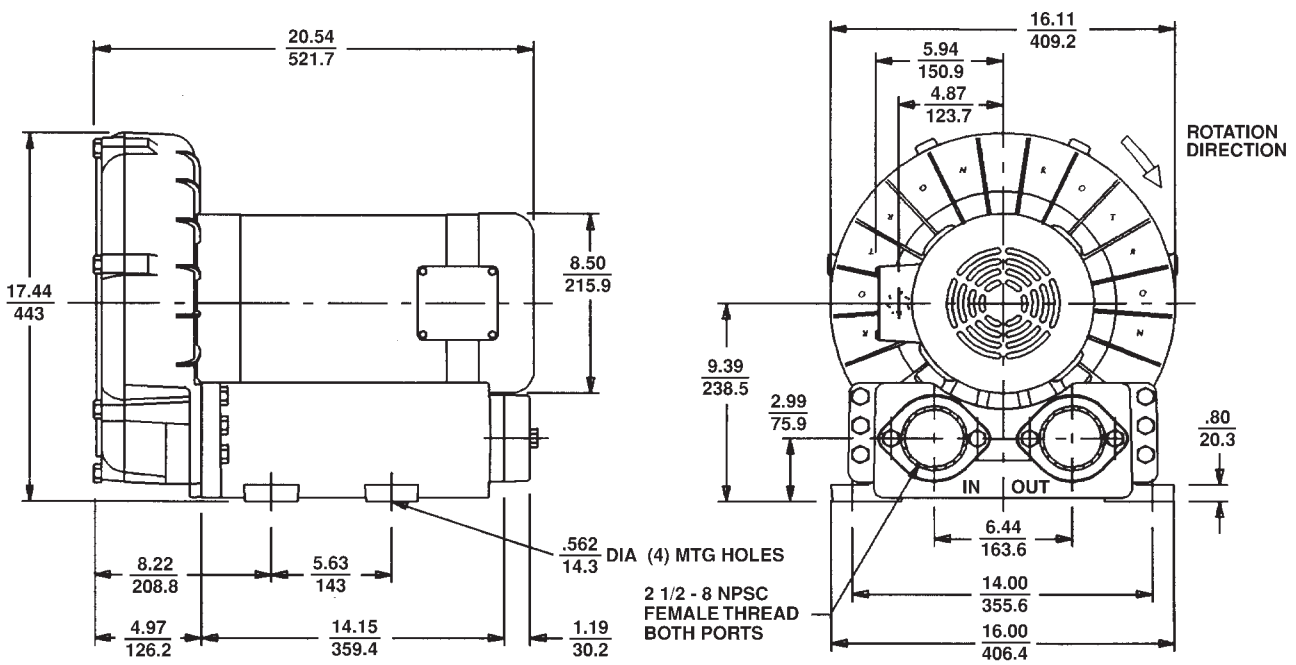


Rev. 2/04

AMETEK Technical and Industrial Products, Kent, OH 44240 • e mail: rotronindustrial@ametek.com • internet: www.ametektmd.com

EN 707 & CP 707 Three-Phase Sealed Regenerative Blower w/Explosion-Proof Motor

Scale CAD drawing available upon request.



DIMENSIONS: IN / MM
TOLERANCES: .XX ± .1 / 2.5
(UNLESS OTHERWISE NOTED)

A 0.75" NPT CONDUIT CONNECTION AT 12 O'CLOCK POSITION

SPECIFICATIONS

MODEL	EN707F72MXL		EN707F86MXL	CP707FW72MXLR
Part No.	038710		038711	038974
Motor Enclosure – Shaft Material	Explosion-proof – **CS**		Explosion-proof – **CS**	Chem XP – **SS**
Horsepower	5.0		5.0	Same as EN707F72MXL – 038710 except add Chemical Processing (CP) features from catalog inside front cover
Phase – Frequency [1]	Three - 60 Hz		Three - 60 Hz	
Voltage [1]	230	460	575	
Motor Nameplate Amps	14	7	5.7	
Max. Blower Amps [3]	15	7.5	6.3	
Inrush Amps	152	76	61	
Starter Size	1	0	0	
Service Factor	1.0		1.0	
Thermal Protection [2]	Class B - Pilot Duty		Class B - Pilot Duty	
XP Motor Class – Group	I-D, II-F&G		I-D, II-F&G	
Shipping Weight	174 lb (79 kg)		174 lb (79 kg)	

[1] Rotron motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

[2] Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

[3] Maximum blower amps corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

Specifications subject to change without notice. Please consult your Local Field Sales Engineer for specification updates.

Rev. 2/04

Granular Activated Carbon (GAC) Information

Granular Activated Carbon (GAC)

Carbonair does not manufacture granular activated carbon (GAC) in house, but has over 25 years of experience in developing techniques that effectively uses granular carbon for water treatment. Carbonair has a large inventory of liquid-phase filter vessels and vapor-phase carbon vessels available for temporary projects. Pre-assembled activated carbon treatment systems on skids and trailers are available for mobility at job sites. Carbonair strictly follows the regulatory guideline for the handling and disposal of the spent carbon. In some cases, the spent GAC can be sent back to reactivation facilities for reactivation and reuse. The applications that Carbonair uses GAC to treat contaminated water and air flows are the following: Liquid Phase Carbon Vessels, Vapor Phase Carbon Vessels.

Questions? Click Here.

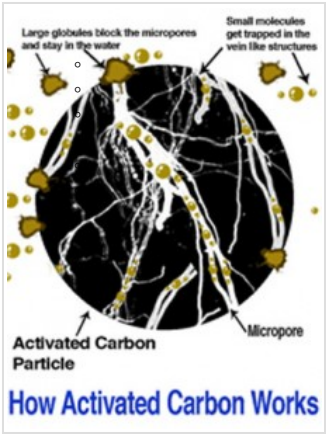
What is Granular Activated Carbon (GAC)?

GAC is basically carbon in a granular form, which is made from raw carbonaceous materials such as coconut shells or coal. In the activation process, heat is used to burn off some of the raw materials and produce microscopic pores which are capable of trapping the molecules of contaminants in water or air – so-called "*adsorption*". The activated carbon is then pulverized and sieved into appropriate and uniform particle sizes. Most of *organic* contaminants can be treated by GAC; however, there are a small portion of organic compounds that cannot be effectively treated.

Those organic compounds are either too small or too large in molecular or globular size. Excessively small organic molecules, such as vinyl chloride, methylene chloride, chloromethane, and chloroethane, etc., can get away from being trapped in the carbon micropores. Oils and greases are present in water as globules, which are too large in size to enter the carbon micropores. Most of *inorganic* compounds such as iron, manganese, sulfate, and nitrate, etc. cannot be treated by granular activated carbon. Those constituents are typically present in water as ionized forms, which are strongly bound to and difficult to separate from water.

Liquid Phase Carbon Vessels for Rent | Vapor Phase Carbon Vessels for Rent

Liquid Phase Carbon Vessels for Sale | Vapor Phase Carbon Vessels for Sale



Typical Applications that Require the Use of GAC

Removal of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs)
Dechlorination (chlorine and chloramines removal)
Total organic carbon (TOC) reduction
Color removal
Taste and odor removal
Reverse osmosis (RO) pre-treatment

Contact Us

Contact a Carbonair Specialist

Full Name *

Email *

Company *

How can we help you?

Phone (555-555-5555)

Submit

Carbonair U.S. Locations

Midwest
Toll Free:
1.800.526.4999

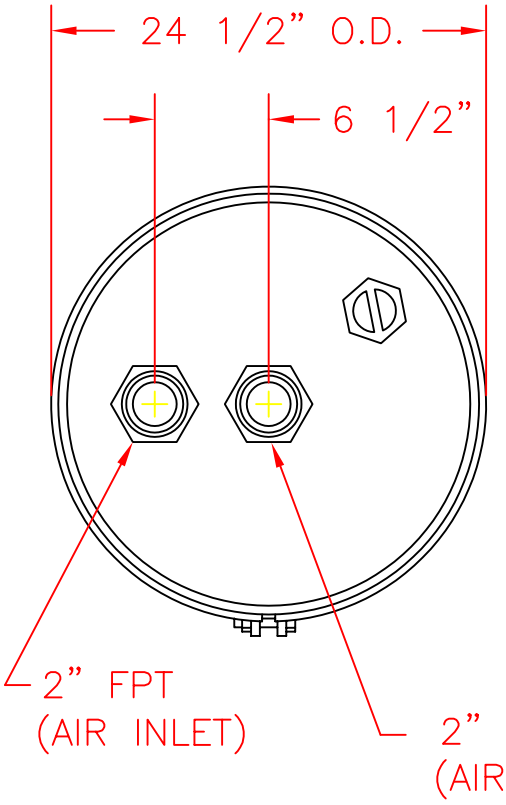
Southeast
Toll Free:
1.800.241.7833

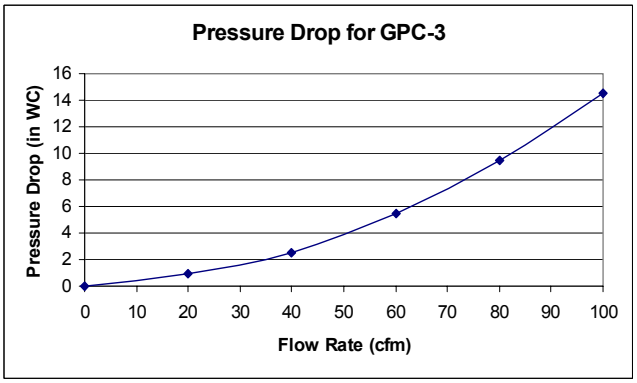
Southwest
Toll Free:
1.800.893.5937

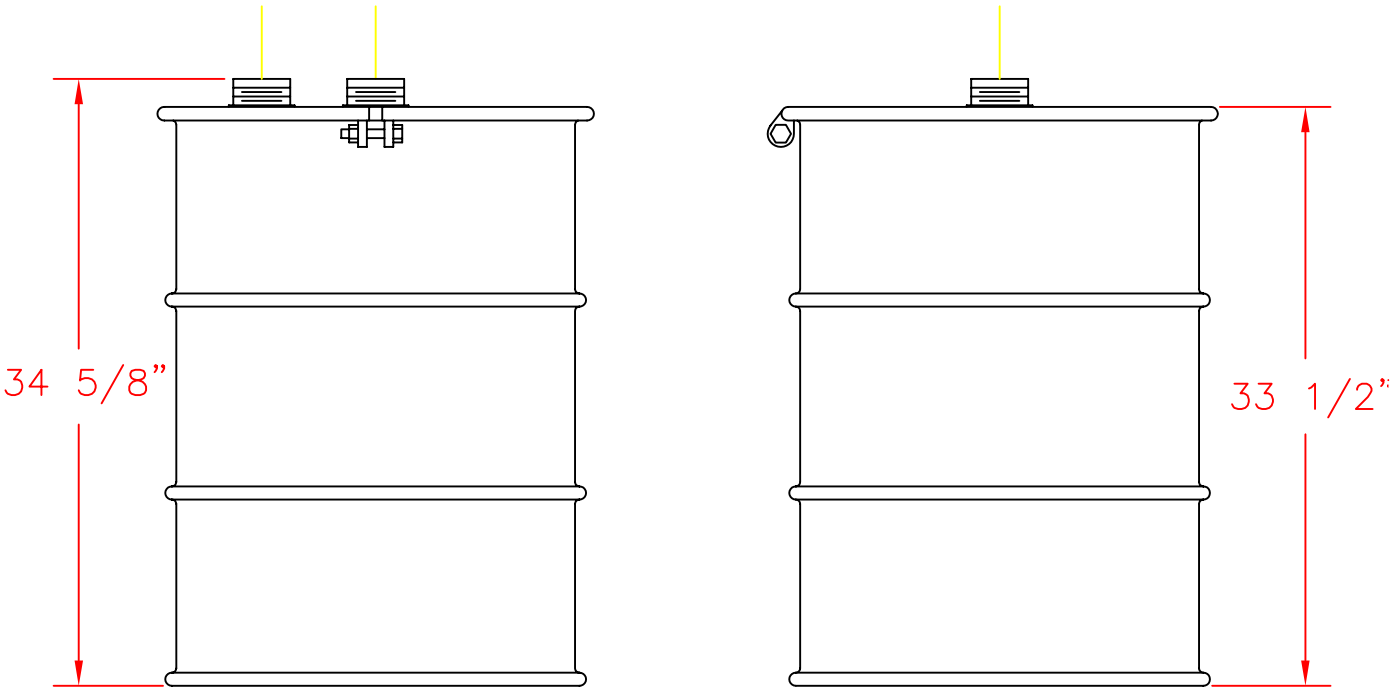
Mid-Atlantic
Toll Free:
1.800.204.0324

Northeast
Toll Free:
1.877.426.1912

Carbon Adsorber–Vapor Phase
GPC 3







Sales Drawing #119776
03/22/05

CARBONAIR

Temporary Water Treatment Services Carbon • Rental • Service

7500 Boone Ave N, Suite 101, Brooklyn Park, MN 55428 Ph: 800-526-4999 Fax: 763-315-4614 www.carbonair.com

Virgin Granular Coal Based Carbon (Vapor Phase)

Carbonair's virgin granular coal based carbon is manufactured from selected grades of bituminous coal which give high adsorption surface area with a broad pore size distribution (micropore, mesopore, and macropore). This adsorbent media is recommended for treating a variety of organic hydrocarbons in molecular size.

Typical Applications

Soil vapor extraction, air stripper off-gas, VOC control, tank vent, and solvent recovery.

Typical Contaminants

Petroleum hydrocarbons such as MTBE, BTEX (benzene, toluene, ethylbenzene, xylenes), butylbenzene, isopropylbenzene, isopropylether, propylbenzene, styrene, trimethylbenzene, tetraethyl lead (TEL), low molecular weight PAHs (polyaromatic hydrocarbons such as naphthalene, methylnaphthalene) and high molecular wieght PAHs (fluoranthene, phenanthrene, and pyrene).

Chlorinated and brominated hydrocarbons such as bromoform, bromodichloromethane, carbontetrachloride, chlorodibromomethane, chloroform, dibromochloropropane, dichloroethene (DCE), dichloroethane (DCA), ethylenedibromide, trichloroethane (TCA), trichloroethene (TCE), tetrachloroethane, and tetrachloroethene (PCE), and polychlorinated biphenyls (PCBs).

Typical Physical Properties*

Carbon Tetrachloride Number	60% (minimum)
Apparent density (dense packing)	27-31 lbs/ft^3
Hardness Number	95 (minimum)
Moisture Content (as packed)	2% (maximum)
Mesh Size	4x6, 4x10

* Please consult with Carbonair for your specific application.

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TIGG 5CC 0408

Virgin Vapor Phase Coconut Based Activated Carbon

www.TIGG.com

DESCRIPTION

TIGG 5CC 0408 is a granular activated carbon made from coconut shell. The combination of high activity level and selective transport and adsorption pores accommodates adsorbates of varied molecular size. This activated carbon also contains the high energy adsorption pores which are vital to attaining ultra high removal of low molecular weight volatile organic compounds.

TYPICAL PROPERTIES	TIGG 5CC 0408
U.S. Sieve, 90 wt% min	4 x 8
CCl_4 Number, min	60
Iodine Number, mg/g, min	1150
Apparent Density, (dense packing)	
g/cc	0.41 – 0.42
lbs/ft^3	26
Moisture - wt% max (as packed)	3
Hardness No. - min	98

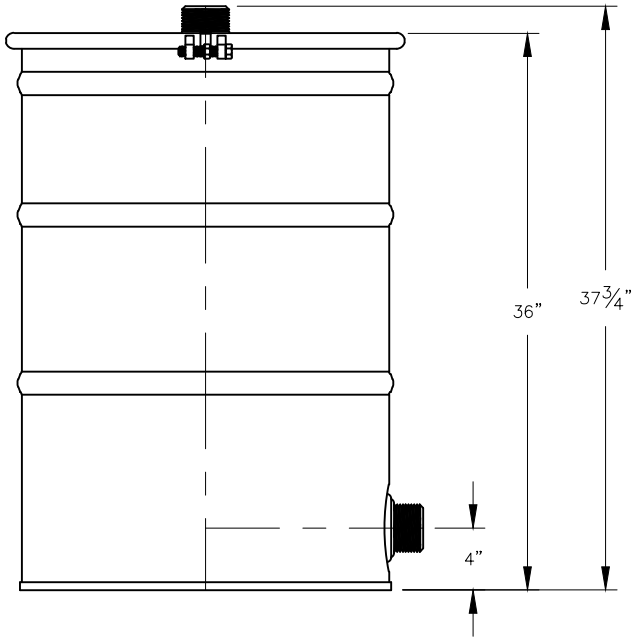
TYPICAL APPLICATIONS

This activated carbon can be used to:

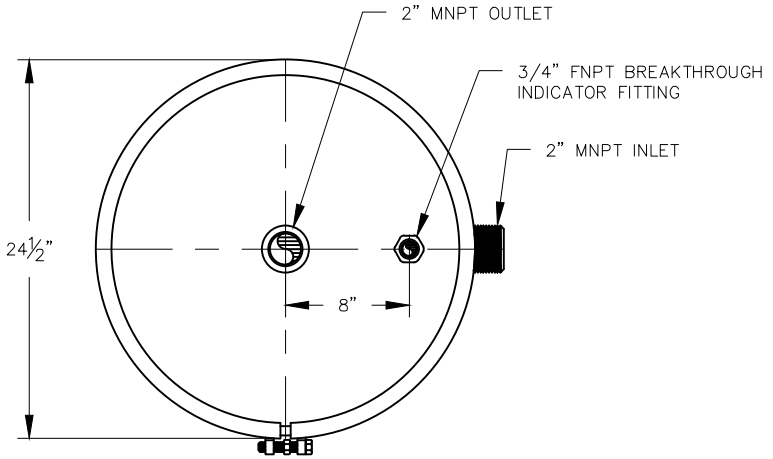
- Capture solvents
- Remove VOC's from:
  - Tank vents
  - Air stripper off gas
  - Soil venting
  - Remediation of excavated soil

Standard packaging of the activated carbon is in 55 pound bags or 1100 pound supersacks.

Wet drained activated carbon adsorbs oxygen from the air. Therefore, when workers need to enter a vessel containing wet activated carbon, they should follow confined space/low oxygen level procedures. Activated carbon dust does not present an explosion hazard.



ELEVATION



PLAN

VESSEL STANDARDS

VESSEL MATERIALS : CARBON STEEL	VOLUME OF VESSEL : 7.5 FT^3
LINING : EPOXY PHENOLIC	STANDARD CARBON FILL : 175 LBS
EXTERIOR PAINT : ACRYLIC ALKYD ENAMEL	SHIP WEIGHT : 218 LBS
INTERNALS : STAINLESS STEEL SCREEN	MAXIMUM OPERATING PRESSURE : 6 PSIG
ADSORBENT OUTLET ASSEMBLY : REMOVABLE COVER	MAXIMUM OPERATING TEMPERATURE : 200°F
LIQUID DRAIN ASSEMBLY : N/A	

NO.	REVISION	BY	DATE
3	REMOVE DRAIN	JB	8/1/13
2	REVISE INLET ELEVATION	JB	11/2/06
1	REVISE TITLEBLOCK	JB	6/30/03

PROJECT

ECONOSORB-V

PROJ. NO. SALES

P.O. NO.

DRAWN BY	ZS
DESIGN BY	BL
CHKD. BY	BL
DATE	10/12/99
SCALE	NTS

TIGG corporation

PLAN & ELEVATION

DWG. NO. ECONOSORB-V-1001 REV. 3

Appendix 9
SSDS O&M Manual

SSDS OPERATION AND MAINTENANCE PLAN

1.0 INTRODUCTION

This Operation and Maintenance Plan describes the measures necessary to operate, monitor and maintain the mechanical components of the SSDS installed as a semi-permanent Engineering Control (EC) at Regency Garden designated for the protection of human health and the environment from impacts emanating from the north-adjacent BCP site. This Operation and Maintenance Plan:

- Includes the steps necessary to allow individuals unfamiliar with the site to operate and maintain the SSDS;
- Includes an operation and maintenance contingency plan; and,
- Will be updated periodically to reflect changes in site conditions or the manner in which the SSDS are operated and maintained.

A copy of this Operation and Maintenance Plan, will be kept at Regency Garden buildings identified as 141-05, 141-12, 141-18 & 141-24 78th Avenue in Flushing, New York.

1.1 SSDS System Scope

The SSDS at the Site will operate 24/7 with no maintenance requirements. Periodic inspections will be performed to assure that the system is continuing to operate properly.

1.2 System Start-Up and Testing

Prior to system start-up, the SSDS system will be tested for operational integrity and verify the presence of potential pipe vacuum leaks using a smoke pen. The system will then be started with 100% applied vacuum to maximize the flow from SSDS pits. System operating parameters including vacuum gauges, vacuum monitoring alarms, and organic vapor concentrations at the effluent at each SSDS will be monitored following start-up. Organic vapor concentrations will

be measured with the PID at the effluent. With the fans turned on and in full operation, the negative pressure will be measured at each pressure test point using a digital micro-manometer, with a resolution of 0.01 inches of water column (in-WC).

A quantitative SSDS post-start-up diagnostic testing exercise will be performed at the eight pressure test points designated 1 to 8 with the negative pressure generated by the Radon blowers. The purpose of this test is to verify the zone of influence exercised by the suction blower at the four installed SSDS and the vacuum communication at the pressure test points.

1.3 Routine SSDS System Operation and Maintenance

The SSDS blower system, has a number of parts that will require routine maintenance. Key parts of the SSDS blower include fans, switches, gauges and sensor. Maintenance will be performed on the SSDS system blower as needed.

In the event that the SSDS blower unit fails, the blower will be repaired or replaced and documented in the Periodic Review Report. VP Capital Holding LLC or the new building's owner or new building superintendent will monitor any sudden changes in the system operation and immediately notify a qualified professional. A logbook will be set up to confirm on-going oversight of the SSDS system.

The routine O&M for the active SSDS is prescribed below:

- The SSD system will be operated by Regency Gardens Company and managed by VP Capital Holdings, LLC.
- Any possible entry routes in the slab should be continuously sealed off to enhance the sub-slab negative pressure when the SSDS is operational and to prevent short-circuiting.
- Current and future building occupants should be notified about the vapor intrusion concerns, the installation of the SSDS as an EC and the SSD system mode of operation.
- The SSDS proper operation will be continuously monitored by Regency Gardens Company and VP Capital Holdings, LLC.

- Routine maintenance of the system will be required if any part if the SSD system has failed or functioning improperly and/or a vacuum is not maintained.
- A formal request to shut down the SSDS will be submitted to the NYSDEC for their approval at two years after system start-up. According to NYSDOH requirements, the SSDS will be shut down for at least one week prior to the performance of indoor air sampling. If the evaluation indicates that the indoor air quality within the buildings meets the acceptable criteria, it will be proposed that the active SSDS operations can be switched to a passive one.

1.4 Non-Routine SSDS System Operation and Maintenance

Non-routine maintenance may also be required during the operation of the SSDS including the following situations:

- Regency Gardens Company report that the alarm installed as part of SSDS assembly sounds-off as an indication of vacuum loss or the system is not operating properly;
- The system becomes damaged; and/or;
- The buildings undergo renovations that may reduce the effectiveness of the system.

VP Capital Holdings, LLC will determine the need for any repairs and parts replacements will be made as required in accordance with the component manuals. Activities conducted during non-routine maintenance visits will vary depending upon the reason for the SSDS system. NYSDEC will be informed of any failure of the SSDS within 48-hours. Repairs or adjustments will be made to the system as appropriate and as per manufacturer guidelines within 15 days of the equipment failure, whenever possible (i.e., pending availability of parts).

SSDS DESIGN AND SPECIFICATIONS

HydroTech Environmental
ENGINEERING AND GEOLOGY, DPC

NYC Office
15 Ocean Avenue, Suite 2B
Brooklyn, New York 11225
T (718) 636-0800 ; F (718) 636-0900

Long Island Office
77 Arkay Drive, Suite K
Hauppauge, New York 11788
T (631) 462-5866 ; F (631) 462-5877

WWW.HYDROTECHENVIRONMENTAL.COM

SUB-SLAB DESPRESSURIZATION SYSTEM
DESIGN WORK PLAN

Regency Garden Apartments
141-05, 141-12, 141-18 & 141-24 78th Avenue
Flushing, New York

Associated with Brownfield Cleanup Site #C241168
77-57 Vleigh Place
Flushing, New York

Prepared For:	VP Capital Holdings, LLC 62 West 47th Street New York, New York 10036
Remedial Engineer:	Tarek Z. Khouri, PE
Prepared On:	July 2, 2019
Revised On:	July 18, 2019
Hydro Tech Job No.	180120

CERTIFICATIONS

I, Tarek Z. Khouri, certify that I am currently a registered professional engineer licensed by the State of New York as defined in 6 NYCRR Part 375 and that this Sub-Slab Depressurization System Design Work Plan was prepared in accordance with all applicable statues and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Tarek Z. Khouri, P.E.
Name

086611
PE License Number

Signature

July 16, 2019
Date

TABLE OF CONTENTS

Figures
1. Site Plan/Proposed Location of Suction Pit
2. Sub-Slab Depressurization System Details

Appendices
1. Cut Sheet for Suction Fan, Alarm and Gauges
2. NYSDEC Correspondence

1.0 EXECUTIVE SUMMARY

This Sub-Slab Depressurization (SSD) System Work Plan (Work Plan) has been prepared by Hydro Tech Environmental Engineering and Geology, DPC (Hydro Tech) on behalf of VP Capital Holdings, LLC (the "Client") to document the details and protocols for implementing vapor mitigation beneath four adjoining residential buildings at 141-05, 141-12, 141-18 & 141-24 78th Avenue in Flushing, New York (the "Site"). The SSD System Work Plan has been prepared consistent with New York State Department of Environmental Conservation (NYSDEC) requirements and in compliance with New York State Department of Health (NYSDOH) guidance in order to mitigate sub-slab soil vapor intrusion and indoor air impacts from the north-adjacent Brownfield Cleanup (BCP) Site #C241168 located at 77-57 Vleigh Place (the "BCP Site").

The SSD System Work Plan has been designed to provide a means of establishing a negative pressure field beneath the basement slabs of the four buildings in order to eliminate the vapor intrusion between the vapor source (soil and groundwater impact at the north-adjacent BCP Site) and the receptor (indoor air within the Regency buildings). This will be accomplished through the installation of individual SSD systems beneath each of the four buildings. Each system will generally consist of a series of SSD suction pits installed beneath the existing basement slab and will be associated with a negative pressure generation system.

2.0 INTRODUCTION

The Sub-Slab Depressurization (SSD) System Work Plan (Work Plan) is designed for the purpose of mitigating potential vapor intrusion originating from a north adjacent BCP Site into the indoor air at the existing four adjoining residential buildings identified as Regency Gardens Company. The addresses of the Regency Garden apartments include 141-05, 141-12, 141-18 & 141-24 78th Avenue in Flushing, New York. The Regency Garden apartments will hereafter be known as the Site.

The remedial approach consists of the installation of an active SSD system in the basement. Each SSD system will consist of a series of suction pits connected to a suction fan and aboveground piping network. The aboveground piping will be connected to a roof-mounted fan that draws vapor from the soil beneath the building and discharges it into the atmosphere.

The SSD system is designed to create and maintain a negative pressure zone beneath the slab of each building. As the negative pressure zone extends under the sub-slab areas, air will flow from the building into the soil, effectively sealing slab and foundation cracks and holes, and thus preventing the entry of volatile organic compounds (VOCs) containing soil vapors into the building.

The written SSD system specifications and accompanying engineering plans are prepared in conformance with standard engineering principles and practices. All work will be conducted under the supervision of a Professional Engineer. The Contractor shall consult with and follow the Remedial Engineer's instructions in case of any conflicts between these plans and specifications and any of the above installation details.

2.1 Site Description & History

The Site is composed of four adjoining 3-story multi-family residential buildings, each with a full basement. The footprint of the four buildings combined is approximately 10,896 square feet. All floors consist of co-op residential apartments. The basement consists of boiler rooms, utility rooms and storage rooms. **Figure 1** provides a Site Plan.

Three Sub-slab Vapor, Indoor and Outdoor Air investigations were performed at the Site during heating season in April 2017, March 2018 and January 2019. The 2019 investigation was performed following the installation of a soil vapor extraction system at the north-adjacent BCP site for the purpose of controlling the migration of soil vapors into adjacent properties. Each of these investigations consisted of the installation of four (4) sub-slab vapor points in the basements of designated buildings at this property and collection of four (4) soil vapor samples, four (4) basement indoor air samples and one (1) outdoor ambient air samples for chemical analysis.

Findings of the 2019 investigation indicated PCE (max. 1,300 micrograms per cubic meter (ug/m^3)) was detected in 4 sub-slab vapor samples and TCE (max. 1.9 µg/m3) was

detected in 2 sub-slab vapor samples. Tetrachloroethylene (PCE) and Trichloroethylene (TCE) were detected in indoor air samples at maximum concentrations of 13 µg/m^3 and 0.97 µg/m^3, respectively. PCE and TCE concentrations in indoor air samples at this property do not exceed their respective NYSDOH guidance values of 30 ug/m^3 and 2 ug/m^3, respectively.

Based on the 2019 findings, NYSDEC indicated that the vapor intrusion from the north adjacent BCP site is not adequately controlled. Therefore, NYSDEC requested the installation of an active SSD system. The NYSDEC correspondence is provided in **Appendix 2**.

3.0 SUB-SLAB DEPRESSURIZATION SYSTEM DETAILS

3.1 System Design

It is expected that two suction pits will be sufficient to create a negative pressure zone and effectively extend the negative pressure field beneath each building at the Site. Therefore, a total of eight (8) sub-slab suction pits will be installed beneath central portions of the basement slabs of the four existing buildings at the Site. The suction pits will provide a direct conduit to the native material beneath the building slabs.

Each SSD system pit will consist of a sub-slab cavity of approximately 2 feet by 2 feet in area by 2 feet in depth. A 4" diameter open-ended PVC pipe will be placed in the pit and held in place with a clamp. The pit will then be filled with crushed stone to prevent displacement of soil particles under vacuum and resurfaced.

Two (2) vacuum monitoring points will be installed in each basement for a total of 8 points. The vapor monitoring points will allow for system monitoring and to ensure proper communication beneath the slab. Each pressure test point will consist of a stainless-steel screen placed within the 6-inch porous layer of bluestone stone placed across the entire site and will be fitted with inert tubing (e.g., polyethylene) of ¼ inch diameter terminating above the slab with a gas-tight fitting. The purpose of these test points is to provide a quantitative pressure field extension testing after SSD system prior and post start-up. **Figure 2** provide the section details of SSD system suction pits.

Each 2 suction pits per building will be manifolded into one riser and routed to the exterior through a rear hopper window in each basement with 4-inch diameter cast iron pipe. The pipe will then be connected in the exterior to a rooftop mounter Radon Away GP-501 suction fan. A pressure gauge, an electronic audio/visual alarm and a sampling port will be placed in line with each suction fan. **Appendix 1** provides a cut sheet for the Radon Away GP-501 suction fan, alarm and gauges.

The suction fans will be placed at least 3 feet above the rooftop parapet and 10 feet away from any exhaust or air intake vents. All systems fans will be hardwired independently in each basement, directly from a main electric panel. The fan will be connected to exterior piping using a 4" to 3" reducer on each end. The fan will be connected to a condensate bypass constructed with a 45 degree Wye fitting that is capped and fitted with a bypass tube to allow condensation to drain away from the fan.

System installation will be witnessed by the Professional Engineer's or personnel directly under his/her supervision and will be equipped with a PID. It is not anticipated that air monitoring will be required during invasive activities.

3.2 General Considerations

- Possible entry routes in the slabs should be properly sealed off to enhance the sub-slab negative pressure when SSD system is operational and to prevent short circuiting of the system.

- All instruments and equipment to be installed per manufacturer's requirements.

- All piping will be installed with a positive pitch back to the extraction point to ensure any condensation is directed back to the suction pit.

- The horizontal piping runs must be sloped downward toward the vertical piping into the slab to allow condensate drainage.

- All equipment, electrical panels, and piping of considerable weight loading to be mounted and supported by adequate supports.

- Equipment and pits locations may be modified during system installation to allow for ease of movement and access following approval by engineer.

- All piping and electrical lines should be routed along walls or overhead or installed along floor unless instructed otherwise by the engineer.

- All piping joints must be carefully cemented.

- All buildings occupants should be notified about the potential soil vapor intrusion concerns, the installation of the SSD system as a vapor mitigation measure and the SSD system mode of operation.

- Each SSD system will be associated with a visible and audible Vacuum Monitor/Alarm with electronic light and audio when radon suction fails (model 28001-2) indicating loss of system vacuum or malfunctioning and a visible Dwyer Magnahelic dial type vacuum gauge (model 2004-M). alarm indicating loss of system vacuum or malfunctioning due to mechanical or electrical failure. A sign with a contact number will be clearly posted in the building so that future occupants can contact the system maintenance technician for immediate assistance.

- Appropriate stickers indicating the content of pipes, purpose of alarm, and contact numbers in case of emergency for immediate assistance are mounted on each system in a visible casing in the basement and the roof of each building.

- Maintenance of the system will be required if installed improperly and/or a vacuum is not maintained.

- The SSD system will be installed at the site following approval of this Work Plan by the NYSDEC.

- Daily reports will be prepared and submitted to the NYSDEC while the system is being installed. For the purpose of this scope, it is anticipated that 18 daily reports will be prepared.

- All alterations, outside the scope under this WP, through and beneath the basement slabs will be subject to CAMP activities for VOCs and particulate matter.

- The SSD system installation will be performed under the oversight of the remedial engineer. Any deviations in the SSDS installation should not be implemented without prior consultation with the remedial engineer and prior notification of NYSDEC.

3.3 Investigatory-Derived Waste

All soil/fill material generated during the installation of each SSD suction pit will be placed into DOT-approved 55-gallon drums (est. 1 drum). The drum will be maintained on-site until disposal arrangements with a disposal facility have been completed. The drum will then be disposed properly of in accordance to DER-10 Technical Guidance for Site Investigation and Remediation (May 2010).

4.0 SUB-SLAB DEPRESSURIZATION SYSTEM START-UP PLAN

4.1 SSD System Inspection and Start-up

Prior to start-up, each SSD system will be tested for operational integrity and verify the presence of potential pipe vacuum leaks using a smoke pen or similar equipment. The system will then be started with 100% applied vacuum to maximize the flow from the SSD locations. System parameters including airflow, vacuum and organic vapor concentrations will be monitored following start-up. Vapor concentrations will be measured with the PID at the effluent. System monitoring will be conducted during the first three days of operation as follows: hourly for 5 consecutive hours on the first day and once on the second and third days. If system parameters are steady for three consecutive days after start-up, two additional monitoring events will be performed 15 days and 30 days, thereafter.

4.2 Quantitative Evaluation of Sub-slab Vacuum Communication

Following SSD system installation, a quantitative vacuum communication performance of the SSD system will be performed at the eight pressure test points designated 1 to 8 with the negative pressure generated by the Radon fans. With the fans turned on and in full operation, the negative pressure will be measured at each pressure test point using a digital micro-manometer, with a resolution of 0.01 inches of water column (in-WC). If negative pressure cannot be confirmed the system will be revised. This approach will determine if the system is efficient enough to create communication under the slab, confirming an area of influence between the suction pit and the associated pressure test points.

Field logs will be completed during the vacuum communication performance testing. A field log will be completed daily that will describe all field activities including:

- Project number, name, manager, and address;
- Description of field activities;
- Date and time of performed tasks
- Monitoring equipment
- Apparent weather conditions (e.g. precipitation, outdoor temperature and wind direction) of the work zone; and
- Record of monitoring data on spreadsheets with all requested parameters and point of measurements

4.3 Post-Start-Up SSD System Indoor Air Sampling

Following SSD system installation, an indoor air assessment will be performed 30 days after start-up utilizing the same sampling and analytical methodologies applied during the previous investigations performed at the Site in 2017, 2018 and 2019. The purpose of this sampling is to verify whether soil vapor intrusion is adequately mitigated by the active SSD system.

4.4 Reporting

The final design of the SSD system including all modifications will be documented in a SSD system Construction Completion Report (CCR) that will be certified by the remedial engineer. The report will be prepared 45 days after SSSD systems start up and subsequent testing at Regency Gardens Aparrtments. This report will include post-startup SSD system data including airflow, vacuum reading, organic vapor concentrations at the SSD risers and also the sub-slab negative pressure measured at the vacuum monitoring points.

5.0 OPERATION AND MAINTENANCE OF THE SUB-SLAB DEPRESSURIZATION SYSTEM

The active SSD system will be considered a semi-permanent Engineering Control (EC) at Regency Gardens designated for the protection of human health and the environment from impacts emanating from the north-adjacent BCP site. Therefore, long-term management of the EC will be subject to Operation and Management Plan (O&M) executed under a site-specific Site Management Plan (SMP) that will be developed and included in the Final Engineering Report (FER) for the Vleigh Place BCP site. The O&M for the active SSD system is prescribed below:

- The SSD system will be operated by Regency Gardens Company and managed by VP Capital Holdings, LLC.
- Any possible entry routes in the slab should be continuously sealed off to enhance the sub-slab negative pressure when the SSD system is operational and to prevent short-circuiting.
- Current and future building occupants should be notified about the vapor intrusion concerns, the installation of the SSD system as an EC and the SSD system mode of operation.
- The SSD system proper operation will be continuously monitored by Regency Gardens Company and VP Capital Holdings, LLC.
- Routine maintenance of the system will be required if any part if the SSD system has failed or functioning improperly and/or a vacuum is not maintained.
- A formal request to shut down the SSD system will be submitted to the NYSDEC for their approval at two years after system start-up. According to NYSDOH requirements, the SSD system will be shut down for at least one week prior to the performance of indoor air sampling. If the evaluation indicates that the indoor air quality within the buildings meets the acceptable criteria, it will be proposed that the active SSD system operations can be switched to a passive one.

5.1 Inspection and Certification Letter Report

The active SSD system will be inspected annually to ensure its operating correctly. This inspection will include systems components such as the vacuum gauges, the vacuum monitoring alarms and the Radonaway fans. Additionally, the inspection will evaluate individual vacuum rates and effluent vapor concentrations utilizing a Photoionization Detector (PID).

Results of each inspection will be documented in an Inspection and Certification Letter Report that will be submitted to NYSDEC.

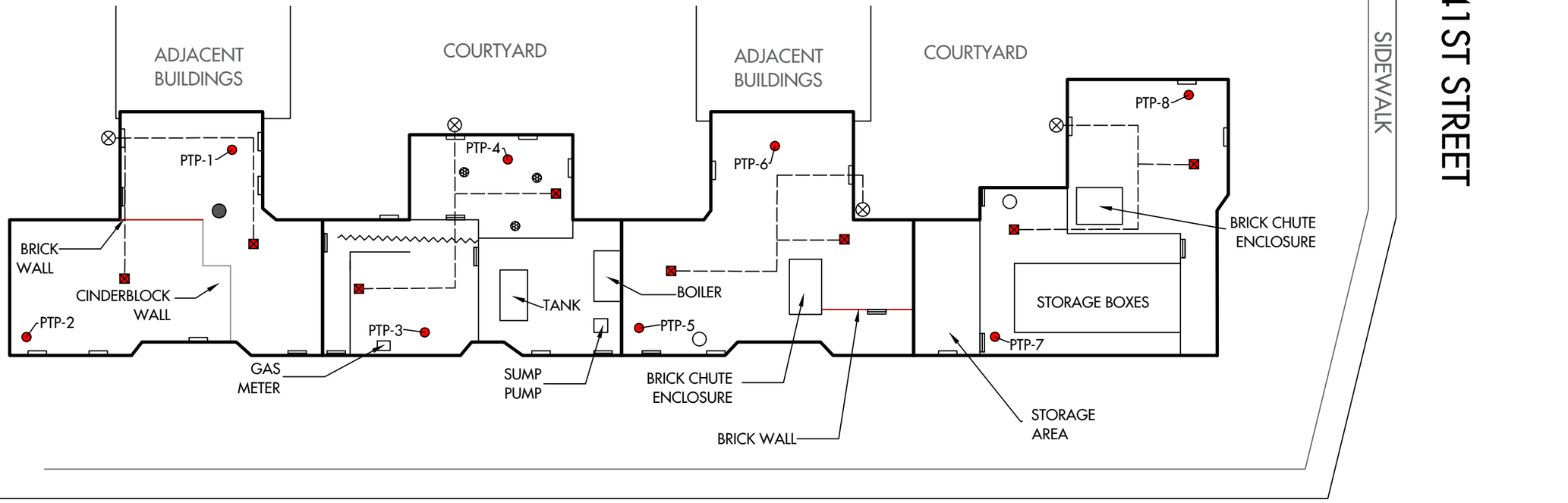
The letter report will include, at a minimum:

- Date of inspections;

- Personnel conducting inspections;
- Description of the inspection activities performed;
- Any observations, conclusions, or recommendations;
- Copy of any inspection forms;
- Certification of the performance of Engineering Controls and Institutional Controls, as discussed below.
- If changes are needed to the SSD system or controls;
- If compliance with the SSD system operations requirements have been maintained;
- If maintenance activities have caused any alteration to the SSD pits or modification of the SSD system piping locations;

END OF WORK PLAN

FIGURES



78TH AVENUE

0 25 50

SCALE IN FEET

NOTES

1. LAYOUT TO SCALE
2. WINDOW DIMENSIONS ARE APPROXIMATE
3. APPLICATION OF DESIGN MAY INCLUDE SHORTCUTS AND ELBOWS TO ALLOW FEASIBLE INSTALLATION WITH THE LEAST AMOUNT OF FRICTION

LEGEND

- BUILDING OUTLINE
- 4" CAST IRON PIPE
- WINDOW
- DOOR
- SUCTION PIT
- DRY PIT
- 4" CAST-IRON RISER EXTENDING TO FAN
- PRESSURE TEST POINT PTP
- BROKEN SLAB TRENCH
- REPAIR SLAB
- DRAIN

DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

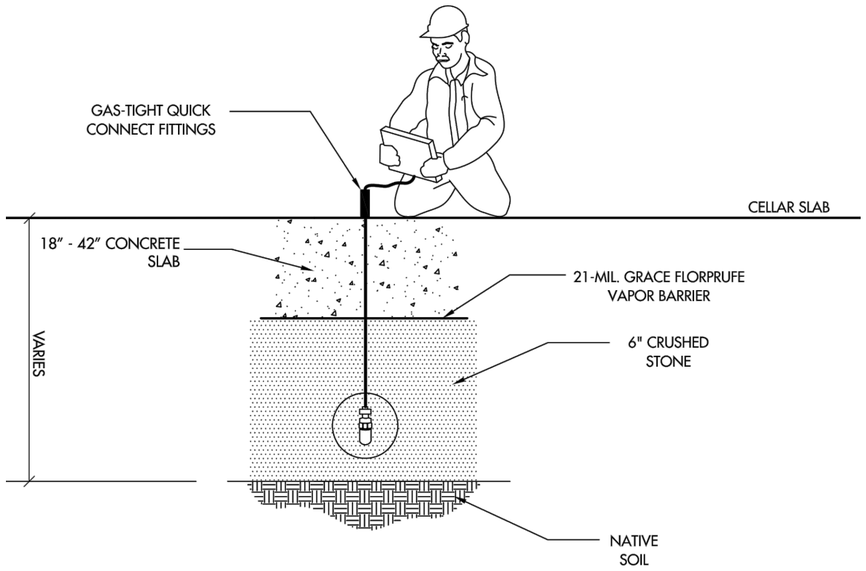
PROJECT NAME AND ADDRESS

141-05, 141-12, 141-18 & 141-24 78TH AVENUE
FLUSHING, NEW YORK

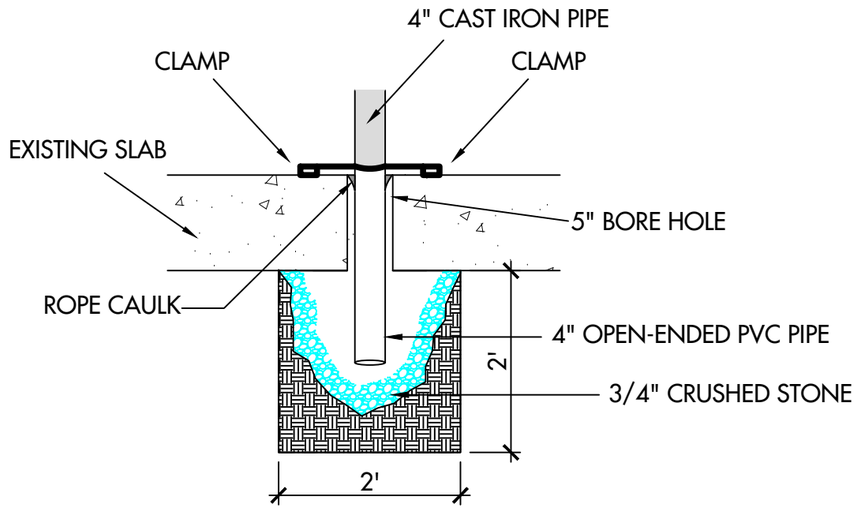
PROJECT FIGURE

FIGURE 1: SITE PLAN/PROPOSED LOCATION OF SUCTION PITS

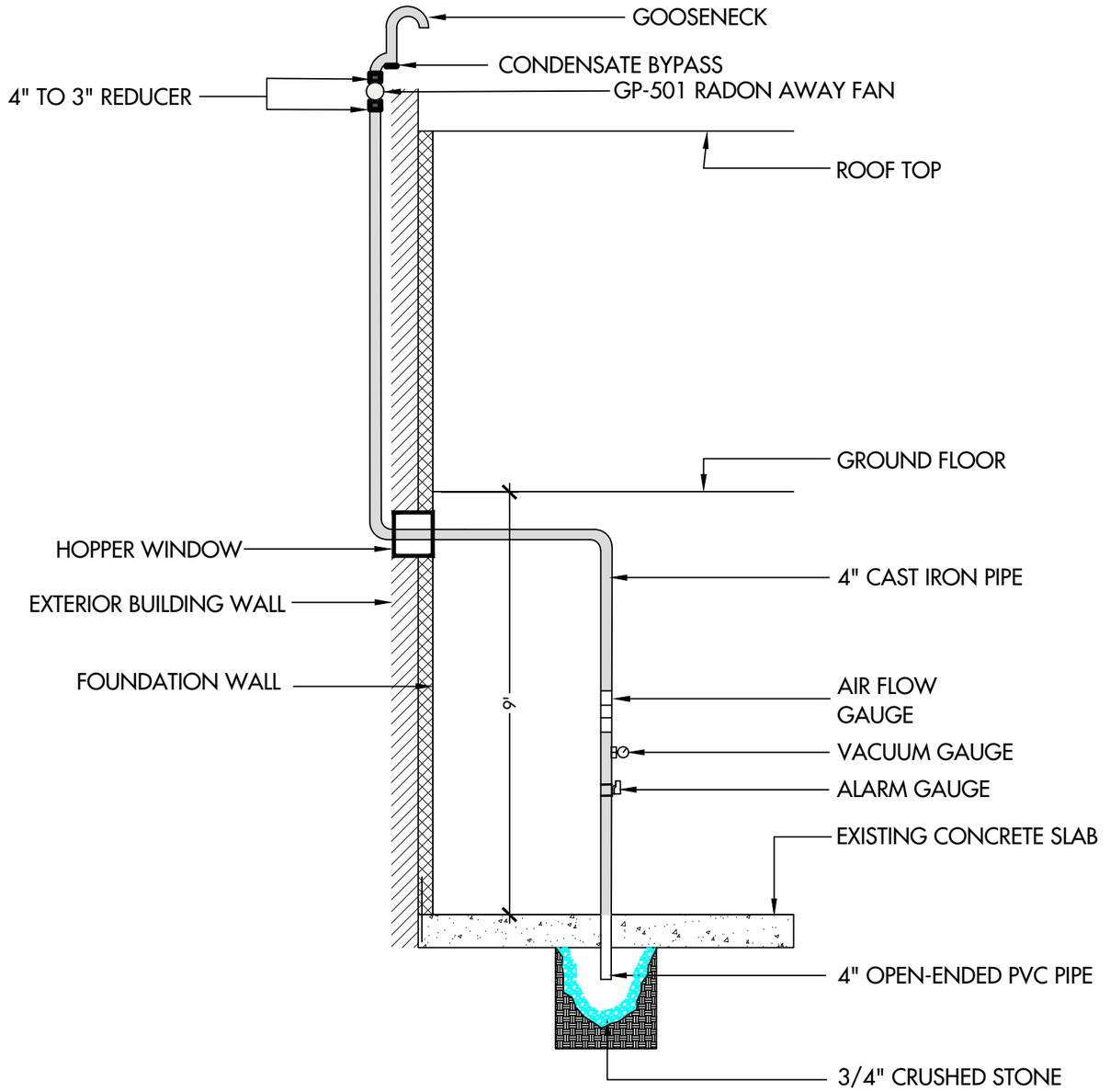
PROJECT NO.	DATE
180120	07/18/2019
DRAWN BY G.T.	REVIEWED BY P.M.
SCALE (11X17) AS NOTED	APPROVED BY P.M.



PRESSURE MONITORING POINT



SECTION DETAIL OF SUCTION PIT



DATE	DESCRIPTION	CHK

SEAL & SIGNATURE

HydroTech

HYDROTECH ENVIRONMENTAL ENGINEERING AND GEOLOGY, DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788

15 OCEAN AVENUE, SUITE 2B BROOKLYN, NY 11225

TEL: (631) 462-5866

FAX: (631) 462-5877

BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS

141-05, 141-12, 141-18 & 141-24 78TH AVENUE
FLUSHING, NEW YORK

PROJECT FIGURE

FIGURE 2: SUB-SLAB DEPRESSURIZATION SYSTEM DETAILS

PROJECT NO.	DATE
180120	07/18/2019
DRAWN BY: G.T.	REVIEWED BY: P.M.
SCALE (11X17): NOT TO SCALE	APPROVED BY: P.M.

APPENDIX 1

CUTSHEET FOR SUCTION FAN, ALARM AND GAUGES

RadonAway™

INSTALLATION INSTRUCTION IN014 Rev G

DynaVac - XP/XR Series		DynaVac - GP Series	
XP101	p/n 23008-1	GP201	p/n 23007-1
XP151	p/n 23010-1	GP301	p/n 23006-1
XP201	p/n 23011-1	GP401	p/n 23009-1
XR261	p/n 23019-1	GP501	p/n 23005-1

1.0 SYSTEM DESIGN CONSIDERATIONS

1.1 INTRODUCTION

The DynaVac GP/XP/XR Series Radon Fans are intended for use by trained, professional Radon mitigators. The purpose of this instruction is to provide additional guidance for the most effective use of a DynaVac Fan. This instruction should be considered as a supplement to EPA standard practices, state and local building codes and state regulations. In the event of a conflict, those codes, practices and regulations take precedence over this instruction.

1.2 ENVIRONMENTALS

The GP/XP/XR Series Fans are designed to perform year-round in all but the harshest climates without additional concern for temperature or weather. For installations in an area of severe cold weather, please contact RadonAway for assistance. When not in operation, the fan should be stored in an area where the temperature is never less than 32 degrees F. or more than 100 degrees F.

1.3 ACOUSTICS

The GP/XP/XR Series Fan, when installed properly, operates with little or no noticeable noise to the building occupants. The velocity of the outgoing air should be considered in the overall system design. In some cases the "rushing" sound of the outlet air may be disturbing. In these instances, the use of a RadonAway Exhaust Muffler is recommended.

1.4 GROUND WATER

In the event that a temporary high water table results in water at or above slab level, water may be drawn into the riser pipes thus blocking air flow to the GP/XP/XR Series Fan. The lack of cooling air may result in the fan cycling on and off as the internal temperature rises above the thermal cutoff and falls upon shutoff. Should this condition arise, it is recommended that the fan be turned off until the water recedes allowing for return to normal operation.

1.5 SLAB COVERAGE

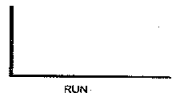
The GP/XP/XR Series Fan can provide coverage up to 2000+ sq. ft. per slab penetration. This will primarily depend on the sub-slab material in any particular installation. In general, the tighter the material, the smaller the area covered per penetration. Appropriate selection of the GP/XP/XR Series Fan best suited for the sub-slab material can improve the slab coverage. The GP & XP series have a wide range of models to choose from to cover a wide range of subslab material. The higher static suction fans are generally used for tighter subslab materials. The XR Series is specifically designed for high flow applications such as stone/gravel and drain tile. Additional suction points can be added as required. It is recommended that a small pit (5 to 10 gallons in size) be created below the slab at each suction hole.

1.6 CONDENSATION & DRAINAGE

Condensation is formed in the piping of a mitigation system when the air in the piping is chilled below its dew point. This can occur at points where the system piping goes through unheated space such as an attic, garage or outside. The system design must provide a means for water to drain back to a slab hole to remove the condensation. The GP/XP/XR Series Fan **MUST** be mounted vertically plumb and level, with the outlet pointing up for proper drainage through the fan. Avoid mounting the fan in any orientation that will allow water to accumulate inside the fan housing. The GP/XP/XR Series Fans are **NOT** suitable for underground burial.

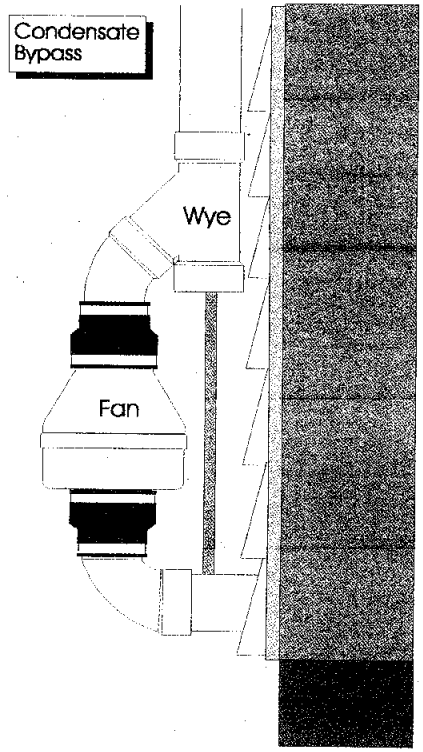
For GP/XP/XR Series Fan piping, the following table provides the minimum recommended pipe diameter and pitch under several system conditions.

Pipe Dia.	Minimum Rise per Foot of Run* @25 CFM	@50 CFM	@100 CFM
4"	1/8"	1/4"	3/8"
3"	1/4"	3/8"	1 1/2"



*Typical GP/XP/XR Series Fan operational flow rate is 25 - 90 CFM. (For more precision, determine flow rate by using the chart in the addendum.)

Under some circumstances in an outdoor installation a condensate bypass should be installed in the outlet ducting as shown. This may be particularly true in cold climate installations which require long lengths of outlet ducting or where the outlet ducting is likely to produce large amounts of condensation because of high soil moisture or outlet duct material. Schedule 20 piping and other thin-walled plastic ducting and Aluminum downspout will normally produce much more condensation than Schedule 40 piping.



The bypass is constructed with a 45 degree Wye fitting at the bottom of the outlet stack. The bottom of the Wye is capped and fitted with a tube that connects to the inlet piping or other drain. The condensation produced in the outlet stack is collected in the Wye fitting and drained through the bypass tube. The bypass tubing may be insulated to prevent freezing.

1.7 "SYSTEM ON" INDICATOR

A properly designed system should incorporate a "System On" Indicator for affirmation of system operation. A manometer, such as a U-Tube, or a vacuum alarm is recommended for this purpose.

1.8 ELECTRICAL WIRING

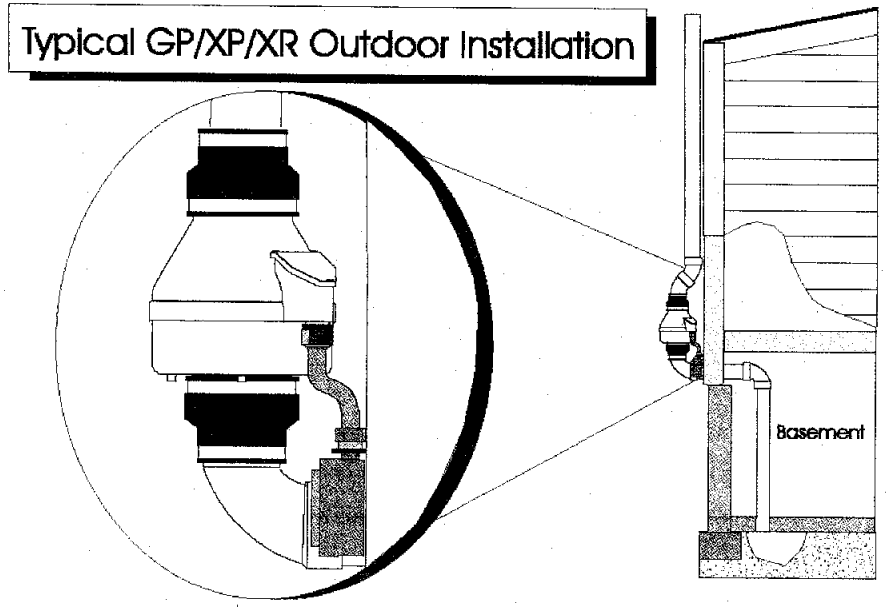
The GP/XP/XR Series Fans operate on standard 120V 60 Hz. AC. All wiring must be performed in accordance with the National Fire Protection Association's (NFPA)"National Electrical Code, Standard #70"-current edition for all commercial and industrial work, and state and local building codes. All wiring must be performed by a qualified and licensed electrician. Outdoor installations require the use of a U.L. listed watertight conduit. Ensure that all exterior electrical boxes are outdoor rated and properly sealed to prevent water penetration into the box. A means, such as a weep hole, is recommended to drain the box.

1.9 SPEED CONTROLS

The GP/XP/XR Series Fans are rated for use with electronic speed controls ,however, they are generally not recommended.

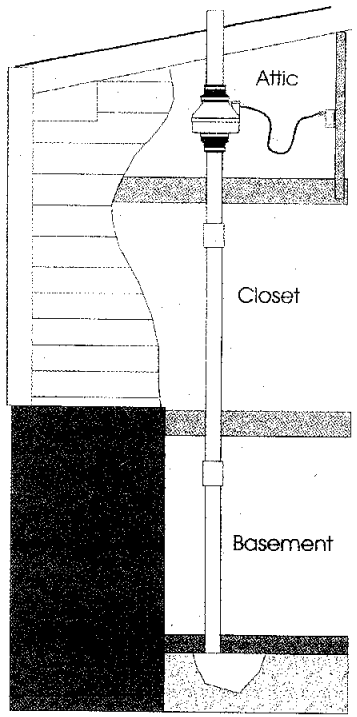
2.0 INSTALLATION

The GP/XP/XR Series Fan can be mounted indoors or outdoors. (It is suggested that EPA recommendations be followed in choosing the fan location.) The GP/XP/XR Series Fan may be mounted directly on the system piping or fastened to a supporting structure by means of optional mounting bracket.



2.1 MOUNTING

Mount the GP/XP/XR Series Fan vertically with outlet up. Insure the unit is plumb and level. When mounting directly on the system piping assure that the fan does not contact any building surface to avoid vibration noise.



2.2 MOUNTING BRACKET (optional)

The GP/XP/XR Series fan may be optionally secured with the integral mounting bracket on the GP Series fan or with RadonAway P/N 25007-2 mounting bracket for an XP/XR Series fan. Foam or rubber grommets may also be used between the bracket and mounting surface for vibration isolation.

2.3 SYSTEM PIPING

Complete piping run, using flexible couplings as means of disconnect for servicing the unit and vibration isolation.

2.4 ELECTRICAL CONNECTION

Connect wiring with wire nuts provided, observing proper connections(See Section 1.8):

Fan Wire	Connection
Green	Ground
Black	AC Hot
White	AC Common

2.5 VENT MUFFLER (optional)

Install the muffler assembly in the selected location in the outlet ducting. Solvent weld all connections. The muffler is normally installed at the end of the vent pipe.

2.6 OPERATION CHECKS

_____ **Verify** all connections are tight and **leak-free**.

_____ **Insure** the GP/XP/XR Series Fan and all ducting is secure and vibration-free.

_____ **Verify** system vacuum pressure with manometer. **Insure** vacuum pressure is **less than** maximum recommended operating pressure

(Based on sea-level operation, at higher altitudes reduce by about 4% per 1000 Feet.)
(Further reduce Maximum Operating Pressure by 10% for High Temperature environments)
See Product Specifications. If this is exceeded, increase the number of suction points.

_____ **Verify Radon levels by testing to EPA protocol.**

XP/XR SERIES PRODUCT SPECIFICATIONS

The following chart shows fan performance for the XP & XR Series Fan:

	Typical CFM Vs Static Suction "WC								
	0"	.25"	.5"	.75"	1.0"	1.25"	1.5"	1.75"	2.0"
XP101	125	118	90	56	5	-	-	-	-
XP151	180	162	140	117	78	46	10	-	-
XP201	150	130	110	93	74	57	38	20	-
XR261	250	215	185	150	115	80	50	20	-

Maximum Recommended Operating Pressure*		
XP101	0.9" W.C.	(Sea Level Operation)**
XP151	1.3" W.C.	(Sea Level Operation)**
XP201	1.7" W.C.	(Sea Level Operation)**
XR261	1.6" W.C.	(Sea Level Operation)**

Reduce by 10% for High Temperature Operation
***Reduce by 4% per 1000 feet of altitude*

Power Consumption @ 120 V AC	
XP101	40 - 49 watts
XP151	45 - 60 watts
XP201	45 - 66 watts
XR261	65 - 105 watts

XP Series Inlet/Outlet: 4.5" OD (4.0" PVC Sched 40 size compatible)
XR Series Inlet/Outlet: 5.875" OD
Mounting: Mount on the duct pipe or with optional mounting bracket.
Recommended ducting: 3" or 4" Schedule 20/40 PVC Pipe
Storage temperature range: 32 - 100 degrees F.
Normal operating temperature range: -20 - 120 degrees F.
Maximum inlet air temperature: 80 degrees F.
Size: 9.5H" x 8.5" Dia.
Weight: 6 lbs. (XR261 - 7 lbs)
Continuous Duty
Thermally protected
Class B Insulation
3000 RPM
Residential Use Only
Rated for Indoor or Outdoor use

LISTED Electric Fan ETL 77728 Tested to UL Std. 507

GP SERIES PRODUCT SPECIFICATIONS

The following chart shows fan performance for the GPx01 Series Fan:

	Typical CFM Vs Static Suction "WC						
	1.0"	1.5"	2.0"	2.5"	3.0"	3.5"	4.0"
GP501	95	87	80	70	57	30	5
GP401	95	82	60	38	12	-	-
GP301	92	77	45	10	-	-	-
GP201	82	58	5	-	-	-	-

Maximum Recommended Operating Pressure*		
GP501	3.8" W.C.	(Sea Level Operation)**
GP401	3.0" W.C.	(Sea Level Operation)**
GP301	2.4" W.C.	(Sea Level Operation)**
GP201	1.8" W.C.	(Sea Level Operation)**

Reduce by 10% for High Temperature Operation
***Reduce by 4% per 1000 feet of altitude*

Power Consumption @ 120 V AC	
GP501	70 - 140 watts
GP401	70 - 110 watts
GP301	55 - 90 watts
GP201	40 - 60 watts

Inlet/Outlet: 3.5" OD (3.0" PVC Sched 40 size compatible)
Mounting: Fan may be mounted on the duct pipe or with integral flanges.
Weight: 12 lbs.
Size: 13H" x 12.5" x 12.5"
Recommended ducting: 3" or 4" Schedule 20/40 PVC Pipe
Storage temperature range: 32 - 100 degrees F.
Normal operating temperature range: -20 - 120 degrees F.
Maximum inlet air temperature: 80 degrees F.
Continuous Duty
Class B Insulation
3000 RPM
Thermally protected
Rated for Indoor or Outdoor Use

LISTED Electric Fan ETL 77728 Tested to UL Std. 507

Checkpoint IIA Mitigation System Alarm

Item # 28001-2

Description - Audible alarm; green and red LED lights; factory preset to activate at .25" WC vacuum pressure; low voltage

RadonAway is a B2B business only. You must be an approved RadonAway customer to purchase products through this website. If you are an existing RadonAway customer and need a website login, click here. If you are a professional and would like to become a RadonAway customer, click here.

Technical Specifications:

Additional Checkpoint Alarm Information:

- Downloadable Checkpoint Alarm Installation Instructions (PDF format)

INSTALLATION & OPERATING INSTRUCTIONS
Instruction P/N IN015 Rev E
FOR *CHECKPOINT IIa*™ P/N 28001-2 & 28001-3
RADON SYSTEM ALARM

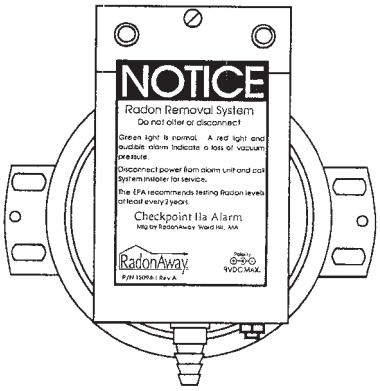
INSTALLATION INSTRUCTIONS
(WALL MOUNTING)

Select a suitable wall location near a vertical section of the suction pipe. The unit should be mounted about four or five feet above the floor and as close to the suction pipe as possible. Keep in mind that with the plug-in transformer provided, the unit must also be within six feet of a 120V receptacle. **NOTE: The Checkpoint IIa is calibrated for vertical mounting, horizontal mounting will affect switchpoint calibration.**

Drill two ¼" holes 4" apart horizontally where the unit is to be mounted.

Install the two ¼" wall anchors provided.

Hang the CHECKPOINT IIa from the two mouting holes located on the mounting bracket. Tighten the mounting screws so the unit fits snugly and securely against the wall.



Drill a 5/16" hole into the side of the vent pipe about 6" higher than the top of the unit.

Insert the vinyl tubing provided about 1" inside the suction pipe.

Cut a suitable length of vinyl tubing and attach it to the pressure switch connector on the CHECKPOINT IIa.

CALIBRATION AND OPERATION.

The CHECKPOINT IIa units are calibrated and sealed at the factory to alarm when the vacuum pressure falls below the factory setting and should not normally require field calibration. Factory Settings are:
28001-2 -.25" WC Vacuum
28001-3 -.10" WC Vacuum

To Verify Operation:

With the exhaust fan off or the pressure tubing disconnected and the CHECKPOINT IIa plugged in, both the red indicator light and the audible alarm should be on.

Turn the fan system on or connect the pressure tubing to the fan piping. The red light and the audible alarm should go off. The green light should come on.

Now turn the fan off. The red light and audible alarm should come on in about two or three seconds and the green light should go out.

WARRANTY INFORMATION

Subject to applicable consumer protection legislation, RadonAway warrants that the CHECKPOINT IIa will be free from defective material and workmanship for a period of (1) year from the date of purchase. Warranty is contingent on installation in accordance with the instructions provided. This warranty does not apply where repairs or alterations have been made or attempted by others; or the unit has been abused or misused. Warranty does not include damage in shipment unless the damage is due to the negligence of RadonAway. All other warranties, expressed or written, are not valid. To make a claim under these limited warranties, you must return the defective item to RadonAway with a copy of the purchase receipt. RadonAway is not responsible for installation or removal cost associated with this warranty. In no case is RadonAway liable beyond the repair or replacement of the defective product FOB RadonAway.

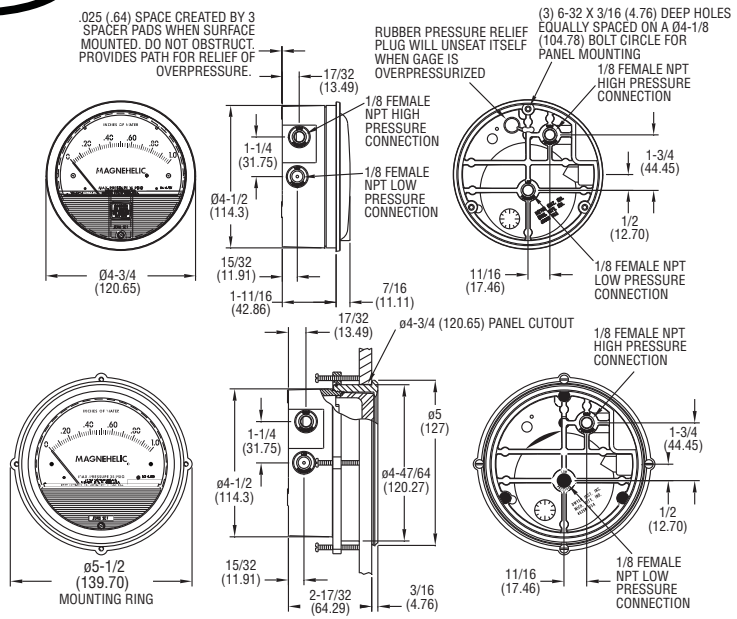
THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. THERE IS NO WARRANTY OF MERCHANTIBILITY. ALL OTHER WARRANTIES, EXPRESSED OR WRITTEN, ARE NOT VALID.

For service under these warranties, contact RadonAway for a Return Material Authorization (RMA) number and shipping information. **No returns can be accepted without an RMA.** If factory return is required, the customer assumes all shipping costs to and from factory.

Manufactured by:
RadonAway
Ward Hill, MA
(978)-521-3703

Bulletin A-27

Magnehelic® Differential Pressure Gage



**The blowout plug is not used on models above 180 inches of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.*

STANDARD GAGE ACCESSORIES: Two 1/8˝ NPT plugs for duplicate pressure taps, two 1/8˝ pipe thread to rubber tubing adapters and three flush mounting adapters with screws.

MP AND HP GAGE ACCESSORIES: Mounting ring and snap ring retainer substituted for 3 adaptors, 1/4" compression fittings replace 1/8" pipe thread to rubber tubing adaptors.

OVERPRESSURE PROTECTION: Standard Magnehelic® Differential Pressure Gages are rated for a maximum pressure of 15 psig and should not be used where that limit could be exceeded. Models employ a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig (excludes MP and HP models). To provide a free path for pressure relief, there are four spacer pads which maintain .023˝ clearance when gage is surface mounted. Do not obstruct the gap created by these pads.

SPECIFICATIONS

Service: Air and non-combustible, compatible gases. (Natural Gas option available.)
Wetted Materials: Consult factory.
Housing: Die cast aluminum case and bezel, with acrylic cover. (MP model has polycarbonate cover).
Accuracy: ±2% of full scale (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on -00, - 00N, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
Pressure Limits: -20˝ Hg to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only. The blowout plug is not used on models above 180 inches of water pressure, medium or high pressure models, or on gages which require an elastomer other than silicone for the diaphragm.
Temperature Limits: 20 to 140°F (-6.67 to 60°C). *Low temperature models available as special option.
Size: 4˝ (101.6 mm) diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8˝ female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
Agency Approvals: RoHS.

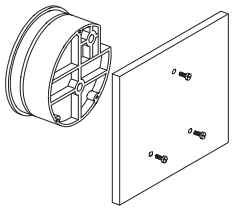
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options.

Note: May be used with hydrogen when ordering Buna-N diaphragm. Pressure must be less than 35 psi.

INSTALLATION

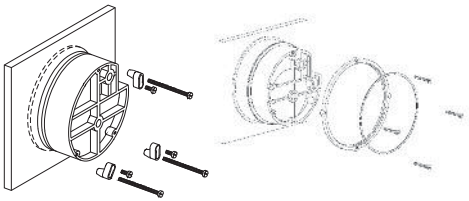
Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F (60°C). Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines may be run any necessary distance. Long tubing lengths will not affect accuracy but will increase response time slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult the factory for ways to provide additional damping.
All standard Magnehelic® Differential Pressure Gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions with only rezeroing. Low range models of 0.5" w.c. plus 0.25" w.c. and metric equivalents must be used in the vertical position only.

SURFACE MOUNTING



Locate mounting holes, 120° apart on a 4-1/8" dia. circle. Use No. 6-32 machine screws of appropriate length.

FLUSH MOUNTING



Provide a 4-9/16" dia. (116 mm) opening in panel. Provide a 4-3/4" dia. (120 mm) opening for MP and HP models. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adapters, firmly secured in place.

PIPE MOUNTING

To mount gage on 1-1/4" - 2" pipe, order optional A-610 pipe mounting kit.

TO ZERO GAGE AFTER INSTALLATION

Set the indicating pointer exactly on the zero mark, using the external zero adjust screw on the cover at the bottom. Note that the zero check or adjustment can only be made with the high and low pressure taps both open to atmosphere.

OPERATION

Positive Pressure: Connect tubing from source of pressure to either of the two high pressure ports. Plug the port not used. Vent one or both low pressure ports to atmosphere.
Negative Pressure: Connect tubing from source of vacuum or negative pressure to either of the two low pressure ports. Plug the port not used. Vent one or both high pressure ports to atmosphere.
Differential Pressure: Connect tubing from the greater of two pressure sources to either high pressure port and the lower to either low pressure port. Plug both unused ports.
When one side of the gage is vented in dirty, dusty atmosphere, we suggest an A-331 Filter Vent Plug be installed in the open port to keep inside of gage clean.

A. For portable use of temporary installation use 1/8" pipe thread to rubber tubing adapter and connect to source of pressure with flexible rubber or vinyl tubing.
B. For permanent installation, 1/4" O.D., or larger, copper or aluminum tubing is recommended.

MAINTENANCE

No lubrication or periodic servicing is required. Keep case exterior and cover clean. Occasionally disconnect pressure lines to vent both sides of gage to atmosphere and re-zero. Optional vent valves should be used in permanent installations. The Series 2000 is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

WARNING

Attempted field repair may void your warranty. Recalibration or repair by the user is not recommended.

TROUBLE SHOOTING TIPS

Gage won't indicate or is sluggish.

1. Duplicate pressure port not plugged.
2. Diaphragm ruptured due to overpressure.
3. Fittings or sensing lines blocked, pinched, or leaking.
4. Cover loose or "O"ring damaged, missing.
5. Pressure sensor, (static tips, Pitot tube, etc.) improperly located.
6. Ambient temperature too low. For operation below 20°F (-7°C), order gage with low temperature, (LT) option.

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P.O. BOX 373 • MICHIGAN CITY, INDIANA 46360 U.S.A.
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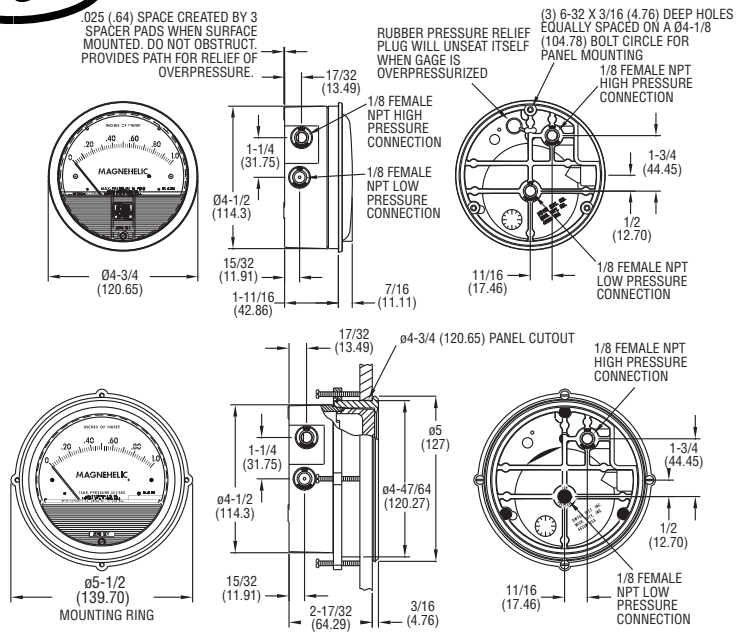
Magnehelic® Differential Pressure Gage
INSTRUCCIONES Y LISTA DE PARTES



(El tapón de goma no es usado en los modelos sobre 180 pulgadas de presión de agua, modelos de presión media o alta, o en instrumentos que requieren un elastizado en cualquier otro material que no sea silicona para el diafragma.)

Accesorios: Tapones 1/8" NPT para las conexiones duplicadas, dos adaptadores de rosca 1/8" NPT a tubo de goma; y tres adaptadores para montaje al ras y tornillos.

Accesorios para Los Modelos MP y HP: El anillo de montaje y el retensor del anillo de presión son substituidos por 3 adaptadores, accesorios de compresión de 1/4" remplazan a los adaptadores de rosca 1/8" a tubo de goma.

Protección Para Sobrepresión: Los Manómetros Diferenciales Magnehelic Estándar están clasificados para una presión máxima de 15 psi y no se deberían de usar donde el límite puede excederse. Los modelos emplean un tapón de goma en el trasero que funciona como una válvula de alivio desmontándose y ventilando el interior del instrumento cuando la sobrepresión alcanza aproximadamente 25 psig. (Los modelos MP y HP son excluidos) Para proveer un camino libre para el alivio de presión, el instrumento viene con rodilleras que mantienen un espacio de .023" cuando el instrumento es montado en superficie. No bloque el espacio creado por estas rodilleras.

† Para aplicaciones con alto ciclo de velocidad dentro de la clasificación de presión total del instrumento, la próxima clasificación mas alta es recomendada. Vea las opciones de media y alta presión.

El instrumento puede ser usado con hidrogeno cuando se ordena con diafragma de Buna-N. La presion tiene que ser menos de 35 psi.

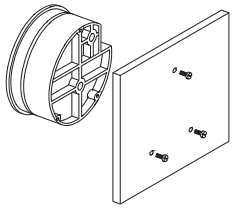
ESPECIFICACIONES

Servicio: aire y gases no combustibles, gases compatibles. (ópcion disponible para uso con gas natural).
Materiales Mojados: Consulte con la fábrica.
Carcasa: Caja y anillo de retención de aluminio fundido a presión con tapadera de acrílico. (El modelo MP tiene la tapadera de policarbonato.)
Exactitud: ±2% de fondo de escala a 21 °C
Mod. 2000-0 ±3%; Mod. 2000-00 ±4%
Límite de Presión: -20 Hg. a 15 psig. † (-0.677 bar a 1,034 bar); opción MP: 35 psig (2.41 bar), opción HP: 80 psig (5.52 bar).
Sobrepresión: El tapón de alivio se abre aproximadamente a los 25 psig, modelos estandard únicamente. El tapón de goma no es usado en los modelos sobre 180 pulgadas de presión de agua, modelos de presión media o alta, o en instrumentos que requieren un elastizado en cualquier otro material que no sea silicio para el diafragma.
Límite de Temperatura: -6.67 a 60ºC. * Modelos de baja temperatura disponibles como opción especial.
Dimensiones: diám. 120,65 mm x 55,6 prof.
Orientación de Montaje: El diafragma debe ser usado solo en posición vertical. Consulte con la fábrica para otras orientaciones de posición.
Conexiones: 1/8" NPT para alta y baja presión, duplicadas (atrás, a los lados).
Peso: 510 g, MP y HP 963 g.
Aprobación de la agencia: RoHS.

Instalacion

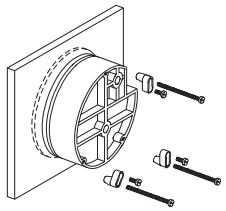
Seleccione un lugar libe de exceso de vibraciones, y donde la temperatura ambiente no supere los 60°C. Evite luz solar directa, para evitar decoloración de la cubierta plástica. Las conexiones de proceso pueden tener cualquier longitud sin afectar la exactitud, pero pueden extender el tiempo de respuesta del instrumento. Si hay pulsación de presión o vibración, consulte a fábrica sobre medios de amortiguación.
Los MAGNEHELIC han sido calibrados con el diafragma vertical, y deben ser usados en esas condiciones. Para otras posiciones, se debe especificar en la orden de provisión. Los de rango elevado pueden ser usados en diversas posiciones, pero se debe reajustar el cero. Los modelos de la serie 2000-00 y equivalentes métricos deben ser usados solo verticalmente.

Montaje en Superficie



Perfore tres orificios separados 120° sobre una circunferencia de 105 mm de diám. y sostenga el instrumento con tres tornillos 6-32 de long. apropiada.

Montaje alineado



Perfore un circulo de 115 mm de diám. en el panel, y sostenga el instrumento mediante los.

Montaje Sobre Pipa

Para montar el instrumento sobre pipas de 32 a 50 mm de diám., ordene el adaptador opcional A-610.

Puesta a Cero Después de Instalar

Deje las conexiones de presión abiertas a atmósfera y ajuste a cero desde tornillo del panel frontal.

Operacion

Presión Positiva: Conecte la tubería desde la fuente de presión a cualquiera de las dos conexiones de alta presión (HIGH), bloqueando la no usada; Las conexiones de baja (LOW) presión pueden dejarse uno o los dos abiertos a la atmósfera.
Presión Negativa: Repita el procedimiento anterior, conectado en este caso las conexiones de baja presión (LOW). Deje las otras conexiones abiertas.
Presión diferencial: Conecte el tubo correspondiente a la presión más positiva al cualquiera de los conectores de alta presión (HIGH) bloqueando el no usado, y la más baja presión o presión negativa (vacío) al conector de baja presión (LOW). Puede usarse cualquier conector de cada par, dejando siempre uno bloqueado. Si se deja una conexión abierta a la atmósfera, se recomienda el uso de un filtro tipo A-331 en el lugar correspondiente para mantener limpio el interior del instrumento. Para uso portable, o instalación temporaria, uso adapta dores para rosca de tubo de 1/89 a tubo flexible, y conecte a proceso mediante una tubería de goma, o equivalente. Para instalación permanente, se recomienda el uso de tubo de cobre o aluminio de por lo menos 1/4" de diám. exterior.

No se requiere mantenimiento específico alguno, ni lubricación. Periódicamente, desconecte el instrumento, ventee la presión acumulada, y reajuste el cero. Para instalaciones permanentes, se debe usar un juego de válvulas de montaje permanente para el venteo.
El instrumento de Serie 2000 no puede ser re parado en el campo y debería de ser regresado si reparos son necesarios (Reparos en el campo no deben de ser intentados y pueden cancelar la garantía.). Asegurarse de incluir una descripción breve del problema más cualquier notas pertinentes a la aplicación para devolución de productos antes de enviar el instrumento.

Cuidado! : La recalibración en campo puede invalidar la garantía. No se recomienda la recalibracion por parte del usuario. En caso necesario envie el instrumento con transporte pago a:

Localización De Fallas

• *El instrumento no indica, o es lento en reacción.*
1. Conexión duplicada abierta.
2. Diafragma roto por sobrepresión.
3. Tubería de conexión perforada, con pérdidas o pinchazos.
4. Anillo de retención flojo, u "O " ring dañado.
5. Conexión a proceso indebida o inadecuada.
6. Temperatura muy baja. Para este caso ordene tipos LT (baja temperatura).

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APPENDIX 2

NYSDEC CORRESPONDENCE

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Remediation, Remedial Bureau B
625 Broadway, 12th Floor, Albany, NY 12233-7016
P: (518) 402-9767 I F: (518) 402-9773
www.dec.ny.gov

SENT VIA EMAIL

February 8, 2019

VP Capital Holdings LLC
Attn: Avi Matatov
62 West 47th Street
New York, NY 10036

Re: Soil vapor intrusion sampling at SteppingStone Day School;
Mitigation of Regency Gardens Apartments
77-57 Vleigh Place
NYSDEC Site I.D. #C241168

Dear Mr. Matatov,

On December 20, 2018, HydroTech Environmental Corp. ("HydroTech") collected groundwater samples from on- and off-site groundwater monitoring wells for the purposes of assessing the effectiveness of ongoing remedial elements, specifically the In Situ Chemical Oxidation (ISCO), currently being implemented at 77-57 Vleigh Place (the "Site"). Sampling results indicate not only continued elevated concentrations of volatile organic compounds tetrachloroethylene (PCE) and trichloroethylene (TCE) in known source areas, but also significant increases in levels of PCE not previously observed at two well locations. Monitoring well MW-2, which is located in the sidewalk adjacent to the SteppingStone Day School, increased from 175 ppb from an August 28, 2018 sampling event, to 8,250 ppb. MW-3D, located in the sidewalk adjacent to the Site along Vleigh Place, increased from 200 ppb from a March 26, 2018 sampling event, to 2,060 ppb.

In addition, HydroTech completed a supplemental round of soil vapor sampling on November 15, 2018 to assist in evaluating not only current soil gas concentrations but provide an indication as to the efficiency of the Soil Vapor Extraction (SVE) system which commenced operation in the summer of 2018. While the sample results do indicate the SVE system may be positively influencing soil gas conditions in the area immediately surrounding the extraction wells, the results at soil vapor points SV-2, SV-6, and SV-7 continue to show elevated concentrations of PCE, TCE, or both. The aforementioned soil vapor points are located in the sidewalks paralleling Vleigh Place and adjacent to the SteppingStone Day School.

HydroTech also completed an additional soil vapor intrusion (SVI) evaluation of Regency Gardens Apartments on January 9, 2019 which mirrored previous evaluations. The results indicate that concentrations of PCE in sub-slab soil vapor have not

sufficiently decreased after implementation of remedial measures. Specifically, sub-slab vapor points SSB-RG-3 and SSB-RG-4 had concentrations of 2,700 ppb and 5,200 ppb respectively. These results are indicative of the continued presence of site related contaminants beneath the basement slab of Regency Gardens Apartments.

Additional Remedial Action work requested:

New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) have reviewed the results of the aforementioned groundwater, soil vapor, and SVI sampling events. Additional actions are needed to address elevated off-site soil gas concentrations of PCE and TCE.

While a previous SVI study had been performed at this school in 2016, in light of the reported elevated concentration of PCE in MW-2, which is in the direct vicinity of the school, the NYSDOH has recommended re-evaluating the potential for soil vapor intrusion into the school. The quantity of samples and their locations are to mirror the previous SVI investigation performed at this school. See the attached letter from NYSDOH regarding the SVI re-evaluation for the SteppingStone Day School. Please contact the SteppingStone Day School to arrange and complete sampling within 30 days of receipt of this letter.

In regard to Regency Gardens Apartments, upon review of the most recent SVI evaluation by NYSDOH, concentrations of site-related chemicals in sub-slab soil vapor have not sufficiently decreased. Sampling data from the January 2019 sampling event indicate that contamination migration is still not adequately controlled and as a result, mitigation is necessary. Please refer to the Soil Vapor/Indoor Air Matrix B (attached) which details sub-slab concentrations of PCE above 1,000 ppb require mitigation, regardless of the reported indoor air concentration. As such, a sub-slab depressurization system (SSDS), or similarly engineered system(s), will need to be implemented to address the potential for exposure associated with soil vapor intrusion into the effected buildings. Please refer to the attached letter from NYSDOH regarding Regency Garden Apartments.

I request a detailed schedule within 7 days of receipt of this letter for the implementation of an SSDS (or similar system) and should include: planning, negotiations with building owner(s), design, and implementation. The system is to be completed and operational within 90 days of receipt of this letter.

If you have any questions concerning this matter, I can be reached at (518)402-9767 or daniel.mcnally@dec.ny.gov, or the NYSDOH Project Manager Dawn Hettrick at (518)402-7860 or dawn.hettrick@health.ny.gov.

Sincerely,

Dan McNally, Project Manager
Remedial Bureau B, Section A
Division of Environmental Remediation

Enclosures: NYSDOH Letter, SVI Evaluation at Stepping Stone Day School
NYSDOH Letter, Mitigation for Regency Gardens Apartments
NYSDOH Soil vapor/Indoor Air Matrix B

ec:
A. Matatov, VP Capital Holdings LLC
T. Khouri, HydroTech Environmental
P. Matli, HydroTech Environmental
G. Duke, Brown Sharlow Duke & Fogel, P.C.
J. Deming, NYSDOH
D. Hettrick, NYSDOH
J. Nehila, NYSDEC
G. Burke, NYSDEC
M. Komoroske, NYSDEC
D. McNally, NYSDEC

NEW YORK STATE OF OPPORTUNITY. Department of Health

ANDREW M. CUOMO
Governor

HOWARD A. ZUCKER, M.D., J.D.
Commissioner

SALLY DRESLIN, M.S., R.N.
Executive Deputy Commissioner

February 6, 2019

Mr. Daniel McNally
Remedial Bureau B
Division of Environmental Remediation
NYS Dept. of Environmental Conservation
625 Broadway, 12th Floor
Albany, NY 12233

Re: Recommendation to Mitigate
Regency Garden Apartments
57-77 Vleigh Place Site
Site #241168
Flushing, Queens County

Dear McNally:

At your Department's request, we have reviewed the analytical data for sub-slab and indoor air collected from the Regency Garden Apartments in January 2019. From that data, we noted that concentrations of site-related chemicals in sub-slab soil vapor in buildings across the street from the site have not sufficiently decreased after implementation of remedial measures at the site.

When soil vapor intrusion was investigated at the Regency Garden Apartments in 2017 elevated concentrations of site-related chemicals were detected in sub-slab soil vapor. At that time the participant planned to quickly implement remedial measures on-site with the objective of reducing and controlling migration of contaminants from the site and a monitoring program was established for the Regency Garden Apartments. Sampling data from December 2018 still show that contamination migration is not adequately controlled and as a result we recommend installation of sub-slab depressurizations systems, or similarly engineered systems, to address the potential for exposure associated with soil vapor intrusion mitigation in the effected buildings at the Regency Garden Apartments. This includes buildings 141-05, 141-12, 141-18 and 141-24 78th Ave. If you have any questions, please contact me at (518) 402-7860.

Sincerely,

Dawn E. Hettrick, P.E.
Bureau of Environmental Exposure Investigation

ec: J. Deming / e-File
C. Westerman – NYSDOH MARO
C. D'Andrea – NYC DOHMH
G. Burke / M. Komoroske – NYSDEC Central Office
J. O'Connell – NYSDEC Region 2

NEW YORK STATE OF OPPORTUNITY. Department of Health

ANDREW M. CUOMO
Governor

HOWARD A. ZUCKER, M.D., J.D.
Commissioner

SALLY DRESLIN, M.S., R.N.
Executive Deputy Commissioner

February 6, 2019

Mr. Daniel McNally
Remedial Bureau B
Division of Environmental Remediation
NYS Dept. of Environmental Conservation
625 Broadway, 12th Floor
Albany, NY 12233

Re: Soil Vapor Intrusion sampling at
Steppingstone Day School
57-77 Vleigh Place
Site #241168
Flushing, Queens County

Dear McNally:

At your Department's request, we have reviewed the analytical data for groundwater collected from monitoring wells around the site in December 2018. From that data, we noted that concentrations of site-related chemicals in MW-2 have increased significantly. This well is near the Steppingstone Day School.

When soil vapor intrusion was investigated at the Steppingstone Day School in 2016, our determination was that no further action was necessary. At that time, concentrations of site related contaminants in groundwater were much lower than this most recent round of sampling. Since it is unknown why contamination in groundwater has increased and how it may influence soil vapor concentrations under the Steppingstone Day School, we recommend re-evaluating soil vapor intrusion in the day school.

Please request that the participant contact the day school to arrange sampling. If the participant has difficulties obtaining access or if the day school operator has any questions about the sampling, please have them contact me. If you have any questions, please contact me at (518) 402-7860.

Sincerely,

Dawn E. Hettrick, P.E.
Bureau of Environmental Exposure Investigation

ec: J. Deming / e-File
C. Westerman – NYSDOH MARO
C. D'Andrea – NYC DOHMH
G. Burke / M. Komoroske – NYSDEC Central Office
J. O'Connell – NYSDEC Region 2

Soil Vapor/Indoor Air Matrix A

May 2017

Analytes Assigned:
Trichloroethene (TCE), *cis*-1,2-Dichloroethene (*c*12-DCE), 1,1-Dichloroethene (11-DCE), Carbon Tetrachloride

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)		
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 0.2	0.2 to < 1	1 and above
< 6	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
6 to < 60	4. No further action	5. MONITOR	6. MITIGATE
60 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX A

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 0.20 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

Soil Vapor/Indoor Air Matrix B

May 2017

Analytes Assigned:
Tetrachloroethene (PCE), 1,1,1-Trichloroethane (111-TCA), Methylene Chloride

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)		
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 3	3 to < 10	10 and above
< 100	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
100 to < 1,000	4. No further action	5. MONITOR	6. MITIGATE
1,000 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX B

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 1 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

Soil Vapor/Indoor Air Matrix C

May 2017

Analytes Assigned:
Vinyl Chloride

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)	
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 0.2	0.2 and above
< 6	1. No further action	2. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
6 to < 60	3. MONITOR	4. MITIGATE
60 and above	5. MITIGATE	6. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX C

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 0.20 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

Appendix 10
Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

77-57 Vleigh Place
77-39/63 Vleigh Place a.k.a. 141-15 78th Avenue
Queens, New York
NYSDEC Site Number: C241168

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B. Low Flow Sampling Protocol and Monitoring Well Purge/Sampling Form
C. Sampling Guidelines and Protocols for FPOA and PFCs
D. Sample Chain of Custody Form
E. Conventional Laboratory QA/QC

1.0 Introduction

This Quality Assurance Project Plan (QAPP) has been prepared for the samples to be collected as part of the Brownfield Cleanup Program (BCP) Site Management Plan (SMP) for the property located at 77-39/63 Vleigh Place in Kew Garden Hills neighborhood of Flushing Section of the County of Queens, New York (Site #C241168). The intent of the QAPP is to ensure that (1) proper equipment handling and maintenance is followed, (2) cross-contamination between sampling locations does not occur, (3) standard number of quality control replicate environmental samples are obtained, (4) proper procedures for samples custody are performed and (5) data review, validation and verification requirements are complete.

All related portions of the fieldwork will be performed, at a minimum, in accordance with acceptable industry standards. These acceptable industry standards include, but are not limited to, the ASTM Standard Guide for Phase II Environmental Site Assessments (E 1903-97) and the New York State Department of Environmental Conservation (NYSDEC) Bureau of Spill Prevention & Response Sampling Guidelines and Protocols, March 1991 and NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation, May 2010, 6 NYCRR Subpart 360.

1.1 Organization

The table below lists the individuals involved with QA/QC for this project. The resumes for these personnel can be found in **Attachment A.**

NAME	RESPONSIBILITY	ORGANIZATION
Paul Matli	Environmental Project Manager / Field Geologist	HydroTech Environmental Engineering and geology, DPC
Donald C. Anné	Data Validator / Quality Assurance Officer	Alpha Geoscience
York Analytical Laboratories, Inc. / Con-Test Analytical Laboratory	Laboratory Analysis	York Analytical Laboratories, Inc. / Con-Test Analytical Laboratory

2.0 Project Objective and Scope of Work

The objective of the investigations as set forth in the SMP is to perform the following tasks:

- Monitoring of the groundwater quality following the third round of ISCO injections in the in the southeastern upgradient vicinity of the site in the sidewalk on 78th Avenue. Seven monitoring wells identified as MW-1, MW-2, MW-5D, MW-6, MW-9, MW-11 and MW-12 will be sampled.

- Quarterly monitoring of the effectiveness of the groundwater remedial injection program in reducing the dissolved chlorinated solvents beneath the Site. To meet the above objective existing network of eleven on-site and off-site monitoring wells identified as MW-1, MW-2, MW-3S; MW-3D, MW-5D, MW-6, MW-7, MW-9, MW-11 to MW-13 will be sampled.

- Semi-annual monitoring of the effectiveness of the GAC drums associated with the SVE system in treating and removing organic vapors from extracted soil vapors by sampling the influent and effluent of the drums.

- Annual monitoring of the effectiveness of the SSDS system, which will be installed in the four basements of the four building at Regency Garden by sampling Indoor Air/outdoor samples identified as IA-RG-1 to IA-RG-4 and OA-RG-1.

- Annual monitoring of off-site soil vapors to determine the effectiveness of the interim SVE system in mitigating soil vapor impact emanating from groundwater and remaining soil beneath the Site by sampling off-site soil vapor points identified as SV-KG-1, SV-2, SV-8 and SV-9.

- Annual monitoring of On-site and off-site soil vapors to determine the effectiveness of the final SVE system in mitigating soil vapor impact emanating from groundwater and remaining soil beneath the Site by sampling on-site vacuum pressure monitoring ports identified as PT-3 to PT-6 and off-site soil vapor points identified as SV-2, SV-3, SV-6 to SV-11.

3.0 Sampling Procedures

3.1 Groundwater Sampling

Groundwater samples will be obtained from all existing on-site and off-site monitoring wells including MW-1, MW-2, MW-3S; MW-3D, MW-5D, MW-6, MW-7, MW-9, MW-11 to MW-13). These samples will be analyzed for TCL VOCs and for emerging contaminants identified as 1,4-dioxane and PFAS. The groundwater samples will be collected utilizing a low flow pump fitted with dedicated polyethylene tubing according to USEPA's Low Stress/Flow Groundwater Sampling Protocol (SOP #GW0001, Rev. 1996) utilizing a portable Horiba U-52 water quality meter which utilizes an in-line flow cell for water quality indicator measurements (the USEPA low flow sampling protocol and monitoring well purge/sampling form is provided in **Attachment B**). During this low flow sampling, the use of any equipment, materials or sampling jars that are known to contain Perfluorinated Compounds (PFCs) or polytetrafluoroethylene (PTFE) such as Teflon tubing, low density polyethylene (LDPE) tubing or sample bottle cap liners should be prevented. Besides any contact with PFC waterproofed cloths or PFC containing materials such as aluminum foils and many food and drink packaging materials and should be avoided (**Attachment C** provides sampling guidelines and protocols for FPOA and PFCs). Groundwater will be purged at a low flow rate of less than 500 milliliter per minute (mL/min) until water quality indicator parameters including pH, temperature, specific conductivity, oxidation reduction potential, dissolved oxygen and turbidity are stabilized. The sampling of each well will be performed once groundwater purging is completed.

The groundwater samples will be placed directly into pre-cleaned containers provided by the laboratory. Samples containers will be labeled and placed in a cooler filled with ice and maintained at 4 degrees Celsius. Each sample will be transmitted under proper chain of custody procedures to York Analytical laboratories, for analysis . **Table 1** provides the samples containers, volumes, test methods, preservation techniques, reporting limits and holding times for the groundwater samples.

3.2 SVE Soil Vapor and SSDS Ambient Air Sampling

The sampling for soil vapors from on-site vacuum pressure monitoring ports (PT-3 to PT-6) and off-site soil vapor points (SV-KG-1, SV-2, SV-3, SV-6 to SV-11) and the sampling of off-site ambient air samples at Regency Garden (IA-RG-1 to IA-RG-4 and OA-RG-1) will be performed in accordance with the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York October 2006. All samples will be collected utilizing 6 liter pre-cleaned, passivated, and evacuated whole air Summa® Canister. A 60-cm^3 plastic syringe will be used to purge approximately 1 to 3 implant volumes (i.e. the volume of the sample probe and tube) prior to collecting the soil vapor samples. Each air sampling canister will then be connected to a flow control valve set to collect the 6-L sample over a period of 6 hours at a rate of less than 0.2 liter per minute. The vapor/ambient air samples will be transmitted under proper chain of custody procedures to a NYSDOH ELAP-certified laboratory for analysis. **Table 2** provides the sample containers, volumes, test methods, reporting limits and holding times for the vapor/ambient air samples.

3.3 GAC Drums Testing

The influent and effluent air sampling at the GAC drums will be performed from ports mounts at the inlet and the outlet of each of the two drums for a total of four samples. This sampling will be utilizing 6 liter pre-cleaned, passivated, and evacuated whole air Summa® Canister. Each sampling canister will be connected to a flow control valve set to collect the 6-L sample over a period of 2 hours at a rate of less than 0.2 liter per minute. The influent and effluent air samples will be transmitted under proper chain of custody procedures to a NYSDOH ELAP-certified laboratory for analysis. **Table 2** provides the sample containers, volumes, test methods, reporting limits and holding times for the vapor/air samples.

4. Decontamination Methods, Quality Assurance and Quality Usability Objectives

A HydroTech field geologist (Paul I. Matli.) will adopt this QAPP during the collection of soil and groundwater samples in order to ensure that (1) proper equipment handling and maintenance is followed, (2) cross-contamination between sampling locations does not occur, (3) standard number of quality control replicate environmental samples are obtained, (4) proper procedures for samples custody are performed and (5) data review, validation and verification requirements are complete.

During the field sampling, HydroTech field geologist will be responsible for monitoring the decontamination procedure of every piece of sampling equipment prior to each use by field personnel. The following procedure will be implemented during the decontamination process:

- Wipe clean and wash with Alconox®
- Potable water rinse
- Methanol rinse
- Deionized water rinse
- Air dry

All decontamination procedures will be performed in an area segregated from any sampling areas. Any rinsate from the decontamination area will be contained and placed in 55-gallons drums and properly disposed of.

The following Quality Assurance (QA) and Quality Control (QC) samples will be collected and analyzed for groundwater sampling.

- One trip blank per trip will be analyzed via EPA Method 8260
- One equipment blank (rinsate blank) for groundwater will be analyzed per each day of sampling via EPA Method 8260, EPA Method 8270D SIM and Modified EPA Method 537.
- One field blank for groundwater will be analyzed per each day of sampling via EPA Method 8260 and Modified EPA Method 537.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) samples will also be collected and analyzed.

- One MS groundwater sample and one MSD groundwater sample will be analyzed for every 20 samples via EPA Method 8260, EPA Method 8270D SIM and Modified EPA Method 537.

All soil vapor samples, ambient air samples, Influent/effluent air samples and groundwater samples will be managed and analyzed with the following protocol:

- Samples will be labeled and logged in a monitor notebook upon collection.
- In the field, samples will be the responsibility of, and will stay with, the Field Geologist of HydroTech.
- Once samples have been collected they are returned to HydroTech office and logged in for temporary (i.e. < 48 hrs) storage.
- Groundwater samples will be refrigerated to maintain a temperature at a maximum 4 degrees Celsius.
- Hydro Tech Project Manager will be then responsible for arranging transport of samples to State-certified (ELAP) laboratory for analysis under a proper Chain of Custody. **Attachment D** provides a sample chain of custody form.
- Laboratory personnel will record the date and time of samples arrival at the lab and ensure that all holding times for each matrix and analysis will be met.
- After samples are analyzed, laboratory information is added to the label.
- The Sample Chain of Custody Form will be used to record all transport and storage information.
- Samples analytical data report will undergo QA/QC performed by a laboratory officer who checks each data sheet for precision, missing or illegible information, errors in calculation and values outside of the expected range. **Attachment E** provides conventional lab QA/QC procedures associated with soil, vapor/air and groundwater methods and analyses.

- ASP Protocol, Category B deliverables will be provided for groundwater samples.

Upon completion of the sampling and analysis, an independent QA Officer will generate a data usability analysis. The analysis shall consist of (1) an assessment to determine if the data quality objectives were met; (2) evaluation of field duplicate results to indicate the samples are representative; (3) comparison of the results of all field blanks, trip blanks and methods blanks with full data sets to provide information concerning contaminants that may have been introduced during sampling, shipping or analyzing; (4) evaluation of matrix effects to assess the performance of the analytical method with respect to sample matrix, and determine whether the data has been biased high or low due to matrix effects. The data usability analysis shall be included in the QA summary of the Field Investigation Report. **Table 1 and Table 2** provide the sampling and analytical Method Requirements for groundwater and vapor/ambient air.

Table 1: Sampling & Analytical Method Requirements – Groundwater Samples

Water Matrix [1] / Sample ID	Parameters	Minimum Sample Volume [2]	Sample Container	Sample Preservation	Analytical Method	Lab Reporting Limit	Technical Holding Time
Groundwater Sampling Following 3rd ISCO Injections							
MW1, MW-2, MW-5D, MW-6, MW-9, MW-11, MW-12/ Matrix Spike /Matrix Spike Duplicate/ Field Blank/ Equipment Blank/Trip Blank	PCE & TCE	120 ml	40 ml VOC vial with Teflon lined cap	1:1 HCL to pH<2 Cool 2-6 °C	EPA Method 8260**B**	Compound Specific (0.5-20 µg/L)	14 days
Quarterly Groundwater Sampling Program							
MW1, MW-2, MW-3D, MW-5D, MW-6, MW-7, MW-9, MW-11 to MW-13/ Matrix Spike /Matrix Spike Duplicate/ Field Blank/ Equipment Blank/Trip Blank	PCE & TCE	120 ml	40 ml VOC vial with Teflon lined cap	1:1 HCL to pH<2 Cool 2-6 °C	EPA Method 8260**B**	Compound Specific (0.5-20 µg/L)	14 days
MW1, MW-2, MW-3D, MW-5D, MW-6, MW-7, MW-9, MW-11 to MW-13/ Matrix Spike /Matrix Spike Duplicate/ Equipment Blank	1,4 Dioxine	1 liter	Amber glass with Teflon lined cap	Cool to 4 °C	EPA Method 8270D SIM	Compound Specific (≤0.28 µg/L)	7 days
MW1, MW-2, MW-3D, MW-5D, MW-6, MW-7, MW-9, MW-11 to MW-13/ Matrix Spike /Matrix Spike Duplicate/ Field Blank/ Equipment Blank	Perfluorooctanoic acid (PFOA) and other perfluorinated compounds (PFCs)	500	500 ml ml HDPE or polypropylene	Cool to 4 °C	Modified EPA Method 537	Compound Specific (≤2 ng/L)	14 days

(1)….Analytical Services Protocols (ASP) Deliverables Package Category B

Table 2: Sampling & Analytical Method Requirements – On-Site/Off-Site Vapor/Ambient Air Samples and GAC Influent/Effluent

Vapor/Ambient Air Matrices [1] Sample ID	Parameters	Minimum Sample Volume	Sample Container	Sample Preservation	Analytical Method	Lab Reporting Limit	Technical Holding Time
Interim SVE System: (SV-KG-1, SV-2, SV-8 and SV-9) **Final SVE System** (PT-3 to PT-6, SV-2, SV-3, SV-6 to SV-11) **Sampling at Regency** (IA-RG-1 to IA-RG-4 and OA-RG-1) **Influent and Effluent air sampling at the two GAC drum**s (Inf-1, Eff-1, Inf-2 Eff-2)	VOCS	6 L	Summa® Canister	NA	TO + 15	Compound Specific (1-20 µg/m^3)	30 days

(1)….Analytical Services Protocols (ASP) Deliverables Package Category B

Attachment A
Resume of Key Personnel Involved with This Project

Paul I. Matli, Ph.D., P.G.

EXPERIENCES

Senior Project Manager/Director of Technical Operations/Vice President of Technical Operations
Apr. 2005 - Nov. 2005 & July 2006 - Present/June 2015 - December 2017/December 2017- Present
Hydro Tech Environmental Corp. D/B/A Hydro Tech Environmental Engineering and Geology, DPC – USA

Completed Environmental Assessment Statements, Phase I Environmental Site Assessments, Phase II Investigations Work Plans, environmental monitoring programs of groundwater and indoor air quality, field sampling of soil, water, air, soil gas, mold and solid wastes, data evaluation through Quality Assurance and Quality Control programs and reports writing. Prepared and engineered Phase III Remedial Action Work Plans for regulated developments, superfund sites and hazardous waste facilities by implementing in-situ bio-chemical remedial technologies, ex-situ disposal of impacted media and on-site mitigation methods of soil vapor intrusion. Supervised and coordinated the closure and removal of petroleum storage tanks. Fulfilled the task of Health and Safety Officer and the duties of a Geologist at a New York State Brownfield Cleanup Program site and multiple New York City Brownfield Cleanup Program sites.

Vocational Lecturer of the Course "Ecology and Environment"
Nov. 2003 - Feb. 2004
Saint Joseph University – Lebanon

Introduced undergraduate students in the School of Agriculture Engineering and the Nursing School to advanced knowledge in the fields of ecology, environment, ecosystem management, earth science and multivariate statistical analytical methods.

Agriculture Engineer in the Italian Rural Development Project in the Upper Bekaa Valley, Baalbek-Hermel Region
May 2003 - Jan. 2004
Lebanese Agricultural Research Institute - Lebanon

Contributed to boosting agricultural production in rural communities in a semi-arid region by identifying deficient production and marketing elements in their farming system and promoting sustainable agriculture by introducing drought tolerant crops and the construction and management of engineered water reservoirs.

Teaching Assistant
Apr.1999-Sept. 2002
Tokyo University of Agriculture and Technology - Japan

Played a key role in the completion of research thesis of graduate research students by instructing and assisting them in their experimental designs and the application of statistical analytical methods.

Environmental Manager of Ammiq Private Wetlands in the Bekaa Valley - Lebanon
Oct.1997 - Sept. 1998

Successfully managed the exploitation of natural resources of privately owned wetlands by local stake-holders and implemented the United Nations strategies to suppress hunting of endangered bird species and waterfawls in coordination with government and international non-government organizations.

EDUCATION

Ph.D. in Environmental Sciences [(a)]
Apr. 1999 - Sept. 2002
Tokyo University of Agriculture and Technology- Japan

Research Theme: Conducted field research of crop physiological responses to micro-climatic conditions and developed empirical and multivariate statistical models predicting the impact of future global warming on crop production.

M.Sc. in Environmental Sciences [(b)]
Sept. 1995 - Sept. 1997
International Center for Advanced Mediterranean Agronomic Studies - Greece
Research Theme: Performed field surveys and laboratory analytical studies of the physico-chemical properties of forest and plant species in promoting wildland fires and developed empirical statistical models predicting their inputs into forest fire behavior prediction systems.

D.S.P.G.S. in Management and Conservation of Mediterranean Ecosystems
Nov. 1994 - Aug. 1995
International Center for Advanced Mediterranean Agronomic Studies - Greece

Diploma of Agricultural Engineer [(c)]
Sept. 1989 - July 1994
University of Saint Joseph - Lebanon
Research Theme: Collected and established a socio-economic database of the impact of trout fish farms on the bio-chemical property and microbial quality of fresh watercourses.

PEER-REVIEWED PUBLICATIONS

- **Matli P.I.**, Aoki M., Ozawa Y., Hideshima Y., Nakayama H., and Maruya S. 2002. Characterization of canopy photosynthetic CO_2 flux and leaf stomatal conductance responses of potato crop to changing field meteorological conditions in Hokkaido (in English). Journal of Agricultural Meteorology, **58**(3)115-122.
- Dimitrakopoulos A.P., and **Matli P.** 2001. Bulk density and physical properties of *Sarcopoterium spinosum* (L.) Spach as fuel characteristics (in English). Journal of Mediterranean Ecology, **2**:75-82.
- Elzein G., **Matli P.**, and Darwish S. 1997. The Study of physico-chemical and biological parameters of fresh water in fisheries in the Bekaa Valley (in French). Lebanese Scientific Bulletin, **10**(1):3-20.
- **Matli P.** 1998. Measures and strategies to prevent and manage forest fires in Lebanon (in Arabic). Al
- Nahar Newspaper; Nahar El Shabab, Sept. 22, pp.2-3.
- **Matli P.** 1997. A preliminary planning of managerial strategies for the conservation and management of Ammiq private wetlands (in English). Technical report submitted to the owners committee of Ammiq Estates-Lebanon, 10p.

PROFESSIONAL AFFILATIONS

- New York State Professional Geologist.
- Member of the American Institute of Professional Geologists.

EXTRACURRICULAR TRAININGS AND SKILLS

- 40 Hours OSHA training Course in Health & Safety Methods in Handling Hazardous Materials, USA, Feb. 2010.
- 10 Hours OSHA Training Course in Construction Safety & Health, Feb.2013.
- Gold Certified Environmental Professional for oversight and management of remedial activities at hazardous sites in compliance with the New York City Mayor's Office of Environmental Remediation, Feb. 2015.

[(a), (b), (c)] Accredited US Educational Equivalence, *Globe Language Services, Inc.*

DONALD C. ANNÉ
SENIOR CHEMIST

EDUCATION: M.S., Chemical Oceanography, Florida Institute of Technology, 1981
B.A., Earth Sciences, Millersville University of Pennsylvania, 1975

SPECIAL TRAINING: Certified 40-Hour OSHA Health and Safety
Certified 8-Hour OSHA Supervisory Course
Ground Water Geochemistry (NWWA)
Ground Water Pollution and Hydrology (Princeton Associates)
Quality Assurance Programs for Environmental Monitoring Data (Stat-A-Matrix)

PROFESSIONAL AFFILIATIONS: American Chemical Society (AFS), 1979-Present

EXPERIENCE SUMMARY:

Mr. Anné has more than 27 years of environmental chemistry experience specializing in data validation, environmental sampling, analytical methodologies, petroleum fingerprinting, laboratory audits, field sampling audits, and preparing Quality Assurance Project Plans and Quality Assurance Manuals. Mr. Anné's experience includes analytical laboratory work with gas chromatography, atomic absorption, infrared spectrometry and wet chemistry methods.

PROJECT EXPERIENCE:

Quality Assurance/Quality Control of Chemical Data

Mr. Anné has more than 20 years experience as a data validator and quality assurance officer. Mr. Anné has validated data for most EPA Regions and under several independent state programs, including the NYSDEC. He has performed laboratory and field audits as well as written Quality Assurance Project Plans. Mr. Anné has written, reviewed, and initiated laboratory Quality Assurance Manuals for laboratories to maintain their regulatory compliance. Typical project experience includes:

- Senior Chemist responsible for data validation. Reviewed chemical data for several projects under the New Jersey ISRA regulations. The clients included industry and utilities.

- Supervising Environmental Scientist responsible for data validation. Reviewed chemical laboratory data for adherence to QA/QC protocols for several key projects, including National Priorities List sites and RCRA Corrective Actions located in EPA Regions I, II, III, IV, V, and IX. Validated analytical data, outlined problems and actions to be taken, and qualified all affected data. Consulted with project managers on data usability, and recommended corrective actions to support project goals. Responded to comments made by regulators regarding data quality.

- Supervising Environmental Scientist recognized by the New York State Department of Environmental Conservation (NYSDEC) to perform third party data validation. Attended NYSDEC workshop on data validation as part of the requirements set forth by NYSDEC. Performed data validation in support of NYSDEC STARS and ASP programs as well as data in support of the NYSDEC Part 360 Regulations for landfills. Validated data for an Albany area municipal landfill.

- Supervising Environmental Scientist responsible for developing and preparing Quality Assurance Project Plans (QAPPs) for several state and federal Superfund sites and federal RCRA corrective action sites. Negotiated with regulators for the acceptance of the QAPPs. The sites were located throughout the eastern United States.

- Environmental Chemist responsible for developing a laboratory QA/QC program which fulfilled requirements of the EPA and agencies from the States of Texas and Louisiana. Implemented and managed the program throughout DOE's SPR Environmental laboratories. Received verbal commendations from EPA and the Texas Water commission on the QA/QC Program.

Environmental Chemistry

Mr. Anné is experienced in sampling soil, water, air, and wastes in accordance with federal and state guidelines. He has performed field sampling audits and prepared sampling plans for numerous projects in accordance with applicable programmatic requirements. Mr. Anné is familiar with the geochemical aspects of fate and transport of contaminants. Mr. Anné's typical project experience includes:

- Data manager for the Pennwalt Corporation's RCRA Corrective Action RFI Phase I program. The project included quantifying and characterizing soil contamination and hydrogeologic flow systems of 12 SWMUs at a flourochemicals plant in Thorofare, New Jersey. Validated and prepared QA/QC reports for data generated during the project. Qualified all data in preparation of the final report. Work was performed under the direction of NJDEP.

- Project Chemist in charge of field sampling activities, including coordinating and scheduling all subcontracted laboratory work for more than 25 sites in Connecticut. Trained field teams in sampling techniques for soil, groundwater, and surface water; chain of custody requirements; sampling QA/QC protocols; and analytical requirements. Work was performed under the scrutiny of ConnDEP.

- Field Team Leader for a major hazardous waste drum excavation project. Supervised all field activities including site safety; excavation; removal, sampling, and over packing of drums; staging and sampling of contaminated soil; and preparation of samples. Coordinated excavation and laboratory subcontractors. Work was performed under the scrutiny of ConnDEP.

- Created an environmental monitoring program for the Bryan Mound site of DOE's Strategic Petroleum Reserve for testing ground water and surface water. Developed sampling protocols, frequency of sampling, and lists of target analytes. This program was designed to provide baseline data for pre-spill conditions in the event of a release. The site was under scrutiny by EPA Region V and the Texas Water commission.

- Project Chemist responsible for developing analytical QA/QC program that included sampling and chemical analyses of surface water, groundwater, soil, and sediment matrices as part of a Remedial Investigation/Feasibility Study (RI/FS). The RI/FS involved more than 25 sites throughout the State of Connecticut. Work was under the guidance of ConnDEP.

Analytical Chemistry

Mr. Anné has experience working in both fixed-base and mobile laboratories. His experience includes the use of gas chromatography, atomic absorption spectrometers, infrared spectrometers, and numerous wet chemistry and preparation equipment methods. He has served in the laboratory as an analyst, laboratory advisor, and QA officer. He has interfaced with regulators in the area of analytical chemistry and has experience in petroleum fingerprinting techniques and methods. Typical projects include:

- Performed bench scale experiments for St. Lawrence Zinc in order to obtain the optimum level of Phlotec necessary to treat discharged water to resolve an N.O.V. for the SPDES outfall. The optimum level of Phlotec would precipitate enough dissolved zinc for the water to meet the discharge requirement. Also performed routine analyses of samples after implementing the treatment, to insure that the proper concentration was being used.

- Environmental Chemist in charge of project to design updates for the DOE's laboratories at its SPR facilities. Evaluated IR and FT-IR instrumentation and personal computers to link with existing and future instrumentation. Wrote procedures for the acceptance of an alternative oil & grease method for NPDES permit

monitoring by EPA Region V. Coordinated all site activities necessary for implementing upgrades.

- Environmental Chemist in charge of replacing obsolete total organic carbon (TOC) analyzers for the SPR laboratories. Evaluated state-of-the-art TOC analyzers and recommended replacement TOC analyzer. Negotiated with supplier and wrote technical specification for the bid process required by DOE. Supervised installation and set-up of all new TOC analyzers.

- Analytical Chemist for Berkley Products Company responsible for product development. Analyzed competitor's products and formulated new coatings with equal or better quality. Responsible for solvent operations which included managing the waste solvent recovery operations, solvent formulation, and manufacturing QA/QC. Worked with sales and manufacturing staff to address and resolve client complaints. Received two cash bonuses for suggestions on the manufacture of products which saved the company money.

- Analytical Chemist for the mobile laboratory responsible for sample preparation in support of several projects for a range of clients located in three EPA regions and in conjunction with several state agencies. Extracted, concentrated, and prepared water and soil samples for analyses by GC/FIND, GC/ECD, GC/PID, and GC/MS. Samples were prepared for PCB, pesticide, polynuclear aromatic hydrocarbon, and petroleum hydrocarbon analyses.

EMPLOYMENT:

2005- present, Alpha Geoscience
1998-2005, Alpha Environmental Consultants, Inc.
1990-1998, McLaren/Hart
1986-1990, Fred C. Hart Associates
1985-1986, Boeing Petroleum Services
1982-1985, Petroleum Operations and Support Services
1981-1982, Dravo Utility Constructors
1979-1981, Florida Institute of Technology
1975-1979, Berkley Products Company

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Attachment B
Low Flow Sampling Protocol and Monitoring Well Purge/Sampling Form

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS

Quality Assurance Unit
U.S. Environmental Protection Agency – Region 1
11 Technology Drive
North Chelmsford, MA 01863

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Prepared by:_____ _____
(Robert Reinhart, Quality Assurance Unit) Date

Approved by:_____ _____
(John Smaldone, Quality Assurance Unit) Date

Revision Page

Date	Rev #	Summary of changes	Sections
7/30/96	1	Finalized	
01/19/10	2	Updated	All sections
3/23/17	3	Updated	All sections
9/20/17	4	Updated	Section 7.0

Table of Contents

1.0 USE OF TERMS

Equipment blank: The equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank needs only to include the pump in subsequent sampling rounds. If the pump and tubing are dedicated to the well, the equipment blank is collected prior to its placement in the well. If the pump and tubing will be used to sample multiple wells, the equipment blank is normally collected after sampling from contaminated wells and not after background wells.

Field duplicates: Field duplicates are collected to determine precision of the sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

Indicator field parameters: This SOP uses field measurements of turbidity, dissolved oxygen, specific conductance, temperature, pH, and oxidation/reduction potential (ORP) as indicators of when purging operations are sufficient and sample collection may begin.

Matrix Spike/Matrix Spike Duplicates: Used by the laboratory in its quality assurance program. Consult the laboratory for the sample volume to be collected.

Potentiometric Surface: The level to which water rises in a tightly cased well constructed in a confined aquifer. In an unconfined aquifer, the potentiometric surface is the water table.

QAPP: Quality Assurance Project Plan

SAP: Sampling and Analysis Plan

SOP: Standard operating procedure

Stabilization: A condition that is achieved when all indicator field parameter measurements are sufficiently stable (as described in the "Monitoring Indicator Field Parameters" section) to allow sample collection to begin.

Temperature blank: A temperature blank is added to each sample cooler. The blank is measured upon receipt at the laboratory to assess whether the samples were properly cooled during transit.

Trip blank (VOCs): Trip blank is a sample of analyte-free water taken to the sampling site and returned to the laboratory. The trip blanks (one pair) are added to each sample cooler that contains VOC samples.

2.0 SCOPE & APPLICATION

The goal of this groundwater sampling procedure is to collect water samples that reflect the total mobile organic and inorganic loads (dissolved and colloidal sized fractions) transported through the subsurface under ambient flow conditions, with minimal physical and chemical alterations from sampling operations. This standard operating procedure (SOP) for collecting groundwater samples will help ensure that the project's data quality objectives (DQOs) are met under certain low-flow conditions.

The SOP emphasizes the need to minimize hydraulic stress at the well-aquifer interface by maintaining low water-level drawdowns, and by using low pumping rates during purging and sampling operations. Indicator field parameters (e.g., dissolved oxygen, pH, etc.) are monitored during purging in order to determine when sample collection may begin. Samples properly collected using this SOP are suitable for analysis of groundwater contaminants (volatile and semi-volatile organic analytes, dissolved gases, pesticides, PCBs, metals and other inorganics), or naturally occurring analytes. This SOP is based on Puls, and Barcelona (1996).

This procedure is designed for monitoring wells with an inside diameter (1.5-inches or greater) that can accommodate a positive lift pump with a screen length or open interval ten feet or less and with a water level above the top of the screen or open interval (Hereafter, the "screen or open interval" will be referred to only as "screen interval"). This SOP is not applicable to other well-sampling conditions.

While the use of dedicated sampling equipment is not mandatory, dedicated pumps and tubing can reduce sampling costs significantly by streamlining sampling activities and thereby reducing the overall field costs.

The goal of this procedure is to emphasize the need for consistency in deploying and operating equipment while purging and sampling monitoring wells during each sampling event. This will help to minimize sampling variability.

This procedure describes a general framework for groundwater sampling. Other site specific information (hydrogeological context, conceptual site model (CSM), DQOs, etc.) coupled with systematic planning must be added to the procedure in order to develop an appropriate site specific SAP/QAPP. In addition, the site specific SAP/QAPP must identify the specific equipment that will be used to collect the groundwater samples.

This procedure does not address the collection of water or free product samples from wells containing free phase LNAPLs and/or DNAPLs (light or dense non-aqueous phase

liquids). For this type of situation, the reader may wish to check: Cohen, and Mercer (1993) or other pertinent documents.

This SOP is to be used when collecting groundwater samples from monitoring wells at all Superfund, Federal Facility and RCRA sites in Region 1 under the conditions described herein. Request for modification of this SOP, in order to better address specific situations at individual wells, must include adequate technical justification for proposed changes. All changes and modifications must be approved and included in a revised SAP/QAPP before implementation in field.

3.0 BACKGROUND FOR IMPLEMENTATION

It is expected that the monitoring well screen has been properly located (both laterally and vertically) to intercept existing contaminant plume(s) or along flow paths of potential contaminant migration. Problems with inappropriate monitoring well placement or faulty/improper well installation cannot be overcome by even the best water sampling procedures. This SOP presumes that the analytes of interest are moving (or will potentially move) primarily through the more permeable zones intercepted by the screen interval.

Proper well construction, development, and operation and maintenance cannot be overemphasized. The use of installation techniques that are appropriate to the hydrogeologic setting of the site often prevent "problem well" situations from occurring. During well development, or redevelopment, tests should be conducted to determine the hydraulic characteristics of the monitoring well. The data can then be used to set the purging/sampling rate, and provide a baseline for evaluating changes in well performance and the potential need for well rehabilitation. Note: if this installation data or well history (construction and sampling) is not available or discoverable, for all wells to be sampled, efforts to build a sampling history should commence with the next sampling event.

The pump intake should be located within the screen interval and at a depth that will remain under water at all times. It is recommended that the intake depth and pumping rate remain the same for all sampling events. The mid-point or the lowest historical midpoint of the saturated screen length is often used as the location of the pump intake. For new wells, or for wells without pump intake depth information, the site's SAP/QAPP must provide clear reasons and instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected. If the depths to top and bottom of the well screen are not known, the SAP/QAPP will need to describe how the sampling depth will be determined and how the data can be used.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU, and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection

may still take place provided the indicator field parameter criteria in this procedure are met. If after 2 hours of purging indicator field parameters have not stabilized, one of three optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization), c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may reflect a sampling bias and therefore, the data may not meet the data quality objectives of the sampling event).

It is recommended that low-flow sampling be conducted when the air temperature is above 32°F (0°C). If the procedure is used below 32°F, special precautions will need to be taken to prevent the groundwater from freezing in the equipment. Because sampling during freezing temperatures may adversely impact the data quality objectives, the need for water sample collection during months when these conditions are likely to occur should be evaluated during site planning and special sampling measures may need to be developed. Ice formation in the flow-through-cell will cause the monitoring probes to act erratically. A transparent flow-through-cell needs to be used to observe if ice is forming in the cell. If ice starts to form on the other pieces of the sampling equipment, additional problems may occur.

4.0 HEALTH & SAFETY

When working on-site, comply with all applicable OSHA requirements and the site's health/safety procedures. All proper personal protection clothing and equipment are to be worn. Some samples may contain biological and chemical hazards. These samples should be handled with suitable protection to skin, eyes, etc.

5.0 CAUTIONS

The following cautions need to be considered when planning to collect groundwater samples when the below conditions occur.

If the groundwater degasses during purging of the monitoring well, dissolved gases and VOCs will be lost. When this happens, the groundwater data for dissolved gases (e.g., methane, ethene, ethane, dissolved oxygen, etc.) and VOCs will need to be qualified. Some conditions that can promote degassing are the use of a vacuum pump (e.g., peristaltic pumps), changes in aperture along the sampling tubing, and squeezing/pinching the pump's tubing which results in a pressure change.

When collecting the samples for dissolved gases and VOCs analyses, avoid aerating the groundwater in the pump's tubing. This can cause loss of the dissolved gases and VOCs in

the groundwater. Having the pump's tubing completely filled prior to sampling will avoid this problem when using a centrifugal pump or peristaltic pump.

Direct sun light and hot ambient air temperatures may cause the groundwater in the tubing and flow-through-cell to heat up. This may cause the groundwater to degas which will result in loss of VOCs and dissolved gases. When sampling under these conditions, the sampler will need to shade the equipment from the sunlight (e.g., umbrella, tent, etc.). If possible, sampling on hot days, or during the hottest time of the day, should be avoided. The tubing exiting the monitoring well should be kept as short as possible to avoid the sun light or ambient air from heating up the groundwater.

Thermal currents in the monitoring well may cause vertical mixing of water in the well bore. When the air temperature is colder than the groundwater temperature, it can cool the top of the water column. Colder water which is denser than warm water sinks to the bottom of the well and the warmer water at the bottom of the well rises, setting up a convection cell. "During low-flow sampling, the pumped water may be a mixture of convecting water from within the well casing and aquifer water moving inward through the screen. This mixing of water during low-flow sampling can substantially increase equilibration times, can cause false stabilization of indicator parameters, can give false indication of redox state, and can provide biological data that are not representative of the aquifer conditions" (Vroblesky 2007).

Failure to calibrate or perform proper maintenance on the sampling equipment and measurement instruments (e.g., dissolved oxygen meter, etc.) can result in faulty data being collected.

Interferences may result from using contaminated equipment, cleaning materials, sample containers, or uncontrolled ambient/surrounding air conditions (e.g., truck/vehicle exhaust nearby).

Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment and/or proper planning to avoid ambient air interferences. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

Clean and decontaminate all sampling equipment prior to use. All sampling equipment needs to be routinely checked to be free from contaminants and equipment blanks collected to ensure that the equipment is free of contaminants. Check the previous equipment blank data for the site (if they exist) to determine if the previous cleaning procedure removed the contaminants. If contaminants were detected and they are a concern, then a more vigorous cleaning procedure will be needed.

6.0 PERSONNEL QUALIFICATIONS

All field samplers working at sites containing hazardous waste must meet the requirements of the OSHA regulations. OSHA regulations may require the sampler to take the 40 hour OSHA health and safety training course and a refresher course prior to engaging in any field activities, depending upon the site and field conditions.

The field samplers must be trained prior to the use of the sampling equipment, field instruments, and procedures. Training is to be conducted by an experienced sampler before initiating any sampling procedure.

The entire sampling team needs to read, and be familiar with, the site Health and Safety Plan, all relevant SOPs, and SAP/QAPP (and the most recent amendments) before going onsite for the sampling event. It is recommended that the field sampling leader attest to the understanding of these site documents and that it is recorded.

7.0 EQUIPMENT AND SUPPLIES

A. Informational materials for sampling event

A copy of the current Health and Safety Plan, SAP/QAPP, monitoring well construction data, location map(s), field data from last sampling event, manuals for sampling, and the monitoring instruments' operation, maintenance, and calibration manuals should be brought to the site.

B. Well keys.

C. Extraction device

Adjustable rate, submersible pumps (e.g., centrifugal, bladder, etc.) which are constructed of stainless steel or polytetrafluoroethylene (PTFE, i.e. Teflon®) are preferred. PTFE, however, should not be used when sampling for per- and polyfluoroalkyl substances (PFAS) as it is likely to contain these substances.

Note: If extraction devices constructed of other materials are to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

If bladder pumps are selected for the collection of VOCs and dissolved gases, the pump setting should be set so that one pulse will deliver a water volume that is sufficient to fill a 40 mL VOC vial. This is not mandatory, but is considered a "best practice". For the proper operation, the bladder pump will need a minimum amount of water above the pump; consult the manufacturer for the recommended submergence. The pump's recommended submergence value should be determined during the planning stage, since it may influence well construction and placement of dedicated pumps where water-level fluctuations are significant.

Adjustable rate, peristaltic pumps (suction) are to be used with caution when collecting samples for VOCs and dissolved gases (e.g., methane, carbon dioxide, etc.) analyses. Additional information on the use of peristaltic pumps can be found in Appendix A. If peristaltic pumps are used, the inside diameter of the rotor head tubing needs to match the inside diameter of the tubing installed in the monitoring well.

Inertial pumping devices (motor driven or manual) are not recommended. These devices frequently cause greater disturbance during purging and sampling, and are less easily controlled than submersible pumps (potentially increasing turbidity and sampling variability, etc.). This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

D. Tubing

PTFE (Teflon®) or PTFE-lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics. As discussed in the previous section, PTFE tubing should not be used when sampling for PFAS. In this case, a suitable alternative such as high-density polyethylene tubing should be used.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for metal and other inorganics analyses.

Note: If tubing constructed of other materials is to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

The use of 1/4 inch or 3/8 inch (inside diameter) tubing is recommended. This will help ensure that the tubing remains liquid filled when operating at very low pumping rates when using centrifugal and peristaltic pumps.

Silastic tubing should be used for the section around the rotor head of a peristaltic pump. It should be less than a foot in length. The inside diameter of the tubing used at the pump rotor head must be the same as the inside diameter of tubing placed in the well. A tubing connector is used to connect the pump rotor head tubing to the well tubing. Alternatively, the two pieces of tubing can be connected to each other by placing the one end of the tubing inside the end of the other tubing. The tubing must not be reused.

E. The water level measuring device

Electronic ”tape”, pressure transducer, water level sounder/level indicator, etc. should be capable of measuring to 0.01 foot accuracy. Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level “tape” at the start and end of each sampling event.

F. Flow measurement supplies

Graduated cylinder (size according to flow rate) and stopwatch usually will suffice.

Large graduated bucket used to record total water purged from the well.

G. Interface probe

To be used to check on the presence of free phase liquids (LNAPL, or DNAPL) before purging begins (as needed).

H. Power source (generator, nitrogen tank, battery, etc.)

When a gasoline generator is used, locate it downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate samples.

I. Indicator field parameter monitoring instruments

Use of a multi-parameter instrument capable of measuring pH, oxidation/reduction potential (ORP), dissolved oxygen (DO), specific conductance, temperature, and coupled with a flow-through-cell is required when measuring all indicator field parameters, except turbidity. Turbidity is collected using a separate instrument. Record equipment/instrument identification (manufacturer, and model number).

Transparent, small volume flow-through-cells (e.g., 250 mLs or less) are preferred. This allows observation of air bubbles and sediment buildup in the cell, which can interfere with the operation of the monitoring instrument probes, to be easily detected. A small volume

cell facilitates rapid turnover of water in the cell between measurements of the indicator field parameters.

It is recommended to use a flow-through-cell and monitoring probes from the same manufacturer and model to avoid incompatibility between the probes and flow-through-cell.

Turbidity samples are collected before the flow-through-cell. A "T" connector coupled with a valve is connected between the pump's tubing and flow-through-cell. When a turbidity measurement is required, the valve is opened to allow the groundwater to flow into a container. The valve is closed and the container sample is then placed in the turbidimeter.

Standards are necessary to perform field calibration of instruments. A minimum of two standards are needed to bracket the instrument measurement range for all parameters except ORP which use a Zobell solution as a standard. For dissolved oxygen, a wet sponge used for the 100% saturation and a zero dissolved oxygen solution are used for the calibration.

Barometer (used in the calibration of the Dissolved Oxygen probe) and the conversion formula to convert the barometric pressure into the units of measure used by the Dissolved Oxygen meter are needed.

J. Decontamination supplies

Includes (for example) non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.

K. Record keeping supplies

Logbook(s), well purging forms, chain-of-custody forms, field instrument calibration forms, etc.

L. Sample bottles

M. Sample preservation supplies (as required by the analytical methods)

N. Sample tags or labels

O. PID or FID instrument

If appropriate, to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

P. Miscellaneous Equipment

Equipment to keep the sampling apparatus shaded in the summer (e.g., umbrella) and from freezing in the winter. If the pump's tubing is allowed to heat up in the warm weather, the cold groundwater may degas as it is warmed in the tubing.

8.0 EQUIPMENT/INSTRUMENT CALIBRATION

Prior to the sampling event, perform maintenance checks on the equipment and instruments according to the manufacturer's manual and/or applicable SOP. This will ensure that the equipment/instruments are working properly before they are used in the field.

Prior to sampling, the monitoring instruments must be calibrated and the calibration documented. The instruments are calibrated using U.S Environmental Protection Agency Region 1 *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity),* March 23, 2017, or latest version or from one of the methods listed in 40CFR136, 40CFR141 and SW-846.

The instruments shall be calibrated at the beginning of each day. If the field measurement falls outside the calibration range, the instrument must be re-calibrated so that all measurements fall within the calibration range. At the end of each day, a calibration check is performed to verify that instruments remained in calibration throughout the day. This check is performed while the instrument is in measurement mode, not calibration mode. If the field instruments are being used to monitor the natural attenuation parameters, then a calibration check at mid-day is highly recommended to ensure that the instruments did not drift out of calibration. Note: during the day if the instrument reads zero or a negative number for dissolved oxygen, pH, specific conductance, or turbidity (negative value only), this indicates that the instrument drifted out of calibration or the instrument is malfunctioning. If this situation occurs the data from this instrument will need to be qualified or rejected.

9.0 PRELIMINARY SITE ACTIVITIES (as applicable)

Check the well for security (damage, evidence of tampering, missing lock, etc.) and record pertinent observations (include photograph as warranted).

If needed, lay out a sheet of clean polyethylene for monitoring and sampling equipment, unless equipment is elevated above the ground (e.g., on a table, etc.).

Remove well cap and if appropriate measure VOCs at the rim of the well with a PID or FID instrument and record reading in field logbook or on the well purge form.

If the well casing does not have an established reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook (consider a photographic record as well). All water level measurements must be recorded relative to this reference point (and the altitude of this point should be determined using techniques that are appropriate to site's DQOs.

If water-table or potentiometric surface map(s) are to be constructed for the sampling event, perform synoptic water level measurement round (in the shortest possible time) before any purging and sampling activities begin. If possible, measure water level depth (to 0.01 ft.) and total well depth (to 0.1 ft.) the day before sampling begins, in order to allow for re-settlement of any particulates in the water column. This is especially important for those wells that have not been recently sampled because sediment buildup in the well may require the well to be redeveloped. If measurement of total well depth is not made the day before, it should be measured after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe may not be necessary unless analytical data or field analysis signal a worsening situation. This SOP cannot be used in the presence of LNAPLs or DNAPLs. If NAPLs are present, the project team must decide upon an alternate sampling method. All project modifications must be approved and documented prior to implementation.

If available check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). If changes are made in the intake depth or extraction rate(s) used during previous sampling event(s), for either portable or dedicated extraction devices, record new values, and explain reasons for the changes in the field logbook.

10.0 PURGING AND SAMPLING PROCEDURE

Purging and sampling wells in order of increasing chemical concentrations (known or anticipated) are preferred.

The use of dedicated pumps is recommended to minimize artificial mobilization and entrainment of particulates each time the well is sampled. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

A. Initial Water Level

Measure the water level in the well before installing the pump if a non-dedicated pump is being used. The initial water level is recorded on the purge form or in the field logbook.

B. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the appropriate depth (may not be the mid-point of the screen/open interval). The Sampling and Analysis Plan/Quality Assurance Project Plan should specify the sampling depth (used previously), or provide criteria for selection of intake depth for each new well. If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well.

Pump tubing lengths, above the top of well casing should be kept as short as possible to minimize heating the groundwater in the tubing by exposure to sun light and ambient air temperatures. Heating may cause the groundwater to degas, which is unacceptable for the collection of samples for VOC and dissolved gases analyses.

C. Measure Water Level

Before starting pump, measure water level. Install recording pressure transducer, if used to track drawdowns, to initialize starting condition.

D. Purge Well

From the time the pump starts purging and until the time the samples are collected, the purged water is discharged into a graduated bucket to determine the total volume of groundwater purged. This information is recorded on the purge form or in the field logbook.

Start the pump at low speed and slowly increase the speed until discharge occurs. Check water level. Check equipment for water leaks and if present fix or replace the affected equipment. Try to match pumping rate used during previous sampling event(s). Otherwise, adjust pump speed until there is little or no water level drawdown. If the

minimal drawdown that can be achieved exceeds 0.3 feet, but remains stable, continue purging.

Monitor and record the water level and pumping rate every five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" somewhat as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. If the initial water level is above the top of the screen do not allow the water level to fall into the well screen. The final purge volume must be greater than the stabilized drawdown volume plus the pump's tubing volume. If the drawdown has exceeded 0.3 feet and stabilizes, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are collected.

Avoid the use of constriction devices on the tubing to decrease the flow rate because the constrictor will cause a pressure difference in the water column. This will cause the groundwater to degas and result in a loss of VOCs and dissolved gasses in the groundwater samples.

Note: the flow rate used to achieve a stable pumping level should remain constant while monitoring the indicator parameters for stabilization and while collecting the samples.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (e.g., bladder, peristaltic), and/or the use of dedicated equipment. For new monitoring wells, or wells where the following situation has not occurred before, if the recovery rate to the well is less than 50 mL/min., or the well is being essentially dewatered during purging, the well should be sampled as soon as the water level has recovered sufficiently to collect the volume needed for all anticipated samples. The project manager or field team leader will need to make the decision when samples should be collected, how the sample is to be collected, and the reasons recorded on the purge form or in the field logbook. A water level measurement needs to be performed and recorded before samples are collected. If the project manager decides to collect the samples using the pump, it is best during this recovery period that the pump intake tubing not be removed, since this will aggravate any turbidity problems. Samples in this specific situation may be collected without stabilization of indicator field parameters. Note that field conditions and efforts to overcome problematic situations must be recorded in order to support field decisions to deviate from normal procedures described in this SOP. If this type of problematic situation persists in a well, then water sample collection should be

changed to a passive or no-purge method, if consistent with the site's DQOs, or have a new well installed.

E. Monitor Indicator Field Parameters

After the water level has stabilized, connect the "T" connector with a valve and the flow-through-cell to monitor the indicator field parameters. If excessive turbidity is anticipated or encountered with the pump startup, the well may be purged for a while without connecting up the flow-through-cell, in order to minimize particulate buildup in the cell (This is a judgment call made by the sampler). Water level drawdown measurements should be made as usual. If possible, the pump may be installed the day before purging to allow particulates that were disturbed during pump insertion to settle.

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, ORP, DO) at a frequency of five minute intervals or greater. The pump's flow rate must be able to "turn over" at least one flow-through-cell volume between measurements (for a 250 mL flow-through-cell with a flow rate of 50 mLs/min., the monitoring frequency would be every five minutes; for a 500 mL flow-through-cell it would be every ten minutes). If the cell volume cannot be replaced in the five minute interval, then the time between measurements must be increased accordingly. Note: during the early phase of purging, emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments followed by stabilization of indicator parameters. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings are within the following limits:

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

All measurements, except turbidity, must be obtained using a flow-through-cell. Samples for turbidity measurements are obtained before water enters the flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and

continue monitoring activities. Record start and stop times and give a brief description of cleaning activities.

The flow-through-cell must be designed in a way that prevents gas bubble entrapment in the cell. Placing the flow-through-cell at a 45 degree angle with the port facing upward can help remove bubbles from the flow-through-cell (see Appendix B Low-Flow Setup Diagram). Throughout the measurement process, the flow-through-cell must remain free of any gas bubbles. Otherwise, the monitoring probes may act erratically. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must remain submerged in water at all times.

F. Collect Water Samples

When samples are collected for laboratory analyses, the pump's tubing is disconnected from the "T" connector with a valve and the flow-through-cell. The samples are collected directly from the pump's tubing. Samples must not be collected from the flow-through-cell or from the "T" connector with a valve.

VOC samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

If the pump's flow rate is too high to collect the VOC/dissolved gases samples, collect the other samples first. Lower the pump's flow rate to a reasonable rate and collect the VOC/dissolved gases samples and record the new flow rate.

During purging and sampling, the centrifugal/peristaltic pump tubing must remain filled with water to avoid aeration of the groundwater. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help ensure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use the following procedure to collect samples: collect non-VOC/dissolved gases samples first, then increase flow rate slightly until the water completely fills the tubing, collect the VOC/dissolved gases samples, and record new drawdown depth and flow rate.

For bladder pumps that will be used to collect VOC or dissolved gas samples, it is recommended that the pump be set to deliver long pulses of water so that one pulse will fill a 40 mL VOC vial.

Use pre-preserved sample containers or add preservative, as required by analytical methods, to the samples immediately after they are collected. Check the analytical methods

(e.g. EPA SW-846, 40 CFR 136, water supply, etc.) for additional information on preservation.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter (transparent housing preferred) is required, and the filter size (0.45 μm is commonly used) should be based on the sampling objective. Pre-rinse the filter with groundwater prior to sample collection. Make sure the filter is free of air bubbles before samples are collected. Preserve the filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in groundwater for human health or ecological risk calculations.

Label each sample as collected. Samples requiring cooling will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

G. Post Sampling Activities

If a recording pressure transducer is used to track drawdown, re-measure water level with tape.

After collection of samples, the pump tubing may be dedicated to the well for re-sampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth annually is usually sufficient after the initial low stress sampling event. However, a greater frequency may be needed if the well has a “silting” problem or if confirmation of well identity is needed.

Secure the well.

11.0 DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well, and then following sampling of each subsequent well. Pumps should not be removed between purging and sampling operations. The pump, tubing, support cable and electrical wires which were in contact with the well should be decontaminated by one of the procedures listed below.

The use of dedicated pumps and tubing will reduce the amount of time spent on decontamination of the equipment. If dedicated pumps and tubing are used, only the initial sampling event will require decontamination of the pump and tubing.

Note if the previous equipment blank data showed that contaminant(s) were present after using the below procedure or the one described in the SAP/QAPP, a more vigorous procedure may be needed.

Procedure 1

Decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump and tubing. The pump may be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Optional - flush with isopropyl alcohol (pesticide grade; must be free of ketones {e.g., acetone}) or with methanol. This step may be required if the well is highly contaminated or if the equipment blank data from the previous sampling event show that the level of contaminants is significant.

Flush with distilled/deionized water. This step must remove all traces of alcohol (if used) from the equipment. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

12.0 FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the groundwater samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. Quality control samples include field duplicates, equipment blanks, matrix spike/matrix spike duplicates, trip blanks (VOCs), and temperature blanks.

13.0 FIELD LOGBOOK

A field log shall be kept to document all groundwater field monitoring activities (see Appendix C, example table), and record the following for each well:

Site name, municipality, state.

Well identifier, latitude-longitude or state grid coordinates.

Measuring point description (e.g., north side of PVC pipe).

Well depth, and measurement technique.

Well screen length.

Pump depth.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and detection method.

Pumping rate, drawdown, indicator parameters values, calculated or measured total volume pumped, and clock time of each set of measurements.

Type of tubing used and its length.

Type of pump used.

Clock time of start and end of purging and sampling activity.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analyses.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions, including approximate ambient air temperature.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling/monitoring equipment used, including trade names, model number, instrument identification number, diameters, material composition, etc.

14.0 DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, field indicator parameters measured during purging, field instrument calibration information, and whatever other field logbook information is needed to allow for a full evaluation of data usability.

Note: the use of trade, product, or firm names in this sampling procedure is for descriptive purposes only and does not constitute endorsement by the U.S. EPA.

15.0 REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, *DNAPL Site Evaluation*; C.K. Smoley (CRC Press), Boca Raton, Florida.

Robert W. Puls and Michael J. Barcelona, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, April 1996 (EPA/540/S-95/504).

U.S. Environmental Protection Agency, 1992, *RCRA Ground-Water Monitoring: Draft Technical Guidance*; Washington, DC (EPA/530-R-93-001).

U.S. Environmental Protection Agency, 1987, *A Compendium of Superfund Field Operations Methods*; Washington, DC (EPA/540/P-87/001).

U.S Environmental Protection Agency, Region 1, *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity),* March 23, 2017 or latest version.

U.S Environmental Protection Agency, EPA SW-846.

U.S Environmental Protection Agency, 40 CFR 136.

U.S Environmental Protection Agency, 40 CFR 141.

Vroblesky, Don A., Clifton C. Casey, and Mark A. Lowery, Summer 2007, Influence of Dissolved Oxygen Convection on Well Sampling, *Ground Water Monitoring & Remediation* 27, no. 3: 49-58.

APPENDIX A

PERISTALTIC PUMPS

Before selecting a peristaltic pump to collect groundwater samples for VOCs and/or dissolved gases, (e.g., methane, carbon dioxide, etc.) consideration should be given to the following:

- The decision of whether or not to use a peristaltic pump is dependent on the intended use of the data.
- If the additional sampling error that may be introduced by this device is NOT of concern for the VOC/dissolved gases data's intended use, then this device may be acceptable.
- If minor differences in the groundwater concentrations could affect the decision, such as to continue or terminate groundwater cleanup or whether the cleanup goals have been reached, then this device should NOT be used for VOC/dissolved gases sampling. In these cases, centrifugal or bladder pumps are a better choice for more accurate results.

EPA and USGS have documented their concerns with the use of the peristaltic pumps to collect water sample in the below documents.

- "Suction Pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, December 1987.
- "The agency does not recommend the use of peristaltic pumps to sample ground water particularly for volatile organic analytes" *RCRA Ground-Water Monitoring Draft Technical Guidance*, EPA Office of Solid Waste, November 1992.
- "The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and volatiles loss", *Low-flow (Minimal drawdown) Ground-Water Sampling Procedures*, by Robert Puls & Michael Barcelona, April 1996, EPA/540/S-95/504.
- "Suction-lift pumps, such as peristaltic pumps, can operate at a very low pumping rate; however, using negative pressure to lift the sample can result in the loss of volatile analytes", USGS Book 9 Techniques of Water-Resources Investigation, Chapter A4. (Version 2.0, 9/2006).

APPENDIX B

SUMMARY OF SAMPLING INSTRUCTIONS

These instructions are for using an adjustable rate, submersible pump or a peristaltic pump with the pump's intake placed at the midpoint of a 10 foot or less well screen or an open interval. The water level in the monitoring well is above the top of the well screen or open interval, the ambient temperature is above 32°F, and the equipment is not dedicated. Field instruments are already calibrated. The equipment is setup according to the diagram at the end of these instructions.

1. Review well installation information. Record well depth, length of screen or open interval, and depth to top of the well screen. Determine the pump's intake depth (e.g., mid-point of screen/open interval).

2. On the day of sampling, check security of the well casing, perform any safety checks needed for the site, lay out a sheet of polyethylene around the well (if necessary), and setup the equipment. If necessary a canopy or an equivalent item can be setup to shade the pump's tubing and flow-through-cell from the sun light to prevent the sun light from heating the groundwater.

3. Check well casing for a reference mark. If missing, make a reference mark. Measure the water level (initial) to 0.01 ft. and record this information.

4. Install the pump's intake to the appropriate depth (e.g., midpoint) of the well screen or open interval. Do not turn-on the pump at this time.

5. Measure water level and record this information.

6. Turn-on the pump and discharge the groundwater into a graduated waste bucket. Slowly increase the flow rate until the water level starts to drop. Reduce the flow rate slightly so the water level stabilizes. Record the pump's settings. Calculate the flow rate using a graduated container and a stop watch. Record the flow rate. Do not let the water level drop below the top of the well screen.

If the groundwater is highly turbid or discolored, continue to discharge the water into the bucket until the water clears (visual observation); this usually takes a few minutes. The turbid or discolored water is usually from the well-being disturbed during the pump installation. If the water does not clear, then you need to make a choice whether to continue purging the well (hoping that it will clear after a reasonable time) or continue to

the next step. Note, it is sometimes helpful to install the pump the day before the sampling event so that the disturbed materials in the well can settle out.

If the water level drops to the top of the well screen during the purging of the well, stop purging the well, and do the following:

> Wait for the well to recharge to a sufficient volume so samples can be collected. This may take a while (pump may be removed from well, if turbidity is not a problem). The project manager will need to make the decision when samples should be collected and the reasons recorded in the site's log book. A water level measurement needs to be performed and recorded before samples are collected. When samples are being collected, the water level must not drop below the top of the screen or open interval. Collect the samples from the pump's tubing. Always collect the VOCs and dissolved gases samples first. Normally, the samples requiring a small volume are collected before the large volume samples are collected just in case there is not sufficient water in the well to fill all the sample containers. All samples must be collected, preserved, and stored according to the analytical method. Remove the pump from the well and decontaminate the sampling equipment.

If the water level has dropped 0.3 feet or less from the initial water level (water level measure before the pump was installed); proceed to Step 7. If the water level has dropped more than 0.3 feet, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are be collected.

7. Attach the pump's tubing to the "T" connector with a valve (or a three-way stop cock). The pump's tubing from the well casing to the "T" connector must be as short as possible to prevent the groundwater in the tubing from heating up from the sun light or from the ambient air. Attach a short piece of tubing to the other end of the end of the "T" connector to serve as a sampling port for the turbidity samples. Attach the remaining end of the "T" connector to a short piece of tubing and connect the tubing to the flow-through-cell bottom port. To the top port, attach a small piece of tubing to direct the water into a calibrated waste bucket. Fill the cell with the groundwater and remove all gas bubbles from the cell. Position the flow-through-cell in such a way that if gas bubbles enter the cell they can easily exit the cell. If the ports are on the same side of the cell and the cell is cylindrical shape, the cell can be placed at a 45-degree angle with the ports facing upwards; this position should keep any gas bubbles entering the cell away from the monitoring probes and allow the gas bubbles to exit the cell easily (see Low-Flow Setup Diagram). Note:

make sure there are no gas bubbles caught in the probes' protective guard; you may need to shake the cell to remove these bubbles.

8. Turn-on the monitoring probes and turbidity meter.

9. Record the temperature, pH, dissolved oxygen, specific conductance, and oxidation/reduction potential measurements. Open the valve on the "T" connector to collect a sample for the turbidity measurement, close the valve, do the measurement, and record this measurement. Calculate the pump's flow rate from the water exiting the flow-through-cell using a graduated container and a stop watch, and record the measurement. Measure and record the water level. Check flow-through-cell for gas bubbles and sediment; if present, remove them.

10. Repeat Step 9 every 5 minutes or as appropriate until monitoring parameters stabilized. Note: at least one flow-through-cell volume must be exchanged between readings. If not, the time interval between readings will need to be increased. Stabilization is achieved when three consecutive measurements are within the following limits:

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

If these stabilization requirements do not stabilize in a reasonable time, the probes may have been coated from the materials in the groundwater, from a buildup of sediment in the flow-through-cell, or a gas bubble is lodged in the probe. The cell and the probes will need to be cleaned. Turn-off the probes (not the pump), disconnect the cell from the "T" connector and continue to purge the well. Disassemble the cell, remove the sediment, and clean the probes according to the manufacturer's instructions. Reassemble the cell and connect the cell to the "T" connector. Remove all gas bubbles from the cell, turn-on the probes, and continue the measurements. Record the time the cell was cleaned.

11. When it is time to collect the groundwater samples, turn-off the monitoring probes, and disconnect the pump's tubing from the "T" connector. If you are using a centrifugal or peristaltic pump check the pump's tubing to determine if the tubing is completely filled with water (no air space).

All samples must be collected and preserved according to the analytical method. VOCs and dissolved gases samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

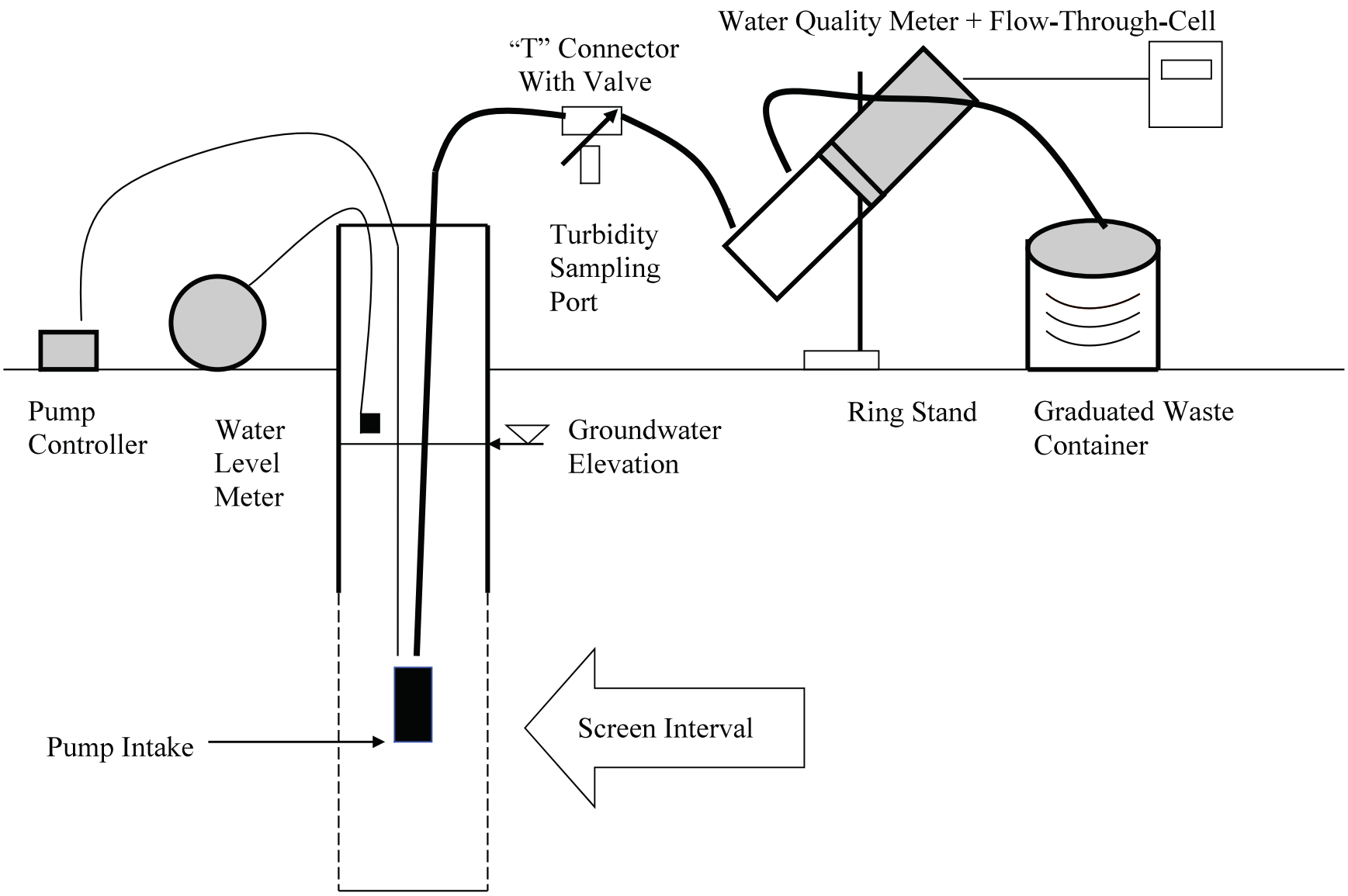
If the pump's tubing is not completely filled with water and the samples are being collected for VOCs and/or dissolved gases analyses using a centrifugal or peristaltic pump, do the following:

> All samples must be collected and preserved according to the analytical method. The VOCs and the dissolved gases (e.g., methane, ethane, ethene, and carbon dioxide) samples are collected last. When it becomes time to collect these samples increase the pump's flow rate until the tubing is completely filled. Collect the samples and record the new flow rate.

12. Store the samples according to the analytical method.

13. Record the total purged volume (graduated waste bucket). Remove the pump from the well and decontaminate the sampling equipment.

Low-Flow Setup Diagram



APPENDIX C

EXAMPLE (Minimum Requirements)

WELL PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name)_____ Depth to _____/_____ of screen
Well Number_____ Date_____ (below MP) top bottom
Field Personnel_____ Pump Intake at (ft. below MP)_____
Sampling Organization_____ Purging Device; (pump type)_____
Identify MP_____ Total Volume Purged _____

Clock Time 24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. "C	Spec. Cond.[2] µS/cm	pH	ORP[3] mv	DO mg/L	Tur-bidity NTU	Comments
Stabilization Criteria					3%	3%	±0.1	±10 mv	10%	10%	

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm(same as µmhos/cm)at 25°C.
3. Oxidation reduction potential (ORP)

Figure 2. **Ground Water Sampling Log**

Project _____ **Site** _____ **Well No.** _____ **Date** _____

Well Depth _____ **Screen Length** _____ **Well Diameter** _____ **Casing Type** _____

Sampling Device _____ **Tubing type** _____ **Water Level** _____

Measuring Point _____ **Other Infor** _____

_____

Sampling Personnel _____

Time	pH	Temp	Cond.	Dis.O_2	Turb.	[ ]Conc			Notes

Type of Samples Collected

_____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi r^3$

Figure 3. **Ground Water Sampling Log** (with automatic data logging for most water quality parameters)

Project _____ **Site** _____ **Well No.** _____ **Date** _____
Well Depth _____ **Screen Length** _____ **Well Diameter** _____ **Casing Type** _____
Sampling Device _____ **Tubing type** _____ **Water Level** _____
Measuring Point _____ **Other Infor** _____

Sampling Personnel _____

Time	Pump Rate	Turbidity	Alkalinity	[ ] Conc	Notes

Type of Samples Collected

_____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi r^3$

Attachment C
Sampling Guidelines and Protocols for FPOA and PFCs

Groundwater Sampling for Emerging Contaminants

July 2018

Issue: NYSDEC has committed to analyzing representative groundwater samples at remediation sites for emerging contaminants (1,4-dioxane and PFAS) as described in the below guidance.

Implementation

NYSDEC project managers will be contacting site owners to schedule sampling for these chemicals. Only groundwater sampling is required. The number of samples required will be similar to the number of samples where "full TAL/TCL sampling" would typically be required in a remedial investigation. If sampling is not feasible (e.g., the site no longer has any monitoring wells in place), sampling may be waived on a site-specific basis after first considering potential sources of these chemicals and whether there are water supplies nearby.

Upon a new site being brought into any program (i.e., SSF, BCP), PFAS and 1,4-dioxane will be incorporated into the investigation of groundwater as part of the standard "full TAL/TCL" sampling. Until an SCO is established for PFAS, soil samples do not need to be analyzed for PFAS unless groundwater contamination is detected. Separate guidance will be developed to address sites where emerging contaminants are found in the groundwater. The analysis currently performed for SVOCs in soil is adequate for evaluation of 1,4-dioxane, which already has an established SCO.

Analysis and Reporting

Labs should provide a full category B deliverable, and a DUSR should be prepared by an independent 3rd party data validator. QA/QC samples should be collected as required in DER-10, Section 2.3(c). The electronic data submission should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html ,

The work plan should explicitly describe analysis and reporting requirements.

PFAS sample analysis: Currently, ELAP does not offer certification for PFAS compounds in matrices other than finished drinking water. However, laboratories analyzing environmental samples (ex. soil, sediments, and groundwater) are required, by DER, to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537 or ISO 25101.

Modified EPA Method 537 is the preferred method to use for groundwater samples due to the ability to achieve 2 ng/L (ppt) reporting limits. If contract labs or work plans submitted by responsible parties indicate that they are not able to achieve similar reporting limits, the project manager should discuss this with a DER chemist. Note: Reporting limits for PFOA and PFOS should not exceed 2 ng/L.

PFAS sample reporting: DER has developed a PFAS target analyte list (below) with the intent of achieving reporting consistency between labs for commonly reportable analytes. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. This list may be updated in the future as new information is learned and as labs develop new capabilities. If lab and/or matrix specific issues are encountered for any particular compounds, the NYSDEC project manager will make case-by-case decisions as to whether particular analytes may be temporarily or permanently discontinued from analysis for each site. Any technical lab issues should be brought to the attention of a NYSDEC chemist.

Some sampling using this full PFAS target analyte list is needed to understand the nature of contamination. It may also be critical to differentiate PFAS compounds associated with a site from other sources of these chemicals. Like routine refinements to parameter lists based on investigative findings, the full PFAS target analyte list may not be needed for all sampling intended to define the extent of contamination. Project managers may approve a shorter analyte list (e.g., just the UCMR3 list) for some reporting on a case by case basis.

1,4-Dioxane Analysis and Reporting: The method detection limit (MDL) for 1,4-dioxane should be no higher than 0.35 µg/l (ppb). Although ELAP offers certification for both EPA Method 8260 SIM and EPA Method 8270 SIM, DER is advising the use of method 8270 SIM. EPA Method 8270 SIM provides a more robust extraction procedure, uses a larger sample volume, and is less vulnerable to interference from chlorinated solvents.

Full PFAS Target Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	**Perfluorobutanesulfonic acid**	**PFBS**	**375-73-5**
	Perfluorohexanesulfonic acid	**PFHxS**	**355-46-4**
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	**PFOS**	**1763-23-1**
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	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	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Bold entries depict the 6 original UCMR3 chemicals

Collection of Groundwater Samples for Per- and Polyfluoroalkyl Substances (PFAS) from Monitoring Wells Sample Protocol

Samples collected using this protocol are intended to be analyzed for perfluorooctanoic acid (PFOA) and other perfluorinated compounds by Modified (Low Level) Test Method 537.

The sampling procedure used must be consistent with the NYSDEC March 1991 Sampling Guidelines and Protocols http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf with the following materials limitations.

At this time acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE) and polypropylene. Additional materials may be acceptable if proven not to contain PFAS. **NOTE: Grunfos pumps and some bladder pumps are known to contain PFAS materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps).** All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse will be performed for equipment that does come in contact with PFAS materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials must be avoided. Many food and drink packaging materials and "plumbers thread seal tape" contain PFAS.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 250 mL HDPE or polypropylene bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at 4 ± 2º Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples.

Collect one field duplicate for every sample batch, not to exceed 20 samples.

Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category A or B) and an electronic data deliverable.

Attachment D
Sample Chain of Custody Form

YORK
ANALYTICAL LABORATORIES, INC.
120 RESEARCH DR. STRATFORD, CT 06615
(203) 325-1371 FAX (203) 357-0166

Field Chain-of-Custody Record

NOTE: York's Std. Terms & Conditions are listed on the back side of this document.
This document serves as your written authorization to York to proceed with the analyses requested and your signature binds you to York's Std. Terms & Conditions unless superseded by written contract.

York Project No._____

Client Information	Report To:	Invoice To:	Client Project ID / Purchase Order No.	Turn-Around Time	Report Type/Deliverbles
Company:	Company:	Company:		24 hr _____	Summary_____QA/QC Summary_____ Results Only
Address:	Address:	Address:		48 hr _____	RCP Package_____ASP B Pkg _____
Phone No.	Phone No.	Phone No.		72 hr _____	ASP A Pkg_____Excel format_____
Contact Person:	Attention:	Attention:		5 Day _____	EDD _____OTHER_____
E-Mail Address:	E-Mail Address:	E-Mail Address:		Standard_____	

Print Clearly and Legibly. All Information must be complete. Samples will NOT be logged in and the turn-around time clock will not begin until any questions by York are resolved.

_____
Samples Collected/Authorized By (Signature)

_____
Name (printed)

Matrix Codes
S - soil
Other - specify(oil, etc.)
WW - wastewater
GW - groundwater
DW - drinking water
Air-A - ambient air
Air-SV - soil vapor

Volatiles		Semi-Vols.	Pest/PCB/Herb	Metals	Misc. Org.	Full Lists	Miscellaneous Parameters		
8260 full	TICs	8270 or 625	8082PCB	RCRA8	TPH GRO	Pri.Poll.	Corrosivity	Nitrate	Color
624	Site Spec.	STARS	8081Pest	PP13	TPH DRO	TCL Organics	Reactivity	Nitrite	Phenols
STARS	SPLP or TCLP	BN Only	8151Herb	TAL	CT ETPH	TAL Met/CN-	Ignitability	TKN	Cyanide-T
BTEX	Benzene	Acids Only	CT RCP	CT15	NY 310-13	Full TCLP	Flash Point	Tot. Nitrogen	Cyanide-A
MTBE	Nassau Co.	PAH	App. IX	Total	TPH 418.1	Full App. IX	Sieve Anal.	Ammonia-N	BOD5
TCL list	Suffolk Co.	TAGM	Site Spec.	Dissolved	Air TO14A	Part 360-Routine	Heterotrophs	Chloride	CBOD5
TAGM	Ketones	CT RCP	SPLP or TCLP	SPLP or TCLP	Air TO15	Part 360-Baseline	TOX	Phosphate	BOD28
CT RCP	Oxygenates	TCL list	TCLP Pest	**Indiv. Metals**	Air STARS	Part 360-Expanded (No Dioxins/Furans)	BTU/lb.	Tot. Phos.	COD
Arom.	TCLP list	TICs	TCLP Herb	Hg, Pb, As, Cd	Air VPH	Part 360-Expanded Full List	Aquatic Tox.	Oil&Grease	TSS
Halog.	524.2	App. IX	Chlordane	Cr, Ni, Be, Fe,	Air TICs	NYCDEP-Sewer	TOC	F.O.G.	Total Solids
App.IX	502.2	SPLP or TCLP	608 Pest	Sc, Tl, Sb, Cu,	Methane	NYSDEC-Sewer	Asbestos	pH	TDS
8021B list	5035	TCLP BNA	608 PCB	Na, Mn, Ag, etc.	Helium	TAGM	Silica	MBAS	TPH - IR

Special Instructions
Field Filtered ☐
Lab to Filter ☐

Sample Identification	Date Sampled	Sample Matrix	Choose Analyses Needed from the Menu Above and Enter Below	Container Description(s)

Comments

Preservation Check those Applicable								
4°C____ Frozen_____ HCl____ MeOH____	4°C____	4°C____	HNO_3___ 4°C___	4°C____ H_2SO_4___	4°C____ Other___	4°C____ H_2SO_4____ ZnAc___	NaOH____ Ascorbic___	Other___

_____ _____
Samples Relinquished By Date/Time

_____ _____
Samples Relinquished By Date/Time

_____ _____
Samples Received By Date/Time

_____ _____
Samples Received in **LAB** by Date/Time

Temperature on Receipt
_____ °C

Attachment E
Conventional Laboratory QA/QC

120 Research Drive
Stratford, CT 06615
203-325-1371

132-02 89th Avenue
Richmond Hill, NY 11418
203-325-1371

Quality Manual-Rev. 2.8

Reviewed by:

Lab Director

Benjamin Gulizia

Corporate Technical Director

Robert Q. Bradley

Technical Director/NY

Michelle Freeman

QA/QC Officer CT

Sarah Widomski

Date of Issue/Effective date: January 22, 2019

Revision: **2.8**

Table of Contents-York Quality Manual

Quality Manual

This Quality Manual meets the requirements of ISO 17025, ISO 9001 and NELAC. This Quality Manual is confidential and assigned as outlined below.

Issued to: _____

Revision History

Revision 2.0	04/30/2010	First issue rewritten quality manual
Revision 2.1	11/13/2011	Updated Org Chart and Master List of Documents
Revision 2.2	06/29/2012	Updated Org Chart and Master List of Documents
Revision 2.3	12/26/2012	Added Data Integrity Plan, Reformatted document
Revision 2.4	04/12/2013	Added Aquatic Toxicity information
Revision 2.5	07/18/2014	Updated Org Chart and Master List of Documents
Revision 2.6	10/06/2014	Updated Org Chart and Master List of Documents
Revision 2.7	07/12/2016	Updated Org Chart and Master List of Documents and added new facility, removed Aq. Tox. information
Revision 2.8	01/22/2018	Update Cover page, Org Chart, Master List of Documents, added Mgmt Review page

Controlled Copy in Canary Yellow only

1. Introduction

Purpose

This Quality Manual contains all the requirements that our laboratory uses to demonstrate our quality management system, technical competence, and valid results.

Analytical data are used for many purposes, including: compliance with regulatory requirements; determination for the presence, concentration, and movement of hazardous materials in the environment; potential effects upon or protection required for persons; and the actions necessary for disposal of treatment of hazardous materials.

Analytical data may be used to support a broader-based project involved with: site characterization and/or remediation; on-site treatment; treatment and/or disposal or health and safety protection of York personnel and the public. Data may also be produced for outside commercial testing and submitted directly to clients for their decision making. In all cases, data must be of known quality.

It is the purpose of the York Quality Assurance Program, as expressed in this Quality Systems Manual, to provide all data which are of known quality. To achieve this, a system is described which controls:

- Preservation of samples
- Receipt and handling of samples
- Processing and analyses of samples
- Analytical instrumentation
- Data verification
- Data reporting

Section 4 specifies how we demonstrate sound management and maintain client satisfaction.

Section 5 specifies how we demonstrate technical competence in our laboratory.

In addition, this Quality Manual outlines how York complies with:

- ISO 17025
- ISO 9001
- NELAC

All personnel are to take an active role in establishing, implementing, and maintaining our quality management program. We do not separate quality from our daily business. Quality cannot be something that we do just to pass audits. Quality is integrated into every facet of the decision-making process in the management of our laboratory and the science that we practice.

Distribution List

The Quality Assurance Officer (QAO) maintains the distribution list for this Quality Manual.

2. Scope

This Quality Manual facilitates:

- Recognition of technical competence for standardized methods, non-routine methods, and laboratory-developed methods we perform
- Inspection and product certification capabilities and/or services we provide
- Total quality for our administrative and technical systems
- Audits by clients, regulatory authorities and accreditation bodies
- Meeting the requirements of NELAC, ISO 17025, and ISO 9001
- Client satisfaction

3. Normative References

Reference List

ISO/IEC 17000, Conformity assessment – Vocabulary and general principles

VIM, International vocabulary of basic and general terms in metrology, issued by BIPM, IEC, IFCC, ISO, IUPAC, IUPAP and OIML.

ISO 9001:2008 – Quality Management Systems – Requirements.

ISO 17025:2005 – General Requirements for the Competence of Testing and Calibration Laboratories.
NELAC 2003 and NELAC 2009-Quality Systems

4. Management Requirements

4.1 Organization

This section discusses general positions and quality-related responsibilities which provide for the implementation of the Qualit y Assurance Program and completion of quality control activities. Also discussed is the role of the York Quality Assurance Officer.

4.1.1 Legal Identification / Registration

York Analytical Laboratories, Inc.
120 Research Drive
Stratford, Connecticut 06615
203-325-1371
Fax 203-357-0166
E-mail: ClientServices@yorklab.com

York Analytical Laboratories, Inc. (II)
132-02 89th Avenue
Richmond Hill, NY 11418
203-325-1371
Fax 203-357-0166
E-mail: ClientServices@yorklab.com

State of Connecticut Department of Health (CTDOH) Certification no. PH-0723
New York State Department of Health (NYSDOH) Certifications no. 10854 and 12058
State of New Jersey Dept. of Environmental Protection (NJDEP) Certification no. CT-005
State of Pennsylvania Registration No. 68-04440
EPA ID NO. CT-005

4.1.2 Laboratory Requirements

The departments of York Analytical Laboratories, Inc. have been organized to satisfy the needs of the Client and regulatory authorities and to meet the NELAC and international standards ISO 17025 and ISO 9001. York Analytical Laboratories, Inc. is comprised of the following Departments or Groups:

Laboratory Director's Office

Quality Assurance Group

Client Services/Sales Groups

Sample Control Group

Classical Chemistry Group

Organic Preparations Group

Atomic Spectroscopy/Metals Group

Gas Chromatography Group

Gas Chromatography/Mass Spectrometry Groups (Volatiles, Air and Semi-Volatiles)

Report production/Data Management Group

4.1.3 Scope of Management System

The management system covers activities in the laboratory's permanent facilities at 120 Research Drive, Stratford, CT 06615 and 132-02 89th Avenue Richmond Hill. NY 11418. The fields of activities include:

Analysis of environmental samples (water, wastewater, soil, sludge, and air) for Federal and State regulated contaminants in support of private clients.

The laboratory's scope of tests is listed in the our specific Certifications and encompasses volatile organics, semi-volatile organics, pesticides, herbicides, PCBs, metals, and various general chemistry parameters.

4.1.4 Potential Conflicts of Interest

York has no potential conflicts of interest since it is independently owned and operated and provides only environmental laboratory analysis services. The ownership of York does not have any other interest that would be considered a potential conflict of interest.

4.1.5 Organization

A) Management and Technical Personnel

Policy:
The laboratory managerial and technical personnel, irrespective of other responsibilities, have the necessary authority and resources needed to meet the mandates assigned to their areas.

Details:
Responsibilities are detailed in 4.1.5 (F).

Departures from the organizational and management policies in this manual can only be approved by the Laboratory Director.

Departures from quality management system procedures can only be approved by the Quality Assurance Officer or the Laboratory Director.

Departures from test methods or technical standard operating procedures (SOPs) can only be approved by the Laboratory Director. See also section 5.2.

B) Undue Pressure

Policy:
Management and personnel are to be free from any undue internal and external commercial, financial and other pressures that may adversely affect the quality of their work. The integrity of test results is the responsibility of all personnel. Management ensures that employees are never instructed or forced to alter or falsify data.

Details:
The following list provides some guidelines on how employees avoid conflict of interest situations. Employees shall not:

- falsify records, prepare fraudulent reports, or make false claims
- seek or use privileged or confidential company information, or data from any Client, for any purpose beyond the scope of employment
- conduct non-laboratory business on laboratory time, or use company facilities or instrumentation to conduct outside interests in business, unless prior approval has been obtained
- solicit business on their own behalf (rather than the laboratory) from a Client
- be employed by, or affiliated with, organizations whose products or services compete with laboratory products or services
- have employment that negatively affects or interferes with their performance of laboratory duties
- compete with the laboratory in the purchase, sale, or leasing of property or goods
- allow association, family, or friends to influence business decisions to their benefit - decisions must be made on a strictly business basis, always in the best interest of the laboratory
- make any decision that provides gains or benefits to the employee and/or others
- have personal financial dealings with an individual or company that does business with the laboratory which might influence decisions made on the laboratory's behalf

Firm adherence to this code of values forms the foundation of our credibility. Personnel involved in dishonest activities are subject to a range of disciplinary action including dismissal.

C) Client Confidentiality

Policy:
It is the policy of our laboratory to protect the confidential information and proprietary rights of our Client including the electronic storage and transmission of results.

Details and Procedures:
All employees sign an Employee Confidentiality Agreement. The signed agreement is retained in each employee's Human Resources file.

Test results are only released to the Client. Release to someone other than the Client requires the express permission of the Client, except when the situation contravenes State or Federal Legislation and the results must be provided to the appropriate agency. The release of test results to anyone other than the Client requires the permission of the Client and management. Laboratory reports are reviewed for accuracy and completeness prior to release.

D) Operational Integrity

Policy:
The laboratory will avoid involvement in any activities that would diminish confidence in its competence, impartiality, judgment, or operational integrity.

Details and Procedures:
To ensure confidence in laboratory operations a formal quality assurance program is implemented. Technical competence is ensured through check sample programs. Impartiality is assessed through audits and approvals. Judgment is ensured through the hiring of qualified personnel and by continuously refining, upgrading, and improving his or her skills. Operational integrity is reviewed by management on a regular basis at management review meetings to ensure continued suitability and effectiveness of laboratory policies and procedures. Any problems are acted on immediately through corrective action procedures.

E) Organizational Structure

Policy:
The organization and management structure of the laboratory and the relationships between management, technical operations, support services, and the quality management system is defined through the aid of an organizational chart.

Details:
Senior management keeps the most current organizational chart on file. An organizational chart is available with this manual as a reference record-ATTACHMENT A and is considered the official record on the date it is marked in the lower right corner.

F) Responsibility and Authority

Laboratory Director

- develops primary goals, operating plans, policies, and short and long range objectives for the laboratory; implements these following Board of Directors' approval
- directs and coordinates activities to achieve profit and return on capital
- establishes organizational structure and delegates authority to subordinates
- leads the laboratory towards objectives, meets with and advises other executives, and reviews results of business operations; action plans to meet the needs of stakeholders
- represents organization to major Clients, government agencies, shareholders, and the public as necessary
- is knowledgeable of the scope of all processes under supervision
- provides the necessary resources (personnel, instrumentation, supplies) for the quality assurance program, in order to ensure confidence in the laboratory's results
- ensures instrumentation is maintained and calibrated, reporting all deficiencies (e.g., instrumentation malfunctions) in the appropriate manner
- maintains current job descriptions
- maintains records and manages all aspects of testing activities

Technical Director

- Technical responsibility for SOP preparation to reflect method requirements
- New Procedural implementations
- Assessing SOP modifications before implementation
- Staying current with regulatory needs relative to Technical Procedures
- Staff training
- New Technology recommendations/implementations
- Technical troubleshooting for all areas of the laboratories

Quality Assurance Officer (QAO)

- ensures that the Quality Management System is established, implemented and maintained in accordance with the ISO 9001, ISO 17025 and NELAC standards
- manages the internal audit program; coordinates lab accreditation activities
- handles the maintenance and distribution of the Quality Manual and associated documents
- maintains a master list of current versions of quality documentation
- trains personnel on Quality Management System activities
- monitors the Quality Management System
- reports on the performance of the Quality Management System to senior management for review and as a basis for improvement of the Quality Management System
- supervises the laboratory's double-blind proficiency testing program

Group Leaders

- responds to York Client Services Group inquiries and provides professional advice
- hires personnel with Laboratory Director
- orientates new personnel

- determines technical training needs of personnel
- conducts employee performance reviews
- schedules vacation and coverage
- ensures that all health and safety regulations are followed
- ensures that all Human Rights Legislation are complied with
- prioritizes workload
- facilitates operational concerns in their area
- ensures accurate and consistent testing procedures through the validation of all current procedures and by developing, validating and implementing new procedures
- coordinates purchasing requests
- ensures that the operational needs are within budget and advising management of any discrepancies

Analysts and Technicians

- maintains records of all quality activities as documented in SOPs and test methods
- handles samples and performing analyses according to SOPs and test methods
- provide input and assists in preparation of SOPs and test methods
- maintain and calibrate instrumentation and instrumentation
- reports deficiencies or malfunctions to the Group Leader
- identifies and records nonconformities on *Corrective Action Reports*
- identifies and recording potential nonconformities on *Preventive Action Requests*
- corrects nonconformities and potential nonconformities
- improves laboratory and/or quality activities on a continuous basis

Project Managers/Client Services

- provides vision and direction for analysis activities
- Responds to Clients' and provides professional advice
- develops and reviews proposals/Quotations
- Reviews Quality Assurance Project Plans for Clients
- monitors the progress of Work-in-Process
- reviews reports for selected Clients
- oversees, standard pricing, customized quotations, and invoicing for tests performed
- controls the flow of communication between the Client and the laboratory

Administrative/Data Management Personnel

- performs work functions and keeps records as per approved SOPs and/or laboratory policies
- generate final reports, invoices and data packages for transmittal to Clients
- assist in preparation of SOPs
- identifies and records nonconformities on *Corrective Action Reports*
- identifies and records potential nonconformities on *Preventive Action Requests*
- corrects nonconformities and potential nonconformities

- improves laboratory and/or quality activities on a continuous basis

G) Laboratory Supervision

Policy:
Adequate supervision is provided in each area of the laboratory for all testing and calibration personnel, including trainees, by persons familiar with the methods and procedures.

Details:
Adequate supervision is ensured through designated supervisors as well as through documentation such as this Quality Manual, test methods and SOPs. A thorough orientation and training program is adhered to for all new employees. Ongoing training for regular personnel is required.

H) Technical Management

Policy:
A Group Leader is assigned to each major technical department of the laboratory. They have overall responsibility for the technical operations and the provision of resources needed to ensure the required quality and production of laboratory operations.

Details:
While the Group Leader may at times delegate duties to other personnel, the Group Leader is accountable for any nonconforming activities.

I) Quality Assurance Officer

Policy:
The Quality Assurance Officer is appointed by the highest level of management. The Quality Assurance Officer, who, irrespective of other duties and responsibilities, has defined responsibility and authority for ensuring that the management system related to quality is implemented and followed. The Quality Assurance Officer has direct access to the highest level of management where decisions are taken on laboratory policy or resources.

Details:
This statement notifies all laboratory personnel that Sarah Widomski is the Quality Assurance Officer as authorized by the Laboratory Director. Any change in this position requires the reissue of this section to all holders of controlled copies of the Quality Manual. The following signature also serves as approval for this Quality Manual and affirms senior management's commitment to the policies and procedures set forth in this manual.

J) Managerial Substitutions

Policy:
Deputies for key personnel are appointed to fulfill the key personnel's duties in their absence.

Details:
In the absence of the Quality Assurance Officer, the Technical Director or Laboratory Director will assume his/her responsibilities.

In the absence of the Group Leader, the Laboratory Director, a Technical Director or other Group Leader will assume his/her responsibilities.

Management is responsible for ensuring that current and/or increased workload requirements are met. This includes making adjustments as a result of employee absence. Only fully trained employees are utilized to fulfill the duties of personnel who are absent. If sufficient human resources are not available, management will identify the best possible solution to meet operational requirements.

K) Awareness

Policy:
Management ensures that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the objectives of the management system.

Details:
Supervisors review the details of each employee's job description with the appropriate employee and how the overall Quality Policy Statement (Section 4.2.2) relates to their activities to achieve the objectives of the management system.

4.1.6 Communication Processes

Policy and Details:
Top management ensures that appropriate communication processes are established within the laboratory and that communication takes place regarding the effectiveness of the management system.

Revision History

Revision 2.0	04/30/2010	First Issue of Rewritten Quality Manual
Revision 2.1	11/14/2011	Changed QA Officer name to Teresa Weikel
Revision 2.2	10/06/2014	Changed Acting QA Officer to Robert Bradley
Revision 2.3	07/12/2016	Changed QA Officer name to Magdalena Szymczuk
Revision 2.4	04/15/2017	Changed QA Officer to Aaron Patak, then S.Widomski
Revision 2.5	01/10/2019	Changed York/NY Tech. Dir/QA to Michelle Freeman

4.2 Management System

4.2.1 Policies and Procedures

Policy:
The Quality Management System is established, implemented, and maintained by management. It is applicable to all the fields of testing and activities in which the laboratory is involved and undertakes. All policies, systems, programs, procedures and instructions are documented to the extent necessary to enable the laboratory to assure the quality of results generated. These documents are communicated to, understood by, available to, and implemented by the appropriate personnel.

Details:
The purpose of our Quality Management System is to ensure that all services and products satisfy the Client's requirements and have been designed, manufactured, and delivered under controlled conditions.

The effectiveness of the Quality Management System is assessed in several ways:

- by a program of planned internal audits, covering all aspects of the operation of the quality management system
- by regular management reviews of the suitability and effectiveness of the quality management system
- by analysis of potential and actual problems as shown by Client complaints and supplier and subcontractor assessments
- by other methods approved from time to time by the Laboratory Director

This Quality Manual and associated documents (including procedures) and records serves as the quality plan for the laboratory. Other documents and records include:

- standard operating procedures
- quality control plans in test methods
- organizational charts
- proposals and Quality Assurance Project Plans (QAPP)
- project management schemes

4.2.2 Quality Policy Statement

Policy:
The policies and objectives for laboratory operations are documented in this Quality Manual. The overall objectives are set out in the Quality Policy Statement and reviewed during management review. The Quality Policy Statement is issued under the authority of the Laboratory Director on the effective date.

Quality Policy Statement:
To ensure accurate and timely environmental laboratory analysis services and to continuously meet or exceed the stated or implied expectations of our Clients through day-to-day interactions.

Effective Date: April 30, 2010

a) *Management commitment to good professional practice and quality of services provided to the Client*: analyses and calibrations are always carried out in accordance with stated standardized methods and Clients' requirements. Requests to perform tests that may jeopardize an objective result or have a low validity are rejected.

b) *Standards of service include*:
- Client Satisfaction
- Quality
- Timeliness

Excellence in the workplace is promoted by providing all employees with the knowledge, training, and tools necessary to allow for the completion of accurate and timely work.

c) *Purpose of management system related to quality*: to manage our business by meeting the needs of our Clients.

d) *Personnel*: familiarize themselves with quality documentation and implement the policies and procedures in their work.

e) *Management is committed to complying with NELAC, ISO 17025 and ISO 9001 international standards and to continually improve the effectiveness of the management system*: the objective of this Quality Manual is to document the compliant policies and associated procedures that are integrated into our daily activities. Continual improvements are established, implemented, and integrated into the management system. Additional objectives include:

- to establish the level of the laboratory's performance
- to make test method changes to improve performance within regulatory guidelines
- to participate in proficiency testing or quality evaluation programs with regulatory bodies
- to ensure that all personnel are trained to a level of familiarity with the quality management system appropriate to the individual's degree of responsibility
- to improve and validate laboratory methodologies by participation in method validation collaborative tests, where applicable

4.2.3 Commitment to the Management System

Policy:
Top management is committed to the development and implementation of the management system and continually improving its effectiveness.

Details:
The results of the management system are regularly reviewed during management review (see Section 4.15) and continual improvements are made as outlined in Section 4.10 – Improvements.

4.2.4 Communication of Requirements

Policy:
Top management communicates to the organization the importance of meeting Client requirements as well as statutory and regulatory requirements.

Details:
In general, the underlying message in all oral and written management communications involves meeting the aforementioned requirements. Meeting Client requirements ensures that ongoing business relationships secure the contracts that keep everyone employed. Meeting statutory and regulatory requirements ensures that laboratory operations will not be disrupted and the organization can continue to meet Client needs.

4.2.5 Quality Manual

Policy:
This Quality Manual outlines the structure of the documentation used in the quality management system. This Quality Manual makes reference to supporting procedures including technical procedures and is maintained up to date.

Details:
This quality management system is structured in three tiers of documentation. The tiers are as follows:

1. Quality Manual
2. Standard Operating Procedures and Reference Methods
3. Records

For most Clients, this Quality Manual and the associated documents form a general Quality Plan. If necessary, specific Quality Assurance Project Plans (QAPP) will be prepared on a 'per-Client' basis. These QAPPs will modify the general requirements stated in the Manual and associated documents.

All of the above documents are controlled documents in yellow only.
The following records and directive documents are referenced in the Quality Manual, but maintained separately:

- copies of the Quality Policy Statement posted in the laboratory (section 4.2.2)
- identification of resources and management review (section 4.15.1)
- job descriptions (section 5.2.4)
- statistical techniques (section 5.9)
- test reports (section 4.13.2 and 5.10)
- identification of the laboratory's approved signatures (section 5.10.2)
- laboratory's scope of tests (section 4.1.3)
- instrumentation inventory and records (sections 5.5.4 and 5.5.5)
- calibration status indicators (section 5.5.8)
- reference standards inventory (section 5.6.3)
- verification records (section 5.9)
- quality control plan / criteria for workmanship (section 5.4.1)
- corrective action records (section 4.11)
- preventive action records (section 4.12)
- client complaint records (section 4.8.1)
- audit schedule and records (section 4.14.3)
- procurement and subcontracting records (sections 4.6 and 4.5.4)

- training records (section 5.2.5)
- master list of documentation (section 4.3.2)
- confidentiality agreements (section 4.1.5 C)
- contract review (section 4.4.2)
- validation of test methods (section 5.4.5)
- facility floor plans (section 5.3.1)

4.2.6 Technical Management and the Quality Assurance Officer

4.2.7 The roles and responsibilities for technical management (Group Leaders) and the Quality Assurance Officer are outlined in section 4.1.5 (F) of this manual.

Technical management (Group Leaders) ensures that section 5 of this manual is implemented and maintained. The Quality Assurance Officer ensures that section 4 of this manual is implemented and maintained.

4.2.8 Maintenance

Policy and Details:
Top management ensures that the integrity of the management system is maintained when changes to the management system are planned and implemented.

Revision History

Revision 2.0	04/30/2010	First Issue of Rewritten Quality Manual
Revision 2.1	11/14/2011	Changed QA Officer name to Teresa Weikel
Revision 2.2	10/06/2014	Changed Acting QA Officer to Robert Bradley
Revision 2.3	07/12/2016	Changed QA Officer name to Magdalena
Revision 2.4	04/15/2017	Changed QA Officer to Aaron Patak, the S. Widomski
Revision 2.5	01/10/2019	Changed York/NY Tech. Dir/QA to Michelle Freeman

4.3 Document Control

Policy: The SOP# ADMINDOC043010 is used to control all quality management system documents. These may include documents of external origin, such as regulations,

standards, other normative documents, test and/or calibration methods, as well as drawings, specifications, instructions, and manuals.

Details:
Document means any information or instructions including policy statements, procedures, specifications, calibration tables, charts, text books, posters, notices, memoranda, software, drawings, and plans. These may be in various media, whether hard copy or electronic and they may be digital, analog, photographic or written.

The documents to be controlled include:
- Quality Manual
- Standard Operating Procedures
- Forms
- Standards

The control of data related to testing and calibration is covered in section 5.4.7. The control of records is covered in section 4.13.

4.3.1 Document Approval and Issue

4.3.1.1 Review / Approval / Master List

Policy and Details:
All documents issued to personnel in the laboratory as part of the quality management system are reviewed and approved for use by authorized personnel prior to issue (i.e., reviewed by personnel knowledgeable in the documented activity and then approved by management). A master list identifying the current revision status and distribution of documents in the quality management system is readily available in order to preclude the use of invalid and/or obsolete documents (see SOP# ADMINDOC043010). A revision history of documents is also maintained. Documents are formally reviewed on a biennial basis to ensure their continuing suitability. APPENDIX B contains a current Master List of Documents.

4.3.1.2 Availability and Obsolete Documents

Policy and Details:
The master list includes all current controlled documents. The master list document is organized with the following information:

- Description
- SOP Number
- Date of Issue (effective date of each procedure)
- Revision Number
- Date of Revision (effective date of each current revision)

Controlled documents are approved before issue.

The SOP# ADMINDOC043010 for document control ensures that:

- authorized editions of appropriate documents are available at all locations where operations essential to the effective functioning of the laboratory are performed
- documents are periodically reviewed and where necessary revised to ensure continuing suitability and compliance with applicable requirements
- invalid or obsolete documents are promptly removed from all points of issue or use to assure against unintended use
- obsolete documents retained for either legal or knowledge preservation purposes are suitably marked (i.e., stamped "OBSOLETE" and dated)

4.3.1.3 Identification

Policy and Details:

All quality management system documentation is identified by:

- date of issue and/or revision number
- page numbering
- total number of pages (e.g., page 5 of 5)
- issuing authority (i.e., approval signature)

4.3.2 Document Changes

4.3.2.1 Review / Approval

Policy:

Changes to documents are reviewed and approved by the same function (i.e., personnel or position) that performed the original review unless specifically designated otherwise.

Details:

Developments in policies and procedures require documents to be changed from time to time. Changes to documents receive the same level of review and approval as the originals.

The Quality Manual is reviewed annually by the Quality Assurance Officer. Records are kept of this review.

Test methods and SOPs are reviewed on a biennial basis. Procedures for this are outlined in SOP# ADMINDOC043010.

Obsolete documents are withdrawn, but are retained for archive purposes and clearly labeled as obsolete.

4.3.2.2 Identification of Changes

Policy:
The nature of document changes is identified in the document.

Details:
As outlined in SOP# ADMINDOC043010.

In general, the nature of changes is described in the document. Revision history is recorded at the end of the document.

4.3.2.3 Amendments by Hand

Policy and Details:

Hand-written amendments are clearly marked, initialed, and dated by the Laboratory Director and/or the QA/QC Officer on all controlled yellow copies.

4.3.2.4 puterized Documents

Policy and Details:
The SOP# ADMINDOC043010 details how changes in documents maintained in computerized systems are made and controlled.

Revision History

None

4.4 Review of Requests and Contracts

4.4.1 Policies and Procedures

Policy:
The SOP AMINCONTRACT043010 is used to review requests or contracts. This procedure ensures that:

a) the Client requirements including the methods to be used are adequately defined, documented and understood (see section 5.4.2)
b) the laboratory has the licensing, capability and resources to meet the requirements
c) the appropriate testing method is selected and capable of meeting the Client's requirements or data quality objectives (see section 5.4.2)

Any differences between the request and the contract are resolved before any work commences. Each contract must be acceptable by both the laboratory and the Client.

Details:
The request and contract review is conducted in a practical and efficient manner, and the effect of financial, legal, and time schedule aspects are taken into account.

The review of capability establishes that the laboratory possesses the necessary physical, personnel, and information resources, and that the laboratory's personnel have the skills and expertise necessary for the performance of the tests in question. The review may also encompass results of earlier participation in inter-laboratory comparisons or proficiency testing and/or the running of trial test using samples or items of known value in order to determine uncertainties of measurement, limits of detection, and confidence limits.

The contract review ensures that each Client's requirements are adequately defined and documented before the service or product is ordered or dispatched. This should ensure that any order, once accepted, can be completed without delay, and that the Client's requirements including delivery date, technical specification, and cost can be met.

If the contract review highlights any ambiguities or uncertainties then the Client will be contacted and the problem resolved before the order is accepted.

The SOP AMINCONTRACT043010 also describes the activities that take place should there be a subsequent amendment to a Client's order.

Typical types of contracts include:

- approved service quotations
- confidentiality agreements
- non-disclosure agreements
- sample submission requests
- memorandum of agreement
- memorandum of understanding
- research proposals and contracts
- verbal orders (oral agreements)
- activity plans

4.4.2 Records of Review

Policy:
Records of request and contract review, including significant changes, are maintained. Records of pertinent discussions with a Client relating to the Client's requirements or the work during the period of execution of the contract are also maintained.

Details:
For review of routine and other simple tasks, the date and the identification (e.g., initials) of the person in the laboratory responsible for carrying out the contracted work are considered adequate. For repetitive routine tasks, the review need be made only at the initial enquiry stage or on grant of the contract for on-going routine work performed under a general agreement with the Client, provided that the Client's requirements remain unchanged. For new, complex or advanced testing tasks, a more comprehensive record is maintained.

4.4.3 Review of Subcontracted Work

Policy:
Request and contract review also includes work that is subcontracted by the laboratory.

Details:
Subcontractor laboratories are reviewed as described in section 4.5.

4.4.4 Notification of Client

Policy and Details:
Clients are informed of deviations from the contract. This is typically communicated to the Client prior to the performing the deviation or disclosed in the final report narrative or qualifiers.

4.4.5 Contract Amendment

Policy and Details:
If a contract needs to be amended after the work has commenced, the same contract review process is repeated and any amendments are communicated to all affected personnel.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

4.5 Subcontracting of Analyses and Calibrations

4.5.1 Subcontractor Competence

Policy:

Work that must be subcontracted due to:

- unforeseen circumstances, instrument or QC failures
- workload
- large contracts
- contracts requiring some extra technical expertise
- Tests not performed in-house

is subcontracted to a technically competent laboratory.

Details:

The subcontracted laboratory demonstrates technical competence by possession or receipt of one or more of the following:

- recognized technical accreditation- NYSDOH NELAC or other NELAC accreditation body or other certification where applicable
- satisfactory performance of appropriate quality control check samples, certified reference material, in-house reference material or replicate analysis-NELAC labs do not need this documentation
- Review of the subcontractor's quality management system by our QA Officer

It is the responsibility of the Quality Assurance Officer to assess and approve the competence level of subcontractor laboratories with particular attention to their certifications which are maintained in the Quality Assurance network drive.

4.5.2 Client Approval

Policy:
Clients are advised of work (or any portion thereof) that is being subcontracted to another laboratory and their approval is obtained (preferably in writing). Upon log-in at the lab, a Subcontract Notification Form is generated by Sample Control and e-mailed immediately to the Client. In some cases an email record will serve this purpose.

Details:
Clients are advised of subcontracted work through fee schedules or any type of contract listed in section 4.4.1.

4.5.3 Assurance of Subcontractor Competence

Policy:
The laboratory is responsible to the Client for the subcontractor's work. Technical competence of subcontractor laboratories is demonstrated through various records.

> **Note** – there may be circumstances where the Client specifies which subcontractor is to be used. In such cases we may not be able to demonstrate the competence of the subcontractor and therefore are not responsible for the results.

Details:
Records of subcontractor competence may include, but are not limited to, the following:
- accreditation certificates or documentation
- registration certificates
- check sample results
- audit results
- approval by the Quality Assurance Officer

4.5.4 Subcontractor Register

Policy:
A register of all subcontractors performing tests is maintained in th eQuality Assurance network drive.

The approved register of subcontractors and all relevant records are maintained by the Quality Assurance Officer.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

4.6 Purchasing Services and Supplies

4.6.1 Policies and Procedures

Policy:
The SOP ADMINPURCHASESING043010 is used to select and purchase services and supplies. The SOP ADMINPURCHASESING043010 is used for procurement, reception, and storage of supplies. Individual method SOPs dictate the materials to use. No modification of this is allowed without athorization.

Details:
Consumable materials are stored according to the appropriate test method, SOP, or work instruction.

4.6.2 Specifications

Policy:
Only services and supplies of the required quality are used. These quality requirements are detailed in laboratory SOPs under the "*Materials Required*" section and will identify the appropriate minimum specifications when necessary.

Details:
Packing slips are checked against package content labels and matched with the Purchase Order if accepted. Once accepted, the packing slip is dated and initialed as evidence of compliance. Certificates of analysis (COA) are maintained on file after the COA is checked to ensure the received item meets minimum specifications.

Chemicals are purchased with manufacturer's certificates where possible. Uncertified chemicals are purchased from ISO 9000 registered companies where possible. Whatever the source, the laboratory verifies the quality of the standards by comparing the new batch of standards to the old. Due regard is paid to the manufacturer's recommendations on storage and shelf life.

Reagents are generally purchased from manufacturers who have a quality management system based on ISO 9000. The grade of any reagent used (including water) is stated in the method together with guidance on any particular precautions to be observed in its preparation or use.

Where no independent assurance of the quality of procured goods or services is available or the supplier's evidence is insufficient the laboratory ensures that purchased goods and services comply with specified requirements. Where possible and practical the laboratory ensures that goods are inspected, calibrated, or are otherwise in compliance with any standard specification relevant to the calibrations or tests concerned.

4.6.3 Purchasing Documents

Policy:
Purchasing requests are recorded on the Purchase Order form and contain data describing the product ordered. The Purchase Order is reviewed and approved for technical content prior to release.

Details:
The description may include type, class, grade, precise identification, specifications, drawings, inspection instructions, other technical data including approval of test results, quality required and quality management system standard under which they were produced.

The completion of the Purchase Order is the responsibility of the originator.

4.6.4 Approved Suppliers

Policy:
Suppliers of critical services are evaluated and approved before use. An approved supplier list is maintained.

Details:
Audits or tender evaluation is conducted to qualify suppliers of critical services prior to use. The criteria for evaluation may include, but is not limited to the following:

- references
- accreditation
- formal recognition

The records are maintained by purchasing personnel. **SOPs detail the acceptable vendors for all materials.**

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

4.7 Service to the Client

4.7.1 Service

Policy:
Client requests are clarified for the Clients or their representatives. Furthermore the Client or their representative will be afforded the right to monitor the performance of the laboratory in relation to the work performed, provided that the laboratory ensures confidentiality to other Clients.

Details and Procedures:
Service to the Client includes:

- Affording the Client or the Client's representative reasonable access to relevant areas of the laboratory for the witnessing of work performed for the Client; it is understood that such access should not conflict with rules of confidentiality of work for other Clients or with safety.

- Preparing, packaging, and dispatching of test data needed by the Client for verification purposes.

- Maintaining of open contacts. The Client values advice and guidance in technical matters, and opinions and interpretations based on results. Contact with the Client, especially in large assignments, should be maintained throughout the work by Client Services personnel. The laboratory should inform the Client of any delays or major deviations or issues encountered during the performance of the tests.

4.7.2 Feedback

Policy and Details:
The laboratory seeks feedback from the Client. Positive and negative feedback can be obtained passively through ongoing communications with the Client (e.g., review of test reports with Clients) or actively through Client satisfaction surveys. The feedback is used to improve the quality management system, testing activities, and Client service.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

4.8 Complaints

4.8.1 Policies and Procedures

Policy:
The SOP ADMINCOMPLAINTS 04302010 is used for resolving complaints received from Clients or other parties. Records are maintained of all complaints and follow-up.

Details:
Records of complaints include the following information:

- details of the complaint
- investigation
- corrective action
- follow-up verification

See also section 4.11.

All personnel are responsible for recording and responding to complaints.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

4.9 Control of Nonconforming Analyses

4.9.1 Procedures to Control Nonconforming Work

Policy:
The SOP ADMINNONCONFORM 04302010 is used to control any aspect of testing, or the results of this work, when they do not conform with the test methods, SOPs or the agreed to requirements of the Client.

Details:
The procedure ensures that:

- Responsibilities and authorities for the management of nonconforming work are designated and actions (including halting of work and withholding of test reports as necessary) are defined and taken into consideration when nonconforming work is identified
- an evaluation of the significance of the nonconforming work is made
- correction is taken immediately, together with any decision about the acceptability of the nonconforming work
- where necessary, the Client is notified and the work is recalled
- the responsibility for authorizing the resumption of work is defined

Identification of nonconforming work or problems with the quality management system or with testing activities can occur at various locations within the quality management system and technical operations such as:

- Client complaints
- quality control
- instrument calibration
- checking of consumable materials
- staff observations or supervision
- test report review
- management reviews
- internal or external audits

4.9.2 Root Cause Analysis

Policy:
Where evaluation indicates that nonconforming work could recur or that there is doubt about the compliance of the laboratory's operations with its own policies and procedures,

the corrective action procedures given in 4.11 are followed to identify the root cause(s) of the problem and to eliminate cause(s).

Details:
The SOP ADMINCORRACTION043010 outlines the recording of the root cause analysis for investigating nonconforming work.

Situations warranting corrective action investigation include:
- failure to comply with test method including all applicable procedures necessary to ensure the integrity and representative nature of the sample
- presentation of uncertain knowledge as to compliance with test methods including all applicable procedures necessary to ensure the integrity and representative nature of the sample
- failure or suspected failure in method performance as demonstrated by results provided by quality control samples
- lack of relevant evidence provided by quality audit, proficiency testing, or Client feedback
- lack of relevant evidence provided by data validation
- neglect to check the inherent property of the sample that compromises the testing

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

4.10 Improvements

4.10.1 Policies and Procedures

Policy:
The laboratory continually improves the effectiveness of its management system through the use of the quality policy, quality objectives, audit results, analysis of data, corrective actions, and management review.

Details:
The laboratory has implemented a continual improvement philosophy within the management system. Every employee in the laboratory is encouraged to suggest new ideas for improving services, processes, systems, productivity, and the working environment.

Opportunities for improvement of operations and processes are identified by managers on a continual basis from ongoing feedback on operations and through management reviews. Opportunities for improvement of services are identified by anyone within the organization including Sales, Marketing and Client Services.

Inputs for improvement opportunities are obtained from the following sources:
- Client satisfaction surveys and any other Client feedback
- market research and analysis
- employees, suppliers, and other interested parties
- internal and external audits of the management system
- records of service nonconformities
- data from process and service characteristics and their trends

Opportunities for improvement may also be identified on a special project basis. The following are listed only as examples:
- improving usefulness of bench space
- reducing excessive inspection/analysis
- reducing excessive handling and storage
- reducing test/calibration failures

Opportunities for improvement from daily feedback on operational performance (i.e., internal audits, Client feedback, test/calibration failures) are evaluated by the Laboratory Director or Quality Assurance Officer. Typically, they are implemented through the corrective and preventive action system.

Opportunities for improvement from analysis of longer-term data and trends are evaluated and implemented through the management review process. They are prioritized with respect to their relevance for achieving quality objectives. When opportunities for improvement are no longer supported by the current policy and objectives, management will establish new quality objectives, and possibly change the policy. The process for this evaluation is described in Section 4.15. Longer-term improvement projects are initiated through the management review process, as well as the corrective and preventive action system.

Service improvement opportunities are evaluated by management. They are implemented through the supervisor of the laboratory who ensures that the improvements are validated as outlined in Section 5.4 of this manual and appropriate level of quality control is performed on an ongoing basis.

Revision History

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4.11 Corrective Action

4.11.1 General

Policy:
The SOP ADMINCORRACTION043010 is utilized for implementing corrective action when nonconforming work or departures from policies and procedures in the quality management system or technical operations have been identified. The procedure requires that appropriate authority be designated for the implementation of corrective actions. The procedure includes cause analysis, selection and implementation of corrective action, and monitoring of actions.

Details:
Problems with the quality management system or technical operations of the laboratory may be identified through a variety of activities, such as control of nonconforming work, internal or external audits, management reviews, feed-back from Clients, or staff observations.

Corrective action investigations are documented and required changes to operational procedures are implemented. The corrective action request (CAR), investigation and resolution are recorded on a CAR form.

4.11.2 Cause Analysis

Policy:
Corrective action always begins with an investigation to determine root cause(s) of the problem (see SOP ADMINCORRACTION043010).

Details:
Potential causes of the problem could include Client requirements, the samples, sample specifications, methods and procedures, personnel skills and training, consumable materials, or instrumentation and its calibration.

4.11.3 Selection and Implementation of Corrective Actions

Policy and Details:

After determining the cause(s) of the problem, potential corrective actions are identified. The most likely action(s) (this includes practical and/or reasonable) are selected and implemented to eliminate the problem and to prevent recurrence. It should be noted that any corrective actions taken to eliminate the cause(s) of nonconformities or other departures are to a degree appropriate to address the magnitude of the problem and commensurate with the risks encountered (Note – in plain language, this means determine whether the benefit outweighs the cost). Controls are applied to prevent recurrence. The laboratory documents and implements the required changes resulting from corrective action investigations.

4.11.4 Monitoring of Corrective Action

Policy:
After implementing the corrective action(s), the laboratory monitors the results to ensure that the actions taken have been effective in overcoming the problems originally identified.

Details:
Monitoring is assigned to an appropriate individual such as the originator of the CAR or the originator's manager. Changes resulting from corrective action are documented.

4.11.5 Additional Audits

Policy:
Where the identification of nonconformities or departures casts doubts on compliance of policies, procedures, regulations, international quality standards, the appropriate areas of activity are promptly audited in accordance with section 4.14.

Details:
Special audits follow the implementation of corrective actions to confirm their effectiveness. A special audit is only necessary when a serious issue or risk to the business is identified. Special audits are carried out by trained and qualified personnel who are [whenever resources permit] independent of the activity to be audited. See section 4.14 for more details.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

4.12 Preventive Action

4.12.1 Preventive Action Identification

Policy:
Opportunities for needed improvement and potential sources of nonconformities, either technical or with the quality management system shall be identified. If action is required, action plans are developed, implemented and monitored, to reduce the likelihood of occurrence of such nonconformities and to take advantage of the improvement opportunities.

Details:

Records of preventive action include the following information:

- details of potential nonconformities
- investigation
- preventive action
- follow-up verification

These records are maintained in the Preventive Action Request (PAR) form/binder.

4.12.2 Preventive Action Plans

Policy:
The preventive action procedure includes the initiation of such actions and application of controls to ensure that they are effective.

Details:
Preventive action may result from the review of operational procedures and analysis of data. Analysis of data includes trend analysis, analysis of proficiency testing results, and risk analysis.

The SOP ADMINPREVACTION043010 is utilized to implement opportunities for needed improvement and prevent potential sources of nonconformities.

Revision History

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4.13 Control of Records

The York Quality Assurance Program has been developed to provide analytical results of known quality. To demonstrate that quality has been achieved, York maintains a record management system that includes documents pertinent to the analytical performance of the laboratory. Laboratory records are maintained in two broad categories.

- Documents which are specific to a project or a group of samples within an ongoing project, such as chain-of-custody, and raw analytical data.
- Documents which demonstrate overall laboratory operation, such as instrument log books and control charts. These records will directly affect the data for a specific project, but in general their applicability is not limited to one project.

This procedure addresses identification, collection, indexing, access, file, store, maintain, protect, backup, and disposal of quality and technical records. To outline procedures for the protection and backup of data/records held on computers.

4.13.1 General

This procedure applies to all quality and technical records. Quality records include audit reports, management review, corrective action requests, and preventive action requests. Technical records include observations, calculations, derived data, calibration records, personnel records, and test reports.

4.13.1.1 Procedures

Policy:
The SOP ADMINRECORDS043010 is used to identify, collect, index, access, file, store, maintain, protect, backup, and dispose quality and technical records. Quality records include reports from internal audits and management reviews as well as corrective and preventive action records.

Details:
Records are available to demonstrate conformance to requirements and effective operation of the Quality Management System. Quality records from suppliers are also controlled.

All records, (electronic and hard copy) including test reports, are safely stored and held secure in locked areas, and in confidence to the Client. Records are maintained in the designated archival area for **five (5)** years with the exception of potable water conducted from NY which is 10 years.

4.13.1.2 PROJECT RECORDS

Separate files are maintained for each project. Filing of records for a specific project shall be by the unique project identification number assigned by the laboratory for that project. Within a project file, categories of information are filed separately. Upon completion of all projects (SDGs), the file contents are scanned to an unalterable image file (.pdf) and archived removable hard disk media. Such media are held for a period of 5 years. Paper copy is maintained for 30 days after data submission. Following is a brief discussion of each item that is maintained for each project file.

A - Correspondence

All correspondence pertinent to the analytical program shall be maintained. This includes letters to and from clients and internal memorandums. Correspondence should be filed chronologically.

B - Chain-of-Custody

Chain-of-custody records shall be maintained by the laboratory. The chain-of-custody forms should be filed for samples as received and should be placed in the project file immediately after they are signed by Sample Control personnel.

C - Request for Analysis

Analysis requests provided by the field personnel are maintained in this file. Also, any changes or additions to the analytical program should be documented in this file.

D - Calibration Records

In general, calibration records are maintained with laboratory operation records. However, if an analytical program requires a calibration which is performed solely for a project, the records shall be maintained in this file. If calibration is performed as an integral part of the analytical process, the calibration records should be maintained with the analytical data. If these items are in the Element LIMS system, this is not required.

E - Analytical Data

Analytical data files should be complete for a group of samples. The file should contain raw analytical data, processing of the data and/or data reduction, and any data validation. It should be possible to use data files to completely demonstrate that the data have been adequately obtained, processed, and reviewed.

G - Quality Control Samples

If quality control samples, such as field blanks, are processed for a specific project, the data shall be maintained with the project file. The results of quality control samples processed on a general basis are included in the laboratory operations files. Statistical evaluation of quality control sample data for a project shall also be maintained in this file.

If quality control samples are processed as an integral part of a group of samples such that the data cannot be readily separated, the quality control sample data can be stored with the analytical data.

H - Data Reports

Complete copies of all reports issued by the laboratory are accessible on the Network and are not stored with the project files.

I - Project-Specific Requirements

If a project requires analytical procedures other than what is adopted in the York Quality Assurance Program, the requirements shall be included in this file. Specific requirements may be due to government regulations, specific contracts, or project need. Changes from stated practice can be, for example, frequency of QC sample analysis, test method, statistical data evaluation, and reporting format.

If it is necessary to adopt a new analytical procedure, a procedure different than conventionally used, or alter an existing procedure, the method used for the project must be documented. If the analytical procedure is developed by York as part of the analytical program, the procedure shall be documented and included. If an existing procedure is altered, the Analyst or Group Leader shall prepare a memorandum to the project file stating what the changes were and the justification for change.

J - Nonconformance

Nonconformance's and subsequent corrective actions which are specific to a project are included in this file. The record should be in the form of a memorandum (or

copy of other r ecords discussed in this manual) with the nonconformance stated, how it was corrected, and the approval for the correction. A separate file for each incidence is not required, the file should be maintained chronologically.

K - QA Plan

If a specific Quality Assurance Project Plan, and revisions, are prepared for a project, they shall be stored in this file.

L - Miscellaneous

The miscellaneous file includes all records not applicable to the previous categories.

4.13.1.3 GENERAL LABORATORY OPERATIONS RECORDS

General laboratory records document overall laboratory performance and operations. These records are filed separately from project records and will be maintained so they can be referenced to project records if necessary. Examples of general records pertinent to project records are instrument log books and computer software verifications.

There are two types of general laboratory records:

< Documents which demonstrate laboratory performance

< Reference documents for laboratory operations

Records which demonstrate laboratory performance shall be filed in categories in a manner similar to project files. Reference documents are not indexed and their usage is not controlled.

Many of the laboratory operations records are in daily use, such as the Master Log Book, instrument calibration logs, and control charts. It is not intended that the records be stored daily while they are in use. However, when individual log books, etc. are filled, they shall be placed in the files.

Following is a brief discussion of the General Lab Operations records:

A - Sample Log Books

The Sample Log Books chronologically record all samples entering the laboratory, independent of project designation.

B - Instrument Calibration Logs

All calibration performed independent of a specific project shall be recorded by instrument. A separate file should be maintained for each instrument subject to calibration. These files are scanned and archived on the network by instrument and date.

C - Instrument Maintenance Logs

Separate maintenance files should be kept for each instrument incorporated in the preventive maintenance program. The file shall include records of maintenance performed in-house or by outside groups.

D - Performance Evaluation Records

Laboratory participation in Performance Evaluation Programs shall be documented in this category. If performance standards are analyzed as part of the overall quality control sample program, the results should be included in Category G.

E - Certification Program (NY, CT, NJ , PA) Records

If the laboratory participates in certification programs, such as the NELAP, ELAP, etc. program, the results shall be maintained in this category. Records should include all correspondence, analytical data, agency results, etc.

F - Control Charts

Control charts are generated and maintained on the Element LIMS.

G- Purchased Material Certificates

All information which verifies that purchased materials meet the requirements of the laboratory should be maintained. Certification may be supplied by a vendor or from in-house verification analysis. Separate files should be kept for chemicals, gases, water, glassware, etc.
These certificates are scanned and entered into LIMS.

4.13.1.4 RECORD CONTROL

The individual responsible for the records management system is the QA Officer. For hard copy records , this person shall:

- Initiate new files
- Add new records to existing files, initiate new files within a category, and update any index
- Assist laboratory personnel in withdrawing and returning records.

To maintain control of hard copy records within the laboratory, a Records Accession LOG is maintained. The LOG indicates:

- Project from which file is borrowed
- Date and person borrowing record
- Date returned to the record system

The dating format for records is MM/DD/YYYY.

4.13.2.1 Record Integrity

Policy:
All records are to be legible and shall be retained in such a way that they are readily retrievable in facilities that provide a suitable environment to prevent damage or deterioration and to prevent loss.

Details:
The retention time for hard copy and electronic records is set at **five** years. For the State of NY potable water, the time is extended to 10 years.

Records may be in the form of any type of media, such as hard copy or electronic media.

4.13.2.2 Record Security

Policy:
All records are held secure and in confidence.

Details:
Access to records is secured through limited access areas and computer access via user defined privileges.

4.13.2.3 Records Backup

Policy:
The SOP ADMINRECORDS043010 is followed to protect and backup data/records held on computers at all times and to prevent unauthorized access to or amendment of data/records on computers.
Details:
Data are password protected.

Backups ensure integrity and availability of data / information in the event of a system / power failure. Backup is done to a DATTO system and simultaneously to a Cloud backup solution maintained by our outside IT consultants.

4.13.3 Technical Records

4.13.3.1 Record Information

Policy:
Original observations, calculations, derived data and sufficient information to establish an audit trail, calibration records, personnel records and a copy of each test report issued are retained for five years (ten years for NY State potable water data).

The records for each test shall contain sufficient information to facilitate, if possible, identification of factors affecting the test uncertainty and to enable the test or calibration to be repeated under conditions as close as possible to the original. The records include the identity of personnel responsible for sampling, performing of each test and/or calibration and checking of results.

Details:
Technical records are accumulations of data (see 5.4.7) and information that result from carrying out tests and/or calibrations and which indicate whether specified quality or process parameters are achieved. They may include forms, contracts, work sheets, work books, note books, instrument printouts, magnetic media, check sheets, work notes, control graphs, test reports, calibration certificates, Client's notes, papers and feedback, and test reports to Clients.

The records for each test contain sufficient information to permit its reconstruction. Records include:
- date of sampling
- sample receipt
- sample handling and storage

- identification of personnel
- analyst proficiency
- instrumentation identification and performance
- calibration records
- media performance, where appropriate
- test batch # or lot #, where appropriate
- results
- reports (mailed, e-mailed, faxed)
- review

Note – the above records may be stored in separate locations. They are cross-referenced for easy retrieval.

4.13.3.2 Recording

Policy:
Observations, data, and calculations are clearly and permanently recorded and identifiable to the specific job at the time they are made.

Details:
Handwritten records must be legible and made with indelible ink immediately after an observation, after data is collected and/or after calculations are made.

4.13.3.3 Corrections to Records

Policy:
Changes to test data are made so as not to obscure or delete the previous data entry.

Details:
Mistakes are crossed out and the correct value entered alongside. Mistakes are not erased, made illegible, or deleted. All alterations to records are signed or initialed by the person making the correction. In the case of computer-collected data, similar measures are taken to avoid loss or change of original data.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

4.14 Internal Audits

4.14.1 Internal Audit Program

Policy:
The internal audit program involves periodic audits conducted according to a predetermined schedule for each year. This program is defined on an annual basis and conducted as outlined in this section with further details found in SOP ADMININTAUDIT043010. All elements of this Quality Manual will be audited each year and all relevant laboratory records are available to personnel conducting the audit. These audits are performed to verify operations continue to comply with the requirements of this Quality Manual and are effective.

Details:
The Quality Manual, test procedures, and laboratory results are verified for compliance. It is the responsibility of the Quality Assurance Officer to plan and organize audits as required by the schedule and requested by management. Audits are carried out by trained and qualified personnel who are independent of the activity to be audited. Personnel are not to audit their own activities except when it can be demonstrated that an effective audit will be carried out (see also 4.11.5). Audits are performed through the aid of a checklist prepared in advance to minimize the possibility of overlooking any details during the audit.

Generally, the types of audits include:
- quality management system
- processes and procedures (SOPs)
- services and reports

4.14.2 Corrective Action

Policy:
When audit findings cast doubt on the effectiveness of the operations or on the correctness or validity of test or calibration results, timely corrective action is taken and Clients are notified if investigations show that laboratory results may have been affected.

Details:
Nonconformities that can be resolved easily are to be corrected immediately, ideally during the audit. Records are made on the audit checklist. Nonconformities that require a

more involved resolution are recorded on a CAR and resolved as described in section 4.11.

Corrective actions and Client modifications must be kept on record for each audit deviation that casts doubt as described in this section.

4.14.3 Records and Management

Policy:
Records are made of the activity being audited, the audit findings, and corrective actions that arise. Management ensures that corrective actions are discharged within an appropriate and agreed timeline.

Details:
A report is prepared by the auditors and distributed to those audited and/or the area manager/supervisor within an appropriate and agreed timeline. The audit report may include the following sections, as appropriate:

- audit objective and scope
- area or section audited
- personnel involved – auditors and auditees
- date of audit
- reference documents
- observations including nonconformities and commendations
- opening and closing meetings
- recommendations/corrective actions
- audit report distribution and review

The appropriate manager is responsible for ensuring that corrective actions are sufficiently recorded. Follow-up is performed by the auditor and recorded when corrective action is complete and deemed effective. The audit records are kept on the network.

4.14.4 Follow-up Audits

Policy:
Follow-up audits are performed to verify and record the implementation and effectiveness of the corrective action taken.

Details:
The follow-up audit is performed at a mutually acceptable time between the area implementing corrective action and the auditor. This time is determined when the Corrective Action Report (CAR)is issued.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

4.15 Management Reviews

4.15.1 Review of Quality Management System and Testing

Policy:
Top management periodically (annually) and in accordance with a predetermined schedule and SOP ADMINMGMTREV043010, conduct a review of the laboratory's quality management system and testing activities to ensure their continuing suitability and effectiveness and to introduce any necessary changes or improvements.

Details:
The review takes account of:

- suitability of policies and procedures
- reports from managerial and supervisory personnel
- the outcome of recent internal audits
- corrective and preventive actions
- assessments by external bodies
- results of inter-laboratory comparisons or proficiency tests
- changes in the volume and type of work undertaken
- feedback from Clients, including complaints and Client satisfaction surveys
- recommendations for improvement
- other relevant factors, such as quality control activities, resources and personnel training

The minimum period for conducting a management review is once a year to be completed by the end of the 1st quarter of the ensuing year. Results of the review feed into the laboratory planning system and include goals, objectives and action plans for the coming year.

A management review can be supplemented by consideration of related subjects at regular management meetings.

4.15.2 Findings, Actions, and Records

Policy and Details:
Findings from management reviews and the actions that arise are recorded in the minutes of the meeting. Management will ensure that the actions are discharged within an appropriate and agreed upon timeline.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

4.16 Data Integrity Plan

4.16.1 Purpose

The purpose of the Data Integrity Plan is four-fold:

(a) to describe the laboratory's data integrity system,
(b) to emphasize the paramount importance of ethics in the performance of all analytical work,
(c) to obtain the commitment of laboratory staff to the principle that all analyses shall be performed in a controlled and documented manner, and
(d) to ensure that laboratory staff consistently meet the specific ethical requirements defined in this data integrity plan.

4.16.2 Scope

This procedure applies to all analyses and activities performed within the laboratory's scope of accreditation.

4.16.3 Responsibilities

Senior managers support and the Lab Director and QA Officer provide initial data integrity training and on-going annual training to all laboratory staff. Senior managers ensure that only staff who sign the ethics agreement are allowed to work in the laboratory.

The QA Officer maintains records of ethics/data integrity training and data integrity monitoring.

4.16.4 Procedure

Ethics Training

Ethics training is a required part of new employee orientation and is provided on an annual basis for all laboratory managers and staff by senior laboratory management. Initial training during orientation includes the overall organizational mission and its relationship to the absolute need for honesty and full disclosure in all analytical reporting and record-keeping. Resources where applicable ethics policy and law can be found are made available and copies are distributed. Examples are described that illustrate unethical behavior and ethical behavior related to laboratory data manipulation. Laboratory standard operating procedures are reviewed with respect to proper procedure, data qualifiers, and adequacy of record keeping. Management will disclose that reports and the data generated to support them are subject to routine in-depth review.

The organizations response to infractions of the data integrity plan will be discussed and the trainee shall understand that infractions will be investigated in a detailed way. The consequences to an employee found to be in violation of the data integrity plan may result in immediate termination, debarment, and/or civil/criminal prosecution. Confidentiality is assured during this process.

Employee attendance or participation is documented.

Ethics Agreement

Following initial ethics training and on-going annual training for laboratory managers and staff, trainees shall sign a written ethics agreement. Senior managers who provide the training shall also sign the agreement. The agreement states that the signers will not engage in any unethical practices with respect to data integrity nor will they tolerate improper behavior in others if it is observed or suspected. By signing, senior managers acknowledge their duties in upholding the spirit and intent of the data integrity system and in effectively implementing the specific requirements of the plan.

Monitoring

Data integrity monitoring is accomplished by periodic data package and manual integration reviews by the QA Officer (QAO) or designeee, annual internal audits, and monthly QC sample tracking. Therefore the QAO, shall have an in-depth understanding

of typical inappropriate analytical behavior and be trained in the data integrity system. Refer to the laboratory's SOP for data review.

Documentation

All data integrity incidents must be documented, including investigative findings and disciplinary actions. Corrective actions are recorded. Confidentiality is critical and maintained by use of password protected files. If client disclosure is determined to be necessary by senior laboratory management, then such disclosures and outcomes are recorded.

All data integrity documents, plans, SOPs, personal records and records of investigations shall be maintained for a period of five years. Documents are subject to the document control system and records are subject to the records management system as described in the laboratory's quality manual and related SOPs.

4.16.5 References

Internal

York Data Integrity and Ethics Training SOP (ADMIN Ethics 040102)
York Internal Quality Audit SOP (ADMIN Audit 043010)
York Manual Integration Review SOP (ADMIN ManIntReview 043010)
and any updates to the above SOPs

External

NELAC Quality Systems, Chapter 5, Sections *5.4.2.3, 5.4.2.6, and 5.4.15*, June 5, 2003 and Module 2, *Sections 4.2.8.4, 4.2.8.1, 5.2.7, and 4.16*, August 24, 2009.

Revision History

Revision No.	Date	Responsible Person	Description of Change
1	12/26/12		Initial Release

4.16.6 Annual Review (The review is to be documented if the Quality Manual has not been revised in the past 12 months)

Signature

Ben Gulizia, Lab Director
Name/Title Date: January 19, 2019

Signature

Sarah Widomski, Corporate QA Officer
Name/Title Date: January 19, 2019

5.1 Technical Requirements

5.2 General

5.2.1 .1 Correctness and Reliability

Policy and Details:
Correctness and reliability of the tests and/or calibrations performed have many contributing factors including:

- human factors (see section 5.2)
- accommodation and environmental conditions (see section 5.3)
- test and calibration methods and method validation (see section 5.4)
- instrumentation (see section 5.5)
- measurement traceability (see section 5.6)
- sampling (see section 5.7)
- handling of test and calibration items (see section 5.8)

5.2.2 Measurement Uncertainty

Policy:
When developing test and calibration methods and procedures, total measurement uncertainty must be accounted for in the training and qualification of personnel, and in the selection and calibration of instrumentation.

Details:
The extent to which the factors contribute to total measurement uncertainty differs between (types of) tests and between (types of) calibrations.

See section 5.4.6 for more details.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

5.2 Personnel

Section 5.2 Personnel

York recognizes that all laboratory personnel affect data quality. This manual has been prepared so that staff members will be cognizant of the procedures adopted by York for the production of analytical data, and so they will be aware of their responsibilities.

Staff are properly trained and qualified for their positions and specific procedures.

5.2.1 Competence and Qualification

Policy:
Management ensures the competency of all personnel charged with analysis and those evaluating results and signing test reports. Appropriate supervision is provided for employees undergoing training. Personnel performing specific tasks are qualified on the basis of appropriate education, training, experience and/or demonstrated skills, as required.

In addition, personnel responsible for the opinions and interpretations included in test reports also have:

- relevant knowledge of the technology used for the analysis, materials
- knowledge of the general requirements expressed in the legislation and standards
- an understanding of the significance of deviations found with regard to the normal use of the data

Details:
Management defines the minimum levels of qualification and experience necessary for all posts within the laboratory. In some technical areas it may be required that the personnel performing certain tasks be certified. The laboratory is responsible for fulfilling specified certification requirements of personnel. The requirements for personnel certification might be regulatory, might be included in the standards for the specific technical field, or required by the client.

Continued competence is monitored and where this is not achieved, the need to retrain personnel is considered. Where a method or technique is not in regular use, verification of personnel performance prior to testing may be necessary.

5.2.2 Training Policies and Procedures

Policy:
Management will formulate the goals with respect to the education and the skills of the laboratory personnel. The training program is relevant to the present and anticipated tasks

of the laboratory. SOP# ADMIN Training Revision No. 1.4 09/04/2014 is utilized to identify training needs and providing the necessary training for personnel. The effectiveness of the training actions taken is evaluated.

Details:
The skills and knowledge are defined in the job description for each job function as described in section 5.2.4. Management compares the job description to the skills and knowledge of the new incumbent to determine the training needs.

Training in the laboratory must include all methods or parts of methods and techniques that personnel are asked to perform. Minimally, the analyst must demonstrate competency (Initial Demonstration of Capability) through observation by management and verification using replicate and/or check samples. For technicians who perform only parts of the method, confirmation of competency may be verified by observation only. Re-verification of all personnel must be performed annually on all methods or techniques pertinent to their job description.

In some cases it may be appropriate to define competence related to a particular technique or instrument rather then methods. If so, it will be necessary to define for each method, the necessary technique-based competence required together with any additional requirements.

5.2.3 Employees

Policy:
Competent permanent or part-time employees are employed in the laboratory. No contract labor is used. The Laboratory Director ensures that all technical employees, and key support personnel are supervised and work in accordance to the policies and procedures of this Quality Manual.

Details:
Testing must be either performed or supervised by an experienced person qualified to perform the test. Personnel have relevant practical work experience and training before being allowed to perform accredited work.

5.2.4 Job Descriptions

Policy:
Current job descriptions for managerial, technical and key support personnel involved in laboratory analyses are maintained centrally on the Network with appropriate access.

Details:
Minimum contents of job descriptions include:
- the duty of performing preparation/analysis
- the act of planning analyses and evaluation of results
- the responsibility of developing and validating new methods as / when requested
- expertise and experience
- qualifications and training programs
- managerial duties if applicable

Job descriptions are dated and signed to demonstrate that each incumbent has read it and is in agreement. They are maintained current on the Network.

5.2.5 Authorized Personnel

Policy:
Management authorizes specific personnel to perform particular types of analysis, to issue test reports, to give opinions and interpretations and to operate particular types of instrumentation. Records of the relevant competence, educational and professional qualifications, training, skills and experience of all technical personnel and contracted personnel are maintained. This information is readily available and includes the date on which authorization and/or competence was confirmed and the criteria on which the authorization is based and the confirming authority.

Details:
The purpose of these records is to provide evidence that personnel have been adequately trained and their competence to perform particular tests has been assessed. In some cases it may be pertinent to state any particular limitations to competence. The records are maintained in a registry of skills and include:
- academic and professional qualifications
- external and internal courses attended
- relevant on-the-job training and retraining as necessary (i.e., demonstration of capability)
- skills and experience (i.e., resume-maintained in employee administration file)
- relevant authorizations

Records are held centrally in the Employee Training Records.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

5.3 Accommodation and Environmental Conditions

5.3.1 Facility

Policy:
Laboratory facilities are appropriate to attain correct performance of all analyses. This may include, but not limited to, energy sources, lighting, heating, ventilation and any other environmental conditions.

Appropriate care is taken to ensure that the environment does not invalidate the results or adversely affect the required quality of any measurement. The technical requirements for accommodation and environmental conditions that can affect the results of tests and calibrations are documented.

Details:
This section deals with the test areas in the laboratory and premises for support such as sample receipt and storage. Central laboratory supplies and services, such as water purification systems, air supply, vacuum source, and sample storage, are appropriate to facilitate proper performance of analyses.

5.3.2 Monitoring

Policy:
Critical environmental conditions are monitored, controlled and recorded as required by the relevant specifications, methods, and procedures or where they may influence the quality of the results. Due attention is paid, for example, to the potential for cross contamination by methylene chloride, acetone and hexanes which are used in the Extractions processes, as appropriate to the technical activities concerned. Analyses are stopped when the environmental conditions jeopardize the results.

Details:
Laboratories are ventilated to reduce the levels of contamination, lower humidity, and control temperature. Laboratories' test areas are air-conditioned. The relative humidity in test areas is 45-70 and the temperature is 20-25 °C. Volatiles analyses are conducted in a separate laboratory where the air conditioning system produces a positive pressure in the laboratory and the air intake (economizer) is disabled. In addition, samples for volatiles are stored in a separate Sample Control room in their own refrigerators to minimize potential for cross contamination.

Bench tops and floors are made of impervious, smooth easily cleaned materials. There is at least two linear meters workspace per analyst while working. Walls and ceilings are made of materials that are smooth and easily cleaned.

5.3.3 Separation of Incompatible Activities

Policy:
Effective separation between neighboring areas is made when the activities are incompatible. Measures are taken to prevent cross-contamination.

Details:
Reference materials and certified reference materials must be kept separated from samples (log-in and storage). Sample log-in and storage must are segregated, in separate areas from the testing laboratory, and include proper sanitation to exclude the possibility of cross-contamination. Segregation of activities is achieved through time and space allocations.

An example of space segregation would be for a trace volatiles analysis. Physical separation of the trace volatiles analysis from Extractions using solvents is achieved through the use of separate rooms. This also applies to samples for VOA analysis.

An example of time segregation would be the coordination of activities at different times. It may be appropriate to perform work on "cleaner" samples first before starting "dirtier" type samples.

5.3.4 Controlled Access

Policy:
Access to and use of areas affecting quality of the analyses is defined and controlled.

Details:
Access to the laboratory is restricted to authorized personnel. The authorized personnel are made aware of the following items:

- the intended use of the area
- the restrictions imposed on working within such areas
- the reasons for imposing the restrictions

5.3.5 Good Housekeeping

Policy:
Measures are taken to ensure good housekeeping in the laboratory. Special procedures are prepared when necessary.

Details:
Controlled use of cleaning and pest control materials is exercised. The laboratory complies with the local health and safety requirements.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

5.4 Tests and Calibration Methods and Method Validation

5.4.1 General

Policy:
Methods and procedures used for all analyses are appropriate as per:
- courier handling, transport, storage, and preparation of items to be tested
- an estimation of the measurement of uncertainty as well as statistical techniques for analysis of test data where appropriate

Instructions on the use and operation of all relevant instrumentation and on the handling and preparation of items for testing are available. All instructions, standards, manuals and reference data relevant to the work of the laboratory are maintained current and readily available to personnel. Deviation from SOP and test methods must be documented, technically justified, authorized, and accepted by the client.

Details:
There are SOPs for sample handling, transport, storage, preparation, QA/QC procedures, and standards for approving / rejecting results. These may be combined with or separate from the method. The content of a test method or SOP generally includes:
- scope, applicability, definitions
- description of test items
- holding times
- quantities to be tested
- materials and instrumentation required
- physical environmental conditions required (temperatures, pH requirements)
- description of procedures

- sample identification
- method of recording observations and results
- safety measures
- waste management/pollution prevention
- documentation
- method for data analysis and presentation
- sensitivity of method
- quality control plan
- Revision history

National or state standards or other recognized specifications that contain sufficient and concise information on how to perform the analyses are not necessarily supplemented or rewritten as an internal procedure when they are written in a way that can be used as published by laboratory staff. Consideration may need to be given to providing additional documentation for optional steps in the method.

5.4.2 Selection of Methods

Policy:
Preparation and analysis methods meet the needs of the client and are appropriate for the analysis undertaken. Preference is given to reference methods published as international, Federal, or State standards. The laboratory ensures that the latest edition of a standard is used unless it is not appropriate or possible to do so. When necessary, the standard is supplemented with additional details to ensure consistent application.

Details:
Methods that have been published either in international, Federal, or State standards, or by reputable technical organizations, or in relevant scientific texts or journals, or as specified by the manufacturer are selected when the client does not specify the method to be used. These methods may be adopted from the Environmental Protection Agency, ASTM, Standard Methods for the Examination of Water and Wastewater, Various State agencies, etc.
The ability of the laboratory to achieve satisfactory performance against documented performance characteristics is verified before samples are analyzed.

Laboratory-developed methods or methods adopted by the laboratory may also be used if they are appropriate for the intended use and if they are validated. The client is informed as to the method chosen. The laboratory confirms that it can properly operate standardized methods before introducing the samples for analysis.

The client is informed when the method proposed by the client is considered to be inappropriate or out of date.

5.4.3 Laboratory-Developed Methods

Policy:
Introduction of test methods developed internally is a planned activity and is assigned to qualified personnel equipped with adequate resources. Plans are updated as development proceeds and ensure effective communication among all personnel involved.

Details:
Methods developed in-house are validated and authorized before use. Where available, Certified Reference Materials (CRMs) are used to determine any systemic bias, or where possible results are compared with other techniques, preferably based on different principles of analysis. Determination of uncertainty must be part of this validation process and is essential for ongoing quality control.

5.4.4 Non-Standard Methods

Policy:
Utilization of non-standard methods is subject to agreement with the client and includes a clear specification of the client's requirements and the purpose of the test. The developed method is validated appropriately before use.

Details:
Discussion and agreement for the use of non-standard methods is recorded as part of contract review procedures (see section 4.4).

All non-standard and new tests are validated for their intended purpose. Qualitative test methods must be validated to demonstrate estimated sensitivity and specificity, relative accuracy to official methods (if appropriate), positive and negative deviation, limit of detection, matrix effect, repeatability, and reproducibility.

Quantitative test methods are validated to demonstrate specificity, sensitivity, relative accuracy, positive and negative deviation, repeatability, reproducibility, and limit of determination.

For new methods where procedures are developing rapidly, especially for emergency situations, it may be necessary to circumvent normal validation procedures. Minimally, this must be a demonstrated recovery in replicate.

New test and/or calibration methods are documented prior to providing test and/or calibration results to clients and contain at least the following information:

- appropriate identification
- scope
- description of the type of item to be tested or calibrated
- parameters or quantities to be determined
- apparatus and instrumentation, including technical performance requirements
- reference standards and reference materials required
- environmental conditions required and any stabilization period needed
- description of the procedure, including:
  - affixing identification marks, handling, transporting, storing and preparing of items
  - ensuring checks are made before the work is started
  - checking that the instrumentation is working properly and, where required, calibrating and adjusting the instrumentation before each use
  - listing method of recording the observations and results
  - indicating any safety measures to be observed
- criteria and/or requirements for approval/rejection (quality control plan)
- data to be recorded and method of analysis and presentation
- uncertainty or procedure for estimating uncertainty

5.4.5 Validation of Methods

5.4.5.1 Performance Characteristics

Policy:

Validation of a method establishes, by systematic laboratory studies, that the performance characteristics of the method meet the specifications related to the intended use of the test results.

Details:

The performance characteristics of a validation plan includes, as applicable:

- selectivity and specificity
- range
- linearity
- sensitivity
- limit of detection
- limit of quantitation
- ruggedness
- accuracy
- precision
- reporting limit
- repeatability
- reproducibility
- recovery

- confirmation techniques
- criteria for the number of samples tested to validate method as per defined scope of method
- action levels where defined by regulation
- quality control incorporating statistics as applicable
- interpretation of population results as applicable

Performance characteristics that are selected take into account the intended use of the method, whether for screening, confirmatory analysis, or quantitation.
The design, verification of the method and documentation procedures for validation are planned and conducted by qualified personnel, equipped with adequate resources.

This section lists a few acceptable validation procedures. The choice of the procedure depends on the extent of the deviation from the published method.
Validation of methodology is a value judgment in which the performance parameters of the method are compared with the requirements for the test data. A prerequisite for a valid method is that data produced by the method must attain a state of statistical control.
Such a state is obtained when the mean value of a large number of individual values tends to approach a limiting value called the limiting mean.

Methods may be validated by one or more alternative procedures. Some of these procedures are described below. Apparent differences can be analyzed statistically to confirm their significance. In all cases, the reasons for choosing one or more alternatives must be documented.

- analysis of standard reference materials (SRM) that are identical or almost identical to the test samples
- in the absence of suitable SRMs, analysis of reference materials that are similar in all respect to the test samples; the use and validity of this reference material must be documented
- using an alternative method to measure the same parameter provides a very high level of confidence if results are confirmed
- recovery studies by the addition of a known concentration of the parameter of interest to some of the replicates being measured

The parameters to be determined include:

- the scope of the method and any known interference
- detection limit
- the range of concentration where the method is valid
- precision and bias
- intra-laboratory variations
- inter-laboratory variations

Judgment is required to determine if some or all of the above are required. Requirements will depend largely on the extent of deviation from the original method.

Developments in methodology and techniques require methods to be changed from time to time. The difference in performance between revised and obsolete methods is established so that it is possible to compare old and new data.

Where a change in method involves only minor adjustments, such as sample size, or different reagents, the amended method is validated and the changes brought to the attention of the accreditation body at the next accreditation audit. Where the proposed change involves technology or methodology, the laboratory seeks the approval of the accreditation body.

Records are kept on all validation activities. The records include any of the performance characteristics chosen, reference procedures or guidance documents followed to validate the method or custom validation procedure, and a final confirmation (memo to file) that the method validation results are acceptable for continued use of the method. An example statement would be "This memo serves as record that the validation of the XYZ Test Method has been approved for use by [name and title of approver]".

5.4.5.2 for Use

Policy:

The laboratory validates non-standardized methods, laboratory-designed/developed methods, standardized methods used outside their intended range, and amplifications of standard methods to confirm that the methods are fit for the intended use. The validation is as extensive as is necessary to meet the needs in the given application or field of application (may include procedures for sampling, handling, and transportation). The laboratory records the results obtained, the procedure used for the validation, and a statement as to whether the method is fit for the intended use.

Details and Procedure:

Validation records are kept as in section 5.4.5.1. Included in these records is the validation procedure. The procedure used for the validation is likely to vary between different methods. Therefore, the procedures included in the laboratory records are not as detailed as a typical SOP, but are sufficient enough to re-create how the method was validated.

The techniques used for the determination of the performance of a method, are one of, or a combination of, the following:

- calibration using reference standards or reference materials

- comparison of results achieved with other methods
- inter-laboratory comparisons
- systematic assessment of the factors influencing the result
- assessment of the uncertainty of the results based on scientific understanding of the theoretical principles of the method and practical experience

When changes are made in the validated non-standard method, the influence of such changes carried out is documented and if appropriate a new validation is performed.

5.4.5.3 Client's Needs

Policy:
The range and accuracy of the values obtainable from validated methods (e.g., the uncertainty of the results, detection limit, selectivity of the method, linearity, limit of repeatability and/or reproducibility, robustness against external influences and/or cross-sensitivity against interference from the matrix of the sample/test object) as assessed for the intended use is relevant to the client's needs.

Details:
Validation includes the specification of the requirements, determination of the characteristics of the methods, the comparison of the requirements with the values of the characteristics of the method, and a statement on the validity.

As method development proceeds, regular review is required to verify that the needs of the client are still being fulfilled. Changing requirements requiring modifications to the development plan are approved and authorized.

Validation is always a balance between costs, risks, and technical possibilities.

5.4.6 Uncertainty of Measurement

5.4.6.1 Calibration

Policy:
Physical and chemical standards and instrumentation are calibrated or characterized internally and by subcontractors where appropriate.

Details and Procedures:
Repeatability and reproducibility data are components of measurement uncertainty and are determined as a first step towards producing estimates of this parameter. The uncertainty of measurement is available on the certificate of analysis or calibration certificate from a subcontractor.
Note – in-house calibrations include procedures for uncertainty of measurement estimates where this is common practice.

5.4.6.1.1 CALIBRATION PRACTICES

Instruments and instrumentation used at York are controlled by a formal calibration program. The program verifies that instrumentation is of the proper type, range, accuracy, and precision to provide data compatible with specified requirements. All instruments and instrumentation which measure a quantity, or whose performance is expected at a stated level, are subject to calibration. Calibration may be performed by York personnel using reference standards, or externally by calibration agencies or instrumentation manufacturers.

This section of the Quality Manual prescribes the practices used by York to implement a calibration program. Specifics are not provided herein because the requirements for the calibration of instruments and instrumentation are dependent upon the type and expected performance of individual instruments and instrumentation. Such details are provided in the specific SOPs. Implementation is the responsibility of the Group Leaders and Analysts. The Quality Assurance Officer shall review the implementation of the program as discussed in previously.

Two types of calibration are discussed in this section:

- Operational calibration which is routinely performed as part of instrument usage, such as the development of initial calibration curves for GC, GC/MS, etc. Operational calibration is generally performed for instrument systems.

- Periodic calibration wh ich is performed at prescribed intervals for instrumentation, such as balances and critical temperature measurement devices.

5.4.6.1.2 CALIBRATION SYSTEM

The following is a discussion of the elements comprising the calibration system.

5.4.6.1.3 Calibration Procedures

Written procedures are developed by York within the requirements of this manual for all instruments and instrumentation subject to calibration. Whenever possible, recognized procedures, such as those published by ASTM or the USEPA, or procedures provided by manufacturers are adopted. If established procedures are not available, a procedure shall be developed considering the type of instrumentation, stability characteristics of the instrumentation, required accuracy, and the effect of operational error on the quantities measured. As a minimum, the procedures shall include:

- Instrumentation to be calibrated
- Reference standards used for calibration
- Calibration technique and sequential actions
- Acceptable performance ranges
- Frequency of calibration
- Calibration documentation format

5.4.6.1.4 Instrumentation Identification

Instrumentation that is subject to calibration shall be uniquely identified so that calibration records can be designated with a specific instrument. Instrumentation identification can be by manufacturer's serial number, York inventory control number, or a unique number assigned by York.

5.4.6.1.5 Calibration Frequency

Instruments and instrumentation shall be calibrated at prescribed intervals and/or as part of the operational use of the instrumentation. Frequency shall be based on the type of instrumentation, inherent stability, manufacturer's recommendations, values provided in recognized standards, intended use, effect of error upon the measurement process, and prior experience.

5.4.6.1.6 Calibration Reference Standards

Two types of reference standards are used within the York laboratory for calibration:

- Physical standards, such as weights for calibrating balances and certified thermometers for calibrating working thermometers and ovens, which are generally used for periodic calibration.

- Chemical standards such as Standard Reference Materials (SRMs) provided by the National Bureau of Standards NIST or NIST-traceable standards which are primarily used for operational calibration.

Whenever possible, physical reference standards shall have known relationships to nationally recognized standards (e.g., NIST) or accepted values of natural physical constants. If national standards do not exist, the basis for the reference standards shall be documented.
Whenever possible, chemical references standards shall be directly traceable to NIST SRMs and/or EPA. If SRMs are not available, compounds of certified high purity will be used to prepare calibration standards.

5.4.6.1.7 Calibration Failure

Instrumentation that fails calibration or becomes inoperable during use shall be removed from service and segregated to prevent inadvertent use, or shall be tagged to indicate it is out of service. Such instrumentation shall be repaired and satisfactorily recalibrated before reuse

Scheduled calibration of instrumentation does not relieve the laboratory staff of the responsibility for using properly functioning instrumentation. If an instrumentation malfunction is suspected, the instrumentation shall be tagged and removed from service and recalibrated. If it fails recalibration, the above process shall apply.

5.4.6.1.8 Calibration Records

Records shall be prepared and maintained for each piece of instrumentation subject to calibration. Records demonstrating accuracy of reference standards shall also be maintained.

Records for periodically calibrated instrumentation shall include, as appropriate:

- Identification number of instrumentation and type of instrumentation.

- Calibration frequency and acceptable tolerances.

- Identification of calibration procedure used.

- Date calibration was performed.
- Identity of York personnel and/or external agencies performing the calibration.
- Reference standards used for calibration.
- Calibration date.
- Certificates or statements of calibration provided by manufacturers and external agencies, and traceability to national standards.
- Information regarding calibration acceptance or failure and any repair of failed instrumentation.

Records for periodically calibrated instrumentation shall be maintained in the Quality Assurance Folder Records. Records for each instrument/instrumentation and physical reference standard shall be kept in a separate folder. The title sheet for each file shall be a summary of calibrations performed. It is recommended that an index precede the instrumentation files which lists in matrix form all instrumentation and physical standards, calibration frequency, and dates for upcoming calibration. The use of a calibration due date matrix provides ready reference so that calibration can be maintained by the Group Leaders.

For instruments and instrumentation that are calibrated on an operational basis, calibration generally consists of determining instrumental response against compounds of known composition and concentration or the preparation of a standard response curve (either linear or a verage response factor) of t he same compound at different concentrations. Records of these calibrations are be maintained in several ways:

- The calibration data for all GC, GC/MS, ICP/ICPMS, Ion Chromatography is kept in a uniquely numbered QUALITY BATCH (QB) file. These files include all initial calibrations and continuing calibrations, as well as method blanks, spikes, duplicates and control (LCS) data. The nomenclature for these files follows this example:
    - For a volatiles run on April 1, 2016 on Volatiles GC/MS # 1, the batch QA/QC data is placed in a QB file identified as QBV1040116A. The A represents the first batch of the day. If two batches are run, a B is affixed, etc.

- This unique QB number appears on all sample headers to allow for cross referencing all QA data for a particular batch to each sample.

➢ A log book for each parameter documents all calibration and QA data for each wet chemistry, gravimetric or spectrophotometric analysis.

For operational calibration, the following is recommended:

As above, calibration data must be included in a batch file system. If samples from different p rojects are processed together, c alibration data is included in a batch folder.

- The specific SOPs detail:
- Calibration instructions (curve preparation, linear ranges, etc.).
- Procedures for chemical standards preparations.

5.4.6.1.9 OPERATIONAL CALIBRATION

Operational calibration is generally performed as part of the analytical procedure. Included may be the analysis of a method blank and the preparation of continuing calibration verification standard o r curve. Operational calibration is dependent upon the instrumentation within York, and as previously discussed, the laboratory uses a specific SOP for this purpose.

Following is a brief discussion of the analysis of method blanks and preparation of calibration curves. Guidelines for the major instrument systems within the York laboratory follow:

5.4.6.1.10 General Calibration Procedures

The initial phase of a laboratory testing program requires the selection and certification of the method best suited for an individual parameter. Certification, or verification, is the elimination, or minimizing, of determinate errors which may be due to Analyst's error, the use of less-than-optimum instrumentation, reagents, solvents, or gases. The quality of materials, e ven though they are AR grade or better, may vary from one source t o another. The Analyst must determine, through the use of reagent and/or solvent blanks, if materials are free fro m interfering substances which could affect the analysis. Other steps in certifying the method include the determination of a method blank and the preparation of a standard calibration curve.

5.4.6.1.11 Method Blank

After determining the individual reagent or solvent blanks, the Analyst defines the method blank to determine if the cumulative blank interferes with the analysis. The method blank is defined by following the procedures step by step, including the addition of all of the reagents and solvents, in the quantity required by the method. If the cumulative blank interferes with the determination, steps must be taken to eliminate or reduce the interference to a level that will permit the combination of solvents and reagents to be used. If the blank interference cannot be eliminated, the magnitude of the interference must be considered when calculating the concentration of specific constituents in the samples analyzed.

A method blank must be determined whenever an analysis is made. The number of blanks is determined by the method of analysis and the number of samples analyzed at a given time, but is typically one per 20 samples or one per batch whichever is less.

5.4.6.1.12 Preparation of Standard Calibration Curve

Concurrent with the preparation of reagent and method blanks, a standard calibration curve is accomplished by using calibration standards. The process is summarized as:

- Preparation of a standard calibration curve is accomplished by using five calibration standards prepared by mixing the species to be analyzed into the "solvent" that is to be introduced into the instrument.
- The concentration of the calibration standards are chosen to cover the working range of the instrument.
- All sample measurements are made within this working range.
- The calibration curve is prepared by plotting instrument response versus concentration of the species analyzed. Acceptable regression (linear or Quadratic) or RSDs are defined in the analysis specific SOPs.
- Concentrations of the sample prepared with the same procedure are read directly from the calibration curve or average response factor as detailed in the SOPs.

5.4.6.1.13 GC/MS and LC/MS/MS CALIBRATION PROCEDURES

This section outlines the minimum operations necessary to satisfy analytical requirements associated with the determination of various target lists of organics compounds in air, water and soil/sediment samples. The following operations must be performed routinely (as specified in the SOPs) in the laboratory:

- Documentation of GC/MS or LC-MS/MS mass calibration and abundance pattern.
- Documentation of MS response factor stability.
- Internal standard response and retention time monitoring.

6.2.2.1 Tuning and GC/MS Mass Calibration

Prior to initiating data collection, it is necessary to establish that a given GC/MS meets the standard mass spectral abundance criteria. This is accomplished through the analysis of decafluorotriphenylphosphine (DFTPP) for base/neutral and acid (BNA) compounds or p-bromofluorobenzene (BFB) for volatile c ompounds. The ion abundance criteria as listed in the methods or SOPs for each calibration compound should be met before samples, blanks, or standards can be analyzed.

DFTPP (decafluorotriphenylphosphine)

Each GC/MS system used for the analysis of semivolatile compounds must be tuned to meet the abundance cr iteria of the method f or a 50 nanogram (ng) injection of DFTPP. DFTPP may be analyzed separately or as part of the calibration standard, and the criteria must be demonstrated each (12) hours of use. Documentation of the calibration must be provided in the form of a bar graph plot and as a mass listing.

BFB (p-bromofluorobenzene)

Each GC/MS system used for the analysis of volatile compounds must be tuned to meet the proper abundance criteria for a 50 ng injection of BFB. The criteria should be demonstrated each (12) hours of use. Documentation of the calibration should be provided in the form of a bar graph plot and as a mass listing.

Analysts obtain a system generated GC/MS Tuning and Mass Calibration each time an analytical system is tuned.

5.4.6.1.14 Calibration of the GC/MS System

Prior to the analysis of samples and after tuning criteria have been met, the GC/MS system must be initially calibrated at a minimum of five concentrations to determine the linearity of response utilizing standards. For GC/MS analysis, typical linear ranges are 0.05 (SIM) to 200 ng for base neutrals, 5 to 400 ng for certain phenols, and 0.1 to 1,000 ng for volatiles.

Calibration standards are prepared to cover the linear range and are detailed in the SOPs.

Semivolatiles (B/N/A)

Initial calibration of semivolatile compounds is recommended at 5 to 140 ng for SCAN analysis with SIM covering the range 0.05 to 2 ng.

Pesticides & PCB

Pesticides by GC/ECD are calibrated at five levels from 0.001 ng to 0.2 ng.

PCB's by GC/ECD are calibrated at five levels from 1 ng to 10 ng.

In all cases reference is made to the specific SOP for preparation directions.

Continuing Calibration (GC/MS and GC)

A continuing calibration standard containing all volatile or semivolatile compounds as well as all required internal standards and surrogates, is performed each 12 hours during analysis. This applies to all matrices except air, whose requirements are detailed in EPA method TO15. Compare the RF data from the standards each 12 hours with the average RF from the initial calibration for a specific instrument. A system performance check must also be made each 12 hours. If the SPCC criteria are met, a comparison of RFs is made for all compounds. This is the same check that is applied during the initial calibration. If the minimum response factors are not met, the system should be evaluated and corrective action should be taken before sample analysis begins. See the specific SOP for criteria.

5.4.6.1.15 Calibration of the Gas Chromatograph

Calibration of the gas chromatograph (GC) for pesticide and polychlorinated biphenyl (PCB) or other organic compound analyses is performed with the standardization of the instrument. A five-point standard curve is utilized.

Response factors are to be calculated for each compound at each concentration level. These RF will be averaged to generate the mean daily RF for each compound over the range of the standard curve. The mean response factor will be used to calculate the sample concentration of the compound of interest. When sample responses exceed the range of the standard curve, the sample will be diluted to fall within range of the standard curve and be reanalyzed. The results of the daily GC standardization will be tabulated and filed with the corresponding sample analyses or batch file.

5.4.6.1.16 Calibration of Inductively Coupled Plasma Spectrometer (ICP) and Inductively Coupled Argon Plasma/Mass Spectrometer (ICP/MS) and Cold Vapor AAS

The ICPs and ICP/MSs are standardized for the metal of interest by the analysis of a set of calibration standards prepared by diluting a stock solution of known concentration. A single standard is used to calibrate the ICP, three standards are used for ICP/MS, while five working standards of mercury (Cold Vapor AAS) are prepared by dilution of the stock standard. The concentration of the calibration standards is chosen so as to cover the working range of the instrument. Subsequently all sample measurements are made within this working range. Once the working standards are prepared, they are analyzed on the ICP or AAS and the instrument response is calibrated to provide a direct readout in micrograms of metal per milliliter of water or parts per million.

Once the instrument has been initially calibrated, the analysis of initial calibration verification (ICV) is performed. Continuing calibration verification (CCV) standards are repeated after every ten samples during sample analysis to verify instrument response during analysis and to confirm the calibration. A typical analysis sequence is presented below:

< Working standards are prepared by dilution of a stock standard solution of the metal of interest.

< A calibration curve within the working range of the instrument is established by analysis of five working standards (one for ICP).

< The working standards (ICV, CCV and blank) are reanalyzed to confirm calibration. If the calibration is not confirmed, within SOP limits, the instrument is recalibrated.

< The samples are analyzed for the metals of interest.

< Following completion of the sample analyses, the working standards are reanalyzed to confirm calibration. If calibration is confirmed, the analysis is

completed. However, if the calibration is not confirmed, the problem is corrected, and the affected samples are reanalyzed.

5.4.6.1.17 PERIODIC CALIBRATION

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

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

5.4.6.1.18 Balances (Example Procedure)

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

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

5.4.6.1.19 Thermometers (Example Procedure)

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

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

5.4.6.2 Testing Uncertainties

Policy:
The SOP ADMINESTUNCERT043010 is utilized to estimate uncertainties of measurement in testing, except when the test methods preclude such rigorous calculations. For most environmental analyses these uncertainties have been established and this procedure will be unnecessary.

In certain cases it is not possible to undertake metrologically and statistically valid estimations of uncertainty of measurement. In these cases the laboratory attempts to identify all the components of uncertainty and make the best possible estimation, and ensure that the form of reporting does not give an exaggerated impression of accuracy. Reasonable estimation is based on knowledge of the performance of the method and on the measurement scope and makes use of previous experience and validation data.

Details:
The degree of rigor needed in an estimation of uncertainty of measurement depends on factors such as:

- requirement of the test method
- requirement by the client
- if there are narrow limits on which decisions on conformity to a specification are based

In cases where a well-recognized test method specifies limits to the values of the major sources of uncertainty of measurement and specifies the form of presentation of calculated results, the laboratory is considered to have satisfied the estimation uncertainty of measurement by following the reporting instructions (see section 5.10).

5.4.6.3 Uncertainty Components

Policy:
When estimating the uncertainty of measurement, all uncertainty components that are of importance in the given situation are taken into account using accepted methods of analysis.

Details:
Sources contributing to the uncertainty include, but are not necessarily limited to, the reference standards and reference materials used, methods and instrumentation used, the environmental conditions, the item being tested or calibrated and the operator.

The predicted long-term behavior of the tested and/or calibrated item is normally not taken into account when estimating the measurement uncertainty.

For further information, see ISO 5725 and the Guide to Expression of Uncertainty in Measurement.

5.4.7 Control of Data

5.4.7.1 Calculations and Data Transfers

Policy:
Calculations and data transfers are subject to appropriate checks in a systematic manner.

Details:
Test data are validated through the following to determine accuracy of calculations, conversions, and data transfers

- checks for transcription errors, omissions, and mistakes
- checks to determine consistency with normal or expected values

For those analyses where manual data reduction is required, it is performed according to the instructions provided in the test method or SOP.

5.4.7.2 Computers and Automated Instrumentation

Policy:
When computers or automated instrumentation are used for the acquisition, processing, manipulation, recording, reporting, storage or retrieval of test or calibration data, the laboratory ensures that:

- computer software developed by the user is documented in sufficient detail and suitably validated or otherwise checked as being adequate for use
- procedures are established and implemented for protecting the integrity of data; such procedures include, but are not be limited to, integrity and confidentiality of data entry or collection, data storage, data transmission, and data processing (see section 4.13.1.4)
- computers and automated instrumentation are maintained to ensure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of test and calibration data
- data is securely maintained by preventing unauthorized access to, and unauthorized amendment of, computer records
- Data are backed up both on-site and off site at a frequency that allows minimal loss in the event of catastrophic failure.

Details and Procedures:
Data generated using computer software programs that are interfaced directly to instruments incorporates all dilutions and calculations, thereby eliminating the need for manual data reduction. This coupled with preparation parameters done through the LIMS system yield the final results.

Commercially developed software in general use within its designed application range may be considered sufficiently validated. Laboratory software configuration / modifications are validated and documented.

Electronic records, electronic signatures, and handwritten signatures executed to electronic records must be equivalent to proper records and handwritten signatures to paper and are validated by procedures in 21 CFR. Part II (Docket No. 92NO251) RIN0910-AA29; Federal Register: March 20, 1997, Volume 62, Number 54), Rules and Regulations, pages 13429-13466 and updates. For further details see:

http://www.fda.gov/ora/compliance_ref/part11/

Revision History

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Revision 2.1	06/29/2012	Modified balance calibration procedure, tolerances.

5.5 Instrumentation

Section 5.5 Instrumentation

5.5.1 Required Instrumentation

Policy:
The laboratory is furnished with all items for preparation and analysis required for the correct performance of the analyses. When instrumentation is used outside the laboratory's permanent control, it ensures that the requirements of this Quality Manual are met.

Details:
Instrumentation is used in an environment appropriate to its proper performance. All instrumentation required by a test is described in each method, including instrumentation tolerances.

5.5.2 Required Accuracy

Policy:
Instrumentation and software used for testing are capable of achieving the accuracy required and comply with specifications relevant to the tests and/or calibrations concerned. Calibration programs are established for key quantities or values of the instruments where these properties have a significant affect on the results. When received, instrumentation is checked to establish that it meets the laboratory's specification requirements, complies with the relevant standard specifications, and is checked and/or calibrated in accordance with section 5.6 before use.

Details:
The procedures for checking newly received instrumentation are as determined by manufacturers' specification and/or those determined by the laboratory during procurement.

5.5.3 Authorized Personnel

Policy:
Instrumentation is operated by authorized personnel. Up-to-date instructions on the use and maintenance of instrumentation (including any relevant manuals provided by the manufacturer of the instrumentation) are readily available for use by the appropriate laboratory personnel.

Details:
Access to laboratory instrumentation is controlled to ensure that only authorized personnel use instrumentation.

5.5.4 Unique Identification

Policy:
Each item of instrumentation used for testing is uniquely identified as appropriate.

Details:
Measuring and testing instrumentation is uniquely identified through an asset number or ID. Measuring and testing instrumentation includes any instrument that could affect the quality of test results. Components that can be interchanged between various instruments are tracked in instrumentation logbooks but are not assigned individual asset numbers.

5.5.5 Inventory and Maintenance Records

Policy:
Records are maintained for each item of instrumentation significant to the tests and/or calibrations performed. The records include the following:

- identity of the item of instrumentation (and its software)
- manufacturer's name, type identification, and serial number and/or other unique identification
- checks that instrumentation complies with the specification (see section 5.5.2)
- current location, where appropriate
- the manufacturer's instructions, if available, or reference to their location
- dates, results and copies of reports and certificates of all calibrations, adjustments, acceptance criteria, and due date of next calibration
- maintenance carried out to date and the maintenance plan (includes calibration)
- damage, malfunction, modification or repair to the instrumentation

Details:
Either manual log books are maintained or a database is used to capture the above inventory information. The above information related to service and maintenance is kept in individual instrumentation files and/or binders. Other information kept in these files and/or binders may include:

- date received and date placed in service
- condition when received (e.g., new, used, refurbished)
- dates and results of calibration and/or verification and date of next calibration and/or verification or tuning
- performance history, where appropriate (e.g., response time, drift, noise level)

5.5.6 Instrumentation Procedures

Policy:
The laboratory has as an established plan for use and maintenance (including calibration) of measuring instrumentation, and appropriate use of correction factors to ensure proper functioning and in order to prevent contamination or deterioration.

Details and Procedures:
The procedures for each piece of measuring instrumentation are located in the appropriate room where the instrumentation is located or in the SOP. These procedures detail any information for safe handling, transport, storage, use, and maintenance of measuring instrumentation.

5.5.7 Out of Service Instrumentation

Policy:
Instrumentation that has either been subjected to overloading or mishandling, or gives suspect results, or has been shown to be defective or outside specified limits, is taken out of service, clearly marked, and appropriately stored until it has been repaired and shown by calibration or test to perform correctly.

Details:
Routine testing work is completely discontinued on instrumentation that even shows minor nonconformance. Not only do we do this for ethical reasons in support of our client, but minor nonconformances are often indicative of impending major breakdowns in expensive instrumentation. These breakdowns need to be avoided wherever possible.

Out of service instrumentation is clearly marked as outlined in section 5.5.8.

The laboratory examines the effect of the defect or departure from specified limits on previous test and/or calibrations and institutes the "Control of Nonconforming Work" procedure as outlined in section 4.9.

5.5.8 Calibration Status

Policy:

Instrumentation requiring calibration is labeled to indicate the calibration status and/or operational status and the date when re-calibration is due when appropriate. This is not normally applicable to organics analysis instrumentation, and more applies to balances and temperature devices.

Details:
Calibration labels have a write-on surface and a pressure sensitive adhesive. The areas that are filled out include the person who performed the calibration, the date it was performed, the date it is due for re-calibration, and the instrumentation's identification number. An example label that may be used is shown.

CALIBRATION
BY_____DATE_____
DUE_____ID#_____

Measuring instrumentation that has failed calibration or is deemed out of service is labeled with one of the following labels:

CALIBRATION VOID

DO NOT USE

OUT OF SERVICE

DO NOT USE

A piece of instrumentation that is not calibrated or checked is labeled with the following label:

FOR REFERENCE ONLY

5.5.9 Return to Service

Policy:
When instrumentation goes outside the direct control of the laboratory for a period, the laboratory ensures that the function and calibration status of the instrumentation are checked and validated and shown to be satisfactory before the instrumentation is returned to service.

Details and Procedures:
The procedures used to check and ensure that the function and calibration status of the instrumentation are satisfactory before the instrumentation is returned to service are

outlined in the manufacturer's instrumentation manual. Any additional quality control checks are outlined in the applicable section of the appropriate SOP and/or test method.

5.5.10 Periodic Checks

Policy:
When intermediate checks are needed to maintain confidence in the calibration status of instrumentation, these checks are carried out periodically according to defined procedure.

Details and Procedures:
As stated in section 5.5.6, the procedures for each piece of measuring instrumentation are detailed in the related SOPs. Internal quality control checks are specified in individual test methods that are located in the appropriate laboratory areas thereby providing procedures for intermediate checks.

5.5.11 Correction Factors

Policy
Calibrations that give rise to a set of correction factors are updated along with all copies of this data (e.g., in computer software).

Details and Procedures:
The updating of correction factors, including all copies, is assured by following the appropriate test method or SOP. It is the responsibility of the Group Leaders to ensure that all copies are updated.

5.5.12 Safeguards against Adjustments

Policy:
Test instrumentation, including hardware and software, are safeguarded from adjustments that invalidate test and/or calibration results/status.

Details:
Safeguards against adjustment for laboratory instrumentation include:
- detailed SOPs and manufacturer's manuals on the operation of the instrumentation
- policies permitting only fully trained and competent personnel to operate instrumentation
- access to the laboratory is restricted to authorized personnel

Safeguards against adjustment for software include:

- password protection for important files and packages
- access to the laboratory is restricted to authorized personnel

Revision History

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5.6 Measurement Traceability

5.6.1 General

Policy:
All measurement and test instrumentation having an effect on the accuracy or validity of tests is calibrated and/or verified before being put into service.

Details:
The program includes a system for selecting, using, calibrating, checking, controlling, and maintaining:

- measurement standards
- reference standards used as measurement standards
- measuring and test instrumentation used to perform tests and calibrations

Procedures are documented where appropriate. All measurements that play a defining role in testing accuracy are based directly or indirectly on reference standards, reference materials, certified reference materials, or other standards or materials having appropriate traceability.

Records are maintained for each standard. These records include, as applicable:

- supplier, grade, batch#
- dates of preparation or verification
- measurement of weights, volumes, time intervals, temperatures, and pressures and related calculations
- relevant processes (e.g., pH adjustment, extraction)
- verification results
- identification of personnel involved

Reagents prepared in the laboratory are labeled to identify substance, concentration, solvent (where not water), any special precautions or hazards, restrictions of use, Lot no., and date

of preparation and/or expiry. The person responsible for the preparation of the reagent is identified either from the label or from records.

5.6.2 Specific Requirements

5.6.2.1 Calibration

Policy:
The program for calibration of instrumentation is designed and operated to ensure that calibration measurements are traceable to the Système International (SI) units of measurement or NIST, where appropriate or practical.

Details:
Traceability of measurement is assured by the use of calibration services, internal and from sources that can demonstrate competence, measurement capability and traceability. The calibration certificates issued by these sources show that there is a link to a primary standard traceable to NIST. The calibration certificates contain the measurement results including the measurement uncertainty and/or a statement of compliance with an identified metrological specification (see also section 5.10.4.2).

Calibration vendors accredited to ISO 17025 or A2LA or equivalent are considered competent to provide the appropriate calibration services.

The term "identified metrological specification" means that it must be clear from the calibration certificate against which specification the measurements have been compared with, by including the specification or by giving an unambiguous reference to the specification.

When the terms "international standard" or "national standard" are used in connection with traceability, it is assumed that these standards fulfil the properties of primary standards for the realization of SI units.

Maintain certificates of all reference standards, measuring instrumentation, or certified reference material used in ensuring traceability. Where traceability to national standards of measurement is not applicable, the laboratory provides satisfactory evidence of correlation of results, for example by participation in a suitable program of inter-laboratory comparisons or proficiency testing.

Reference standards, such as thermometers and weights, are traceable to a national or international standard (e.g., NIST).

5.6.2.2 Testing

5.6.2.2.1

Policy:
The requirements given in section 5.6.2.1 apply to measuring and test instrumentation with measuring functions used, unless it has been established that the associated calibration uncertainty contributes little to the total uncertainty of the test result. When this situation arises, the laboratory ensures that instrumentation used can provide the accuracy of measurement needed.

Details:
The extent to which the requirements in section 5.6.2.1 are followed depends on the relative contribution of calibration uncertainty to the total uncertainty. If calibration is the dominant factor, the requirements are strictly followed. If, however, calibration is not one of the major contributors to the total uncertainty, other ways for providing confidence may be used, as given in section 5.6.2.2.2.

5.6.2.2.2

Policy:
Where traceability to SI units of measurement is not possible and/or not relevant, other means for providing confidence in the results are applied such as:

- the use of suitable reference materials certified to give a reliable characterization of the material
- mutual-consent standards or methods which are clearly specified and agreed upon by all parties concerned
- participation in a suitable program of inter-laboratory comparisons or proficiency testing

Details:
Reliable characterization involves an estimate of recovery.

The laboratory participates in proficiency testing and/or check sample programs. The list of programs is maintained by the Quality Assurance Officer and includes NYSDOH NELAP, CTDOH Proficiency Program, and NJDEP Office of Quality Assurance for TO-15 air and NJDEP EPH.

5.6.3 Reference Standards and Reference Materials

5.6.3.1 Reference Standards

Policy:
Reference standards are obtained or calibrated by a body that can provide traceability as described in section 5.6.2.1. For our use traceability to NIST is acceptable for most applications. Such reference standards of measurement held by the laboratory are used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

Details:
Reference standards are obtained from the National Institute of Standards and Technology (NIST), if applicable, or suppliers referencing NIST traceability with appropriate documentation.

5.6.3.2 Reference Materials

Policy:
Where possible, reference materials are traceable to SI units of measurement, or to certified reference materials. Internal reference materials are checked as far as is technically and economically practicable. Where possible all standards used for calibration of any kind are NIST traceable.

Details:
Reference materials, including calibration standards, used in chemical measurement are prepared so that the point of measurement is similar or equivalent to that of the samples. The matrix, prior to the addition of the analyte does not have a detectable concentration of the analyte. Reagents used in the preparation of reference materials, including calibration standards are of certified purity.

5.6.3.3 Intermediate Checks

Policy:
Checks needed to maintain confidence in the calibration status of reference, primary, transfer or working standards and reference materials are carried out according to defined procedures and schedules.

Details and Procedures:
The control check standards (Laboratory Control Samples) used to verify the accuracy of all the other standards are prepared independently from all the other standards used to establish the original calibration. These control check standards are prepared from a separate lot # or second source. It is the responsibility of the Group Leader to establish and maintain the individual schedule for each SOP and/or test method.

5.6.3.4 Transport and Storage

Policy:
The safe handling, transport, storage and use of reference standards and reference materials in order to prevent contamination or deterioration and in order to protect their integrity are defined.

Details:
Proper conditions are established for housing, handling, and care of reference standards/reference materials. All information needed to properly identify references appears on their housing, containers or in the SOP where applicable.

Revision History

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5.7 Sample Handling, Receipt and Initiation

Laboratory analyses are performed to produce data representative of conditions when the sample was obtained. To provide representative samples for analysis, both field and laboratory personnel must satisfactorily perform their activities. Although the purpose of this manual is to define the laboratory Quality Systems, the interrelationship of field and laboratory operations in maintaining sample integrity is briefly discussed because the effect of field operations upon resulting data quality cannot be totally separated from laboratory operations.

5.7.1 CHAIN-OF-CUSTODY

An overriding consideration for resulting data is the ability to demonstrate that the samples have been obtained from the locations stated and that they have reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt and laboratory custody until disposal must be documented to accomplish this. Documentation is accomplished through a chain-of-custody record that records each sample and the individuals responsible for sample collection, shipment, and receipt.
A sample is considered in custody if it is:

- In a person's actual possession.
- In view after being in physical possession.

- Secured so that no one can tamper with it after having been in physical custody.

- In a secure area, restricted to authorized personnel.

A chain-of-custody form is used by York personnel when shipping samples to subcontractors or to York's laboratory locations. This form is also used by all York's clients when submitting samples procured by the client. York does not accept samples collected by any outside or inside source without a correctly prepared chain-of-custody form.

The chain-of-custody form shall be signed by each individual who has the samples in their possession. Preparation of the chain-of-custody shall be as follows:

- The chain-of-custody record shall be initiated in the field by the person collecting the sample, for every sample. Every sample shall be assigned a unique identification number or name that is entered on the chain-of-custody form. Samples can be grouped for shipment and use a common form. The form allows for ten samples per page. If more than ten samples are shipped in the same container, more than one chain-of-custody form is required.

- The record shall be completed in the field to indicate project, sampling location, etc.

- If the person collecting the sample does not transport the samples to the laboratory or deliver the sample containers for shipment, the first block for Relinquished By , Received By shall be completed in the field.

- The person transporting the samples to the laboratory or delivering them for shipment shall sign the record form as Relinquished By .

- If the samples are shipped to the laboratory by commercial carrier, the chain-of-custody form shall be sealed in a watertight zip-lock bag, placed in the shipping container, and the shipping container sealed prior to giving it to the carrier.

- If the samples are directly transported to the laboratory, the chain-of-custody may be kept in possession of the person delivering the samples.

- For samples shipped by commercial carrier, the waybill shall serve as an extension of the chain-of-custody record between the final field Control Group and receipt in the laboratory.

- Upon receipt in the laboratory, the Sample Control Group, or representative, shall open the shipping containers, compare the contents with the chain-of-

custody record, and sign and date the record. Any discrepancies shall be noted on the chain-of-custody form. Discrepancies are immediately discussed with the Project Manager for resolution.

- Chain-of-custody and any shipping records shall be maintained with the records for a specific project, becoming part of the project file.

5.7.2 FIELD COLLECTION AND SHIPMENT

York does not provide Field Collection services. Prior to collecting samples, the client's collection team must consider the analyses to be performed so that proper sample containers and shipping containers can be assembled and the proper preservatives added to containers. In addition, field logs and record sheets, chain-of-custody forms, and analysis request records must be assembled.

All records required for documentation of field collection must be completed by the client field team. Several of the documents that affect laboratory operations are discussed herein. The primary documenting record is the chain-of-custody as discussed above.

In addition to initiating the chain-of-custody form, field personnel are responsible for uniquely identifying (required on the chain-of-custody form) and labeling samples, providing proper preservation, and packaging samples to preclude breakage during transit by York couriers or client shipment.

Every sample shall be labeled to identify:

- Unique sample number (ex. 11F0565-01, -02, etc.)
- Sample Description (such as MW-1, etc.)
- Sampling date and time
- Person obtaining sample
- Container types and methods of sample preservation/conditioning
- Analyses required (e.g., VOC 8260B, etc.)

Samples must be placed in containers compatible with the intended analysis and properly preserved. Also, collection of samples must consider the time interval between acquiring the sample and analysis (holding time) so that the sample is

representative. The requirements for various analytical parameters with respect to the type of container, quantity of sample, preservation method, and maximum holding time between collection and analysis, quantity of sample, are dictated by the Federal Register, EPA SW-846 or the specific Quality Assurance Project Plan (QAPP).

It is recommended to field personnel that shipping containers are to be sealed prior to shipment, whether shipped by direct transport by field personnel or commercial carrier. The only exception to this is if sufficient holding time exists so that the samples can be held in the field and it is necessary to re-ice the containers prior to or during transport.

As soon as field personnel are ready to hand off samples from the field to the courier, the courier takes custody of them and transfers them into a cooler containing ice or ice packs sufficient to maintain 2-6^{o}C until arrival at the laboratory. Upon receipt at the laboratory, the temperature (as measured by an infrared temperature probe) is recorded on the Chain-of-Custody form. In the LIMS log-in module, all other sample related conditions are noted in the appropriate fields.

It is imperative that the analyses requested by the client be clearly provided so that analytical requirements are maintained with respect to sample holding times and limits of detection needed.

5.7.3 LABORATORY SAMPLE RECEIPT

The first step in the laboratory receipt of samples is obtaining the proper information. The information is taken by the Client Services group, documented in ELEMENT and passed on (if not) immediately to the Sample Control. The Sample Control Group shall note that the shipment is expected and notify the Client Services and Group Leaders when samples are received. This is especially important for HOLDING TIMES SENSITIVE parameters and RUSH requests where coordination is essential to meet project deadlines. These communications are done via the RUSH NOTIFICATION and HOLDING TIME SENSITIVE parameters forms.

Upon sample receipt, the Sample Control Group performs the following:

< 5.7.3.1 Examine all samples and determine sample temperature using an Infrared thermometer. This documents that proper temperature has been maintained during shipment (if applicable). Note this on the Chain-of-Custody. If samples have been damaged during shipment, the remaining samples shall be carefully examined to determine whether they were affected. Any samples affected shall be also considered damaged. It will be noted on the chain-of-custody record that specific samples were damaged and that the

samples were removed from the sampling program. Field personnel will be notified as soon as possible that samples were damaged and that they must be re-sampled, or the testing program changed, and an estimate of the cause of damage.

5.7.3.2< Compare samples received against those listed on the chain-of-custody. Note any deviations or problems and clarify with the Project Mana ger or Client Services. CONFIRM preservations has been properly done (chemical preservation) by the client in the field. If this is not the case, enter this into the appropriate field in Element and preserve the samples accordingly. The client receives a Sample Condition/Receipt Report detailing any issues encountered. The lab does not confirm the following chemical preservations upon receipt which are done at the bench: Oil & Grease and Volatile Organics.

5.7.3.4 Sign and date the chain-of-custody form and attach any shipping receipts to the chain-of-custody.

5.7.3.5 Log the project into the lab LIMS system.

<

< 5.7.3.6 Open a laboratory project number and pendaflex file which will contain:

- Project identification number
- Completed Chain-of-Custody record
- Shipping receipts
- Any correspondence related to the project
- WORK ORDER which will include:

    - Client Name
    - Client Project ID
    - Lab Sample numbers
    - Client Sample Identifiers
    - Type of samples (matrix)
    - Date received in laboratory
    - Parameters to be analyzed
    - Project Pricing
    - Any special instructions (such as EDDs, ASP B deliverables, etc.)

If samples collected by Clients arrive without chain-of-custody or incorrect chain-of-custody records, the following shall be done by the Sample Control Group:

If the chain-of-custody is incorrect, a memorandum to the Project Management/Client Services is prepared stating the inaccuracy and correction in the form of a Corrective Action (CA). The CA must be signed and dated by the person originating the chain-of-custody and the Sample Control Group. The memorandum will serve as an amendment to the chain-of-custody. If the information on the chain-of-custody form cannot be corrected by the Sample Control Group or the field personnel, the samples affected shall be removed from the sampling program.

< If the chain-of-custody is not shipped with the samples, the Client personnel shall be contacted and a memorandum prepared which lists the persons involved in collecting, shipping, and receiving the samples and the times, dates, and events. Each person involved must sign and date this memorandum. The complete memorandum will be maintained in lieu of the chain-of-custody.

5.7.4 LABORATORY STORAGE OF SAMPLES

The primary considerations for sample storage are:

< Maintenance of prescribed temperature, if required, which is typically 4°C ± 2°C; some parameters may require freezing (<7.0C)

< Extracting and/or analyzing samples within the prescribed holding time for the parameters of interest.

The requirements for temperatures and holding times shall be met. Placing of samples in the proper storage environment is the responsibility of the Sample Control Group, who should notify the Group Leaders if there are any samples which must be analyzed immediately because of holding time requirements. This is accomplished by issuing a HOLDING TIME SENSITIVE NOTIFICATION FORM.

5.7.5 INITIATION OF TESTING PROGRAM

As stated previously, the chain-of-custody form is prepared by the client and submitted with the samples to the laboratory. If the analytical program is not defined with the sample shipment, Sample Control shall immediately notify the Client Services who will contact the client to determine/clarify the testing program.

The analytical program or any changes requested shall be re-entered onto the original chain-of-custody form, signed and dated. This record serves as the master analytical request form for samples and the clients' authorization to proceed.

Client Services and the Group Leaders are responsible for prioritizing samples on the basis of holding time and required reporting time into the laboratory sample stream.

5.7.6 SAMPLE DISPOSAL

The LIMS allows us to set a sample status for disposal. These records are then maintained on a sample basis in the database. There are several possibilities for sample disposition:

< The sample may be completely consumed during analysis.

< Samples may be returned to the client or location of sampling for disposal.

< The samples may be stored after the analysis. Proper environmental control and holding time must be observed if reanalysis is anticipated. If reanalysis is not anticipated, environmental conditions for storage will not be observed.

The samples may be transferred to proper drums or waste containers for final disposal by licensed waste disposal firms.

The Sample Control Group shall determine disposition of samples if not specified in the project file.

In general, York will not maintain samples and extracts longer than thirty (30) days beyond completion of analysis, unless otherwise specified.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

5.8 Assuring the Quality of Test and Calibration Results

5.8.1 Quality Control / Quality Assurance

Policy:
Quality control procedures are utilized to monitor the validity of test results. These procedures are for each test method utilized in the laboratory. The resulting data are recorded so that trends are detectable (and where practicable, statistical techniques are applied to the reviewing of the results). This monitoring is planned and reviewed and may include, but not limited to, the following:

- regular use of certified reference materials and/or internal quality control using secondary reference materials
- participation in inter-laboratory comparisons or proficiency testing programs
- replicate tests or calibrations using the same or different methods
- re-testing or re-calibration of retained items
- correlation of results for different characteristics of an item

Details:
The methods utilized from the above list will be appropriate for the type and volume of the work undertaken. Records are maintained of assurance activities and any actions taken.
As a guide, for routine analyses the level of internal quality control is typically 5% of the sample throughput. For more complex procedures, 20% is not unusual and on occasions even 50% may be required. For analyses performed infrequently the use of a reference material containing a certified or known concentration of analyte, followed by replicate analyses of the sample and spiked sample is done. For analyses undertaken more frequently, systematic quality control procedures incorporating the use of control charts and check samples are implemented. These procedures are documented in the SOP for each test method.

Internal quality control schemes using statistics include:

- design of experimental/factorial analysis
- variation/regression analysis
- safety evaluation/risk analysis
- tests of significance
- quality control charts
- statistical sampling inspection

Proficiency testing helps to highlight not only repeatability and reproducibility performance between laboratories, but also systematic errors such as bias. It is important to monitor proficiency testing results as a means of checking quality assurance and take action as necessary.

The Quality Assurance Officer maintains a list of all the current proficiency testing programs the laboratory participates in, monitors the results, and notifies the appropriate personnel of both problematic and successful results.

Technical personnel use certified reference materials and other reference materials to evaluate test performance on a daily basis and include daily process control checks. These data are used to evaluate the validity of the test results.

Replicate tests may be used if suitable reference material is available. These materials and proficiency test materials are available for improving repeatability.

Re-testing of test items is performed occasionally at the discretion of the supervisor or when test results seem anomalous.

5.8.2 Correction and Prevention

Policy and Details:
Quality control data are analyzed and, where they are found to be outside pre-defined criteria, planned action is taken to correct and to prevent incorrect results from being reported.

Revision History

Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

5.9 Reporting of Results

Section 5.9 Reporting of Results

5.9.1 General

Policy:
The results of each test or series of tests are reported accurately, clearly, unambiguously and objectively, and in accordance with any specific instructions in the test or calibration methods. All Reporting functions are performed in the Stratford, CT location.
The results are reported, normally in a Technical Report and include all the information requested by the client and necessary for the interpretation of the test results and all information required by the method used or regulatory body reviewing the data. This information may include what is outlined in section 5.9.2, 5.9.3 and 5.9.4.
In the case of tests performed for internal purposes, and in the case of a written agreement with the client, the results may be reported in a simplified way. The information listed in section 5.9.2 to 5.9.4, and not reported, is kept readily available.

Details:
Test reports are normally issued by electronic means (email or web access).

5.9.2 Test reports

Policy:
Test reports (Technical Reports) include the following information, as appropriate:

- a title (e.g., "Technical Report"
- name and address of laboratory, and location where tests were carried out if different from the address of the laboratory
- unique identification of the test report (such as a project no.), and on each page an identification in order to ensure that the page is recognized as a part of the test report, and a clear identification of the end of the test report
- name and address of the client
- identification of the method(s) used
- description, condition, and unambiguous identification of the sample(s) tested
- date of receipt of samples and date(s) of performance of the analyses
- reference to sampling procedures used by the laboratory or other bodies where these are relevant to the validity or application of the results
- test results with, where appropriate, units of measurement
- the name(s), function(s) and signature(s) or equivalent of person(s) authorizing the test report
- a statement to the effect that the results relate only to the items tested
- Notations for Certification by analyte, data qualifiers, and sample qualifiers

Details:
Signing authority for test reports is the responsibility of the Laboratory Director or designee.

Hard copies and electronic copies of test reports include the page number and total number of pages.

A statement is included specifying that the test report is not to be reproduced except in full, without written approval of the laboratory. Data reported to the client contains the appropriate significant digits for each test method. Low level data are identified as being below specified limits by utilizing appropriate flags.

5.9.3 Test Reports

5.9.3.1

Policy and Details:
In addition to the requirements listed in section 5.9.2, test reports include the following, where necessary for the interpretation of results:

- deviations from, additions to, or exclusions from the test method
- where relevant, a statement of compliance/non-compliance with requirements and/or specifications
- Clearly qualified non-compliant data or samples
- where applicable, a statement on the estimated uncertainty of measurement of the test result; information on uncertainty is needed in test reports when it is relevant to the validity or application of the test results, when a client's instruction so requires, or when uncertainty affects compliance to a specification limit
- where appropriate and needed opinions and interpretations (see section 5.9.5)
- additional information required by specific methods, clients, or regulatory authorities.

5.9.3.2

Policy and Details:
In addition to the requirements listed in sections 5.9.2 and 5.9.3.1, test reports containing the results of sampling include the following, where necessary for the interpretation of test results:

- date of sampling
- unambiguous identification of substance, matrix, material sampled

- details of any environmental condition during sampling that may affect the interpretation of the test results
- any standard or other specification for the sampling method or procedure, and deviations, additions to or exclusions from the specification concerned

5.9.5 Opinions and Interpretations

Policy:
When opinions and interpretations are included in the test report, the basis upon which the opinions and interpretations have been made is documented. Opinions and interpretations are clearly marked as such in the test report.

Note - Opinions and interpretations should not be confused with sample data reporting as intended in ISO/IEC 17020 and ISO/IEC Guide 65.

Details:
Opinions and interpretations included in a test report may comprise, but not be limited to the following:

- opinion on conformity of the results with requirements (lab non-conformances)
- fulfilment of contractual requirements
- recommendations on how to use the results
- guidance to be used for improvements
- Electronic Data Deliverables that compare results to regulatory limits

In many cases it is appropriate to communicate the opinions and interpretations by direct dialogue with the client. This dialogue is documented in writing.

5.9.6 Test Results Obtained from Subcontractors

Policy and Details:
Test reports containing the results of tests performed by subcontractors are clearly identified for the subcontracted results. The subcontractor reports the results either in writing or electronically to our laboratory.

5.9.7 Electronic Transmission of Results

Policy:
In the case of transmission of test results by telephone, facsimile or other electronic or electromagnetic means, the requirements of the policies and procedures of this Quality Manual continue to apply (see also 5.4.7).

Details:
Reports that are "published" electronically contain a digital signature.

5.9.8 Format of Reports

Policy:
The format of reports is designed to accommodate each type of test carried out and to minimize the possibility of misunderstanding or misuse.

Details:
The layout of the test report is such that the presentation of the test data facilitates ease of assimilation by the reader.

The headings are standardized as far as possible.

5.9.9 Amendments to Reports

Policy:
Material amendments to a test report after issue are made only in the form of a further document, or data transfer, which includes the statement "Revision no. and includes a description of the revision in the notes section of the report.. Such amendments meet all the requirements in this Quality Manual.

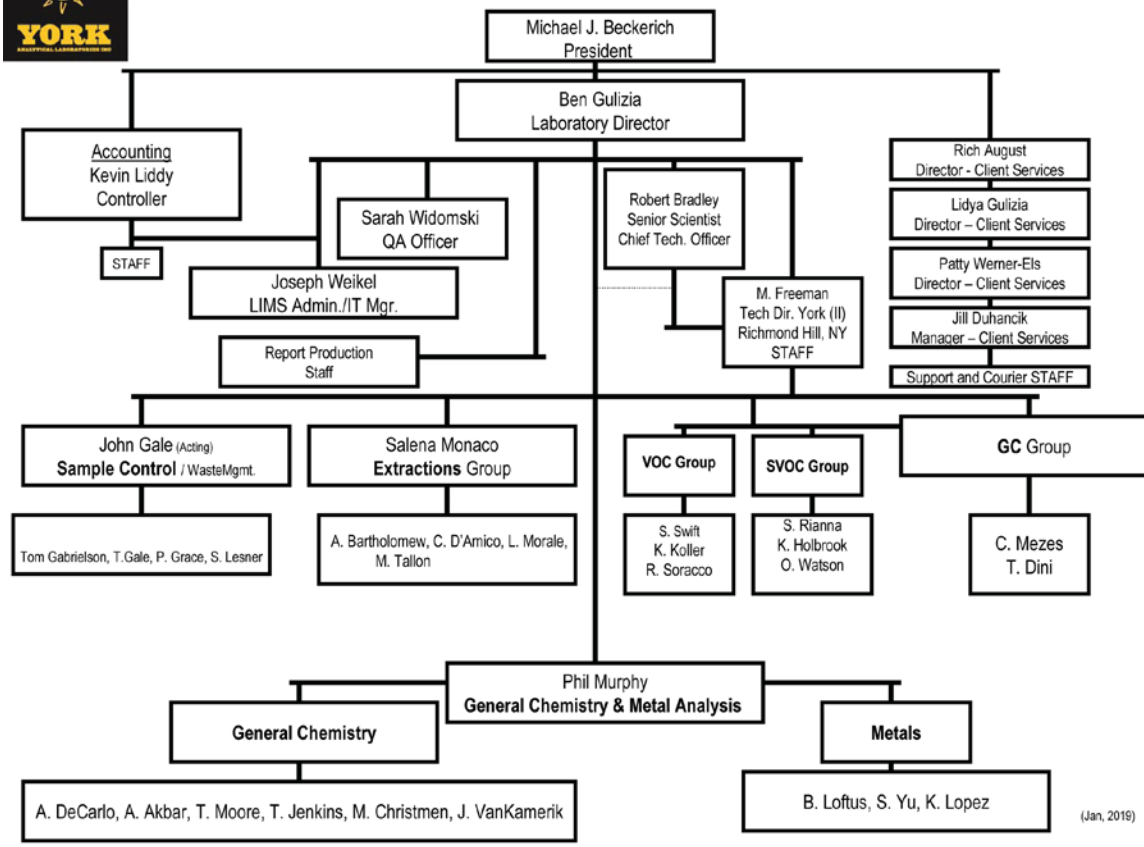
Details:
When it is necessary to issue a complete new test report, it is uniquely identified and contains a reference to the original that it replaces.

Revision History

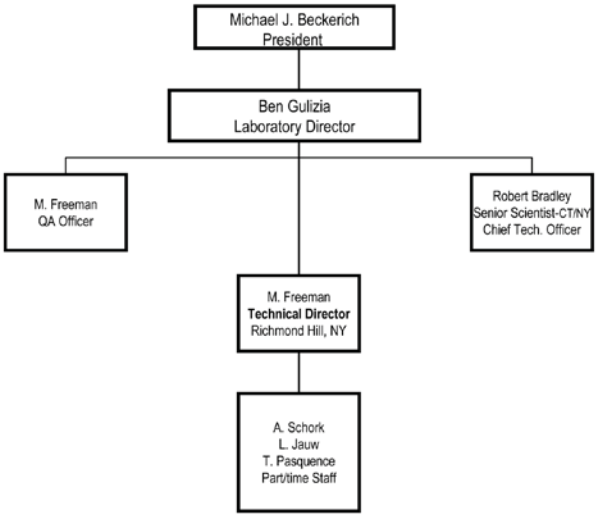
Revision 2.0 04/30/2010 First Issue of Rewritten Quality Manual

ATTACHMENT A

LABORATORY FUNCTIONAL ORGANIZATIONAL CHART



LABORATORY FUNCTIONAL ORGANIZATIONAL CHART/ NY LAB



ATTACHMENT B

York Analytical Laboratories, Inc

MASTER LIST of SOPs-CONTROLLED DOCUMENTS on 01/22/2019

	Description	SOP No.	Date of Issue	Rev. No	Rev. Date
1	VOCs in AIR by EPA TO-14A/TO-15	GCMSAIR111692	11/16/1992	9.7	01/15/2019
2	Cleaning of Summa Canisters	SummaClean111507	11/15/2007	1.4	01/15/2019
3	Calibration of Flow Controllers	FLOW CONT010312	1/3/2012	1.3	01/15/2019
	GC/MS - Volatiles				
1	Volatile Organics by GC/MS 8260/624	GCMS VOC 011700	1/17/2000	3.6	01/31/2019
2	Volatiles in Drinking Water by GC/MS by EPA 524.2	GCMSVOC524.2011700	1/17/2000	1.9	10/22/2012
3	Soil Sampling/Handling by EPA 5035A	GCMSVOC5035060712	6/7/2012	1.0	6/7/2012
	GC/MS - Semi-volatiles				
1	Semi-Volatiles using GC/MS by EPA 8270	GCMSSVOC	1/17/2000	2.8	10/13/2014

		Gas Chromatography			
1	PCBs using GC/ECD by EPA 8082A	GC PCB 011799	1/17/1999	1.7	12/01/2014
2	TPH-DRO using GC/FID by EPA 8015D	GC TPHDRO 091009	9/10/2009	1.4	7/7/2015
3	Pesticides using GC/ECD by EPA 8081B	GC Pest 011799	1/17/1999	1.6	8/5/2015
4	Herbicides using GC/ECD by EPA 8151A	GC Herb	1/19/1999	1.6	1/20/2015
5	Pesticides, PCBs in Potable Water using GC/ECD by EPA 505	505GCPest092010	9/20/2010	1.1	12/2/2014
6	CT-ETPH in Environmental Extracts	GC ETPH 111704	11/17/2004	1.6	2/29/2012
7	NJ EPH by NJDEP EPH 10/08-August 2010 Rev 3	GC NJEPH 032213	3/13/2013	1.0	
8	EDB, DBCP, TCP using GC/ECD by EPA 8011	GC EDB,DBCP 102413	10/24/2013	1.3	08/27/2015
9	GRO using GC/FID by EPA 8015D	GC GROFID 022715	02/27/2015	1.1	03/18/2016
		Extractions			
1	Herbicide Extraction by EPA 8151A	EXT Herb	4/4/2013	1.2	12/19/2015
2	UltraSonic Extraction of solids by EPA 3550C	EXT SSVOC	5/26/2000	2.6	12/03/2014
3	ASE Extraction of solids by EPA 3545A	EXT SVOCSASE	8/31/2006	2.3	1/7/2015
4	Aqueous Extraction by EPA 3510C	EXT AqSVOC	5/26/2000	2.8	12/1/2014
5	Extraction Laboratory Glassware Washing Procedure	EXTGP052600	5/26/2000	1.1	4/3/2012
6	Soxhlet Extraction of solids for PCBs by EPA 3540C	EXT PCBSox	10/22/2010	1.1	1/5/2014
7	MA EPH Extraction of solids and waters	EXT MAEPHAQASE 121207	12/12/2007	2.0	10/22/2009
8	Spike and Surrogate Standard Preparation for Extractables	EXT SVOCStds	6/29/2012	1.3	5/31/2016
9	NJEPH Extraction of Waters and Soils	EXT NJEPH	3/22/2013	1.1	1/5/2014
10	Herbicide Extraction by SM6640B	EXT Herb	1/16/2014	1.1	

11	Microwave Extraction of solids by EPA 3546	EXT SSVOCMAE	06/10/2015	1.0	

Metals Analysis/Prep

1	ICP/MS Analysis of Sample Digestates by EPA 200.8 and SW-846 6020A	M ICPMS 080106	8/1/2006	1.4	6/1/2013
2	Prep of Samples for Metals Analysis by ICP and ICP/MS by SW-846 3010A, 3005A and 3050B	M SPrep 030695	3/6/1995	1.6	6/5/2015
3	ICP Analysis of Sample Digestates by EPA 200.7 and SW-846 6010C	M ICP 031195	3/11/1995	1.7	10/9/2015
4	Mercury Cold Vapor Technique by EPA 245.1, 245.2 and SW-846 7470A/7471B	M Hg 120998	12/10/1998	1.7	5/1/2013
5	Mercury Direct Technique by SW-846 7473	M Hg2	6/21/2013	1.2	6/17/2014
6	Prep of Samples for Metals Analysis by ICP and ICP/MS by SW-846 3010A,	M PrepMAD071715	7/17/2015	1.0	

Wet Chemistry/IC

1	Chemical Oxygen Demand (COD) [SM 5220D]	WC COD	10/4/2000	2.3	4/29/2014
2	TKN, Ammonia and TON [SM 4500-N_{org} C, 4500-NH_3 D]	WC TKN	10/4/2000	1.6	1/5/2014
3	Reactivity-Cyanide [SW-846 Ch 7.3.3]	WC CNR 080800	8/8/2000	1.3	10/22/2015
4	Hexavalent Chromium [SW-846 7196A, 3060A]	WC Cr+6	7/9/2000	1.5	1/5/2014
5	Total Cyanide [SM 4500-CN, SW-846 9014, 9010C]	WC CNT	7/9/2000	1.8	10/31/2015
6	Reactivity-Sulfide [SW-846 Ch 7.3.3]	WC ReacSulf 061296	6/12/1996	1.4	10/22/2015
7	Alkalinity [SM 2320B]	WC T-Alk	2/26/2000	1.5	1/02/2015
8	Hexane Extractable Material [EPA 1664]	WC HemGrav	11/16/2006	1.8	6/8/2015
9	Ion Chromatography [EPA 300.0]	WC IC	1/14/2000	2.0	10/22/2015
10	Biochemical Oxygen Demand (BOD) [SM 5210B]	WC BOD	1/17/2000	1.6	2/10/2015
11	TSS / VSS in Aqueous Samples [SM 2540D, E]	WC TSS	4/7/1995	1.6	8/27/2014
12	pH [SW-846 9040C, 9045D]	WC pH	4/6/1995	1.6	1/5/2014

13	T-Phosphorous and Ortho-Phosphate [EPA 365.3, SM 4500]	WC Phos	5/10/2000	1.6	5/1/2015
14	TCLP / SPLP Extraction [SW-846 1311, 1312]	WC TCLPEX	1/4/2000	1.5	1/20/2014
15	Cyanide Amenable to Chlorination [EPA 335.1]	WC CNA	11/4/2000	1.4	10/15/2014
16	Ignitability of Solids	WC IGN 040795	4/7/1995	1.2	10/17/2014
17	Flash Point [SW-846 1010A]	WC FP	4/7/1995	1.5	1/5/2013
18	Methylene Blue Active Substances (MBAS) [SM 5540C]	WC MBAS	4/26/2010	1.2	1/5/2014
19	TS, VS, TDS in Aqueous Samples [SM 2540B, C, E]	WC TSTDS	4/26/2010	1.4	8/24/2014
20	Color	WC Color	4/26/2010	1.1	12/12/2013
21	Glassware Washing	WC GlassPrep	9/2/1999	2.1	12/16/2013
22	Total Phenols (Low Level) [EPA 420.1]	WC PhenolsLL	10/27/2011	1.5	1/5/2014
23	Total Phenols [EPA 420.1]	WC Phenols	2/29/2012	1.4	1/5/2014
24	Conductivity [EPA 120.1]	WC Cond	2/29/2012	1.3	1/5/2014
25	Turbidity [EPA 180.1]	WC Turbidity	2/29/2012	1.5	1/28/2014
26	TS, FS, VS and % Moisture in Soil Samples [SM 2540G]	WC TS%M 022912	2/29/2012	1.1	9/18/2012
27	Extractable Organic Halogens in solids [SW-846 9023]	WC EOX 041112	4/11/2012	1.2	11/9/2012
28	Total Organic Carbon in Aqueous Samples [SM 5310C]	WC TOC	4/18/2012	1.3	4/29/2014
29	Oxidation-Reduction Potential [ASTM D1498-08]	WC ORP 031213	3/12/2013	1.0	
30	Settleable Solids [SM 2540F]	WC SetSol	5/24/2013	1.2	1/5/2014
31	Sulfide [SM 4500-S F]	WC Sulfide	5/24/2013	1.1	1/5/2014
32	Nitrate and Nitrite by Skalar	WC NOxSK	3/7/2014	1.1	6/24/2014
33	Chlorine Demand [SM 2350B]	WC Cl Demand	4/9/2014	1.0	

34	Ammonia TKN by Skalar	WC NH3TKN SK	12/11/2014	1.0	
35	Free Liquids	WC Free Liquids	3/4/2016	1.0	
	General Laboratory				
1	MDL Studies, Organics	GL MDL 113005	11/30/2005	1.3	3/12/2012
2	Chemical Expiration Dates	GL ExpDt 041812	4/18/2012	1.0	
3	LOQ/LOD Determination	GL LODLOQ	10/23/2013	1.3	6/9/2016
	Sample Control				
1	Sample Control Procedures	SC Proc	1/15/2001	2.5	5/27/2015
2	Sample Collection (drinking water only)	SC 08/09/2000	8/9/2000	1.0	
3	Sample Handling and Chain-of-Custody for Sample Couriers	SC Couriers 091207	9/12/2007	1.0	
	Administration				
1	Laboratory Safety and Health	Safety011600	1/16/2000	1.0	
2	Purchasing	ADMIN Purchasing 043010	4/18/2012	1.2	4/11/2013
3	QC Review/Evaluation of Data	QC040402	4/4/2002	1.1	4/30/2010
4	Ethics & Legal Responsibilities	ADMIN Ethics	4/1/2002	1.4	3/13/2014
5	Training of Personnel	ADMIN Training 080206	8/6/2006	1.4	9/4/2014
6	Manual Integration of Chromatographic Data	ADMIN Integration 09/11/07	9/11/2007	2.1	2/9/2012

7	Laboratory Notebook Control and Use	ADMIN LabNote 091107	9/12/2007	1.1	1/31/2013
8	Control of Records	ADMIN Records 043010	4/30/2010	1.1	11/9/2012
9	Control of Nonconforming Work	QSP 4-9-1	4/30/2010	1.0	
10	Management Review	ADMIN MgmtReview 043010	4/30/2010	1.0	
11	Internal Quality Audit`	ADMIN Audit 043010	4/30/2010	1.1	12/31/2013
12	Estimation of Uncertainty	ADMIN EstUncert 043010	4/30/2010	1.1	10/17/2014
13	Document Control	ADMIN Doc 043010	4/30/2010	1.2	6/2/2012
14	Corrective Action	ADMIN Corraction 043010	4/30/2010	1.1	11/6/2013
15	Complaints	QSP 4-8-1	4/30/2010	1.0	
16	Review of Chromatographic Data for Detection of Manual Re-Integration Issues	ADMIN ManIntReview 043010	4/30/2010	1.0	
17	Additional Policies/Procedures	Additional Policies 05/07/10	5/7/2010	1.2	10/17/2014
18	EDDs and Reports for Client Connect	ADMIN EDDRptCC 091610	9/16/2010	1.0	
20	Standard Prep in Element	ADMIN STD 031816	4/15/2016	1.0	
		Quality Manual			
1	York Quality Systems Manual-ISO-17025/NELAC	Quality Manual	1/4/1996	2.8	01/22/2019

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2020
Issued April 01, 2019

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. ROBERT Q. BRADLEY
YORK ANALYTICAL LABORATORIES INC
120 RESEARCH DRIVE
STRATFORD, CT 06615

NY Lab Id No: 10854

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Fuel Additives	
Methyl tert-butyl ether	EPA 524.2
Naphthalene	EPA 524.2
Metals I	
Arsenic, Total	EPA 200.8 Rev. 5.4
Barium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Iron, Total	EPA 200.7 Rev. 4.4
Lead, Total	EPA 200.8 Rev. 5.4
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Mercury, Total	EPA 245.1 Rev. 3.0
Selenium, Total	EPA 200.8 Rev. 5.4
Silver, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Metals II	
Aluminum, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Metals II	
Antimony, Total	EPA 200.8 Rev. 5.4
Beryllium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Molybdenum, Total	EPA 200.8 Rev. 5.4
Nickel, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Thallium, Total	EPA 200.8 Rev. 5.4
Vanadium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Metals III	
Calcium, Total	EPA 200.7 Rev. 4.4
Magnesium, Total	EPA 200.7 Rev. 4.4
Potassium, Total	EPA 200.7 Rev. 4.4
Sodium, Total	EPA 200.7 Rev. 4.4
Miscellaneous	
Turbidity	EPA 180.1 Rev. 2.0
Non-Metals	
Alkalinity	SM 21-23 2320B (-97)
Calcium Hardness	EPA 200.7 Rev. 4.4
Chloride	EPA 300.0 Rev. 2.1
Color	SM 21-23 2120B (-01)
Fluoride, Total	EPA 300.0 Rev. 2.1
Orthophosphate (as P)	EPA 300.0 Rev. 2.1
	SM 19, 21-23 4500-P E (-99)

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2020
Issued April 01, 2019

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. ROBERT Q. BRADLEY
YORK ANALYTICAL LABORATORIES INC
120 RESEARCH DRIVE
STRATFORD, CT 06615

NY Lab Id No: 10854

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Non-Metals

Solids, Total Dissolved	SM 21-23 2540C (-97)
Specific Conductance	EPA 120.1 Rev. 1982
Sulfate (as SO4)	EPA 300.0 Rev. 2.1

Trihalomethanes

Bromodichloromethane	EPA 524.2
Bromoform	EPA 524.2
Chloroform	EPA 524.2
Dibromochloromethane	EPA 524.2

Volatile Aromatics

1,2,3-Trichlorobenzene	EPA 524.2
1,2,4-Trichlorobenzene	EPA 524.2
1,2,4-Trimethylbenzene	EPA 524.2
1,2-Dichlorobenzene	EPA 524.2
1,3,5-Trimethylbenzene	EPA 524.2
1,3-Dichlorobenzene	EPA 524.2
1,4-Dichlorobenzene	EPA 524.2
2-Chlorotoluene	EPA 524.2
4-Chlorotoluene	EPA 524.2
Benzene	EPA 524.2
Bromobenzene	EPA 524.2
Chlorobenzene	EPA 524.2
Ethyl benzene	EPA 524.2
Hexachlorobutadiene	EPA 524.2
Isopropylbenzene	EPA 524.2
n-Butylbenzene	EPA 524.2

Volatile Aromatics

n-Propylbenzene	EPA 524.2
p-Isopropyltoluene (P-Cymene)	EPA 524.2
sec-Butylbenzene	EPA 524.2
Styrene	EPA 524.2
tert-Butylbenzene	EPA 524.2
Toluene	EPA 524.2
Total Xylenes	EPA 524.2

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 524.2
1,1,1-Trichloroethane	EPA 524.2
1,1,2,2-Tetrachloroethane	EPA 524.2
1,1,2-Trichloroethane	EPA 524.2
1,1-Dichloroethane	EPA 524.2
1,1-Dichloroethene	EPA 524.2
1,1-Dichloropropene	EPA 524.2
1,2,3-Trichloropropane	EPA 524.2
1,2-Dichloroethane	EPA 524.2
1,2-Dichloropropane	EPA 524.2
1,3-Dichloropropane	EPA 524.2
2,2-Dichloropropane	EPA 524.2
Bromochloromethane	EPA 524.2
Bromomethane	EPA 524.2
Carbon tetrachloride	EPA 524.2
Chloroethane	EPA 524.2
Chloromethane	EPA 524.2

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All approved analytes are listed below:

Volatile Halocarbons

cis-1,2-Dichloroethene	EPA 524.2
cis-1,3-Dichloropropene	EPA 524.2
Dibromomethane	EPA 524.2
Dichlorodifluoromethane	EPA 524.2
Methylene chloride	EPA 524.2
Tetrachloroethene	EPA 524.2
trans-1,2-Dichloroethene	EPA 524.2
trans-1,3-Dichloropropene	EPA 524.2
Trichloroethene	EPA 524.2
Trichlorofluoromethane	EPA 524.2
Vinyl chloride	EPA 524.2

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All approved analytes are listed below:

Acrylates	
Acrolein (Propenal)	EPA 8260C
	EPA 624.1
Acrylonitrile	EPA 8260C
	EPA 624.1
Methyl methacrylate	EPA 8260C
Amines	
1,2-Diphenylhydrazine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
Aniline	EPA 625.1
	EPA 8270D
Carbazole	EPA 625.1
	EPA 8270D
Diphenylamine	EPA 8270D
Pyridine	EPA 625.1
	EPA 8270D
Benzidines	
3,3'-Dichlorobenzidine	EPA 625.1
	EPA 8270D
Benzidine	EPA 625.1
	EPA 8270D

Chlorinated Hydrocarbon Pesticides	
4,4'-DDD	EPA 8081B
	EPA 608.3
4,4'-DDE	EPA 8081B
	EPA 608.3
4,4'-DDT	EPA 8081B
	EPA 608.3
Aldrin	EPA 8081B
	EPA 608.3
alpha-BHC	EPA 8081B
	EPA 608.3
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 8081B
	EPA 608.3
Chlordane Total	EPA 8081B
	EPA 608.3
delta-BHC	EPA 8081B
	EPA 608.3
Dieldrin	EPA 8081B
	EPA 608.3
Endosulfan I	EPA 8081B
	EPA 608.3
Endosulfan II	EPA 8081B
	EPA 608.3
Endosulfan sulfate	EPA 8081B
	EPA 608.3
Endrin	EPA 8081B

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Chlorinated Hydrocarbon Pesticides	
Endrin	EPA 608.3
Endrin aldehyde	EPA 8081B
	EPA 608.3
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
	EPA 608.3
Heptachlor epoxide	EPA 8081B
	EPA 608.3
Lindane	EPA 8081B
	EPA 608.3
Methoxychlor	EPA 8081B
	EPA 608.3
Mirex	EPA 8081B
Toxaphene	EPA 8081B
	EPA 608.3
Chlorinated Hydrocarbons	
1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 625.1
	EPA 8270D
2-Chloronaphthalene	EPA 625.1
	EPA 8270D
Hexachlorobenzene	EPA 625.1
	EPA 8270D

Chlorinated Hydrocarbons	
Hexachlorobutadiene	EPA 625.1
	EPA 8270D
Hexachlorocyclopentadiene	EPA 625.1
	EPA 8270D
Hexachloroethane	EPA 625.1
	EPA 8270D
Pentachlorobenzene	EPA 8270D
Chlorophenoxy Acid Pesticides	
2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
	SM 6640B-2006
2,4-D	EPA 8151A
Dicamba	EPA 8151A
Demand	
Biochemical Oxygen Demand	SM 5210B-2011
Carbonaceous BOD	SM 5210B-2011
Chemical Oxygen Demand	SM 5220D-2011
Fuel Oxygenates	
Di-isopropyl ether	EPA 8260C
Ethanol	EPA 8260C
Methyl tert-butyl ether	EPA 8260C
tert-amyl alcohol	EPA 8260C
tert-amyl methyl ether (TAME)	EPA 8260C
tert-butyl alcohol	EPA 8260C

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Fuel Oxygenates	
tert-butyl ethyl ether (ETBE)	EPA 8260C
Haloethers	
2,2'-Oxybis(1-chloropropane)	EPA 625.1
	EPA 8270D
4-Bromophenylphenyl ether	EPA 625.1
	EPA 8270D
4-Chlorophenylphenyl ether	EPA 625.1
	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 625.1
	EPA 8270D
Bis(2-chloroethyl)ether	EPA 625.1
	EPA 8270D
Low Level Halocarbons	
1,2,3-Trichloropropane, Low Level	EPA 8011
1,2-Dibromo-3-chloropropane, Low Level	EPA 8011
1,2-Dibromoethane, Low Level	EPA 8011
Low Level Polynuclear Aromatics	
Acenaphthene Low Level	EPA 8270D
Acenaphthylene Low Level	EPA 8270D
Anthracene Low Level	EPA 8270D
Benzo(a)anthracene Low Level	EPA 8270D
Benzo(a)pyrene Low Level	EPA 8270D
Benzo(b)fluoranthene Low Level	EPA 8270D
Benzo(g,h,i)perylene Low Level	EPA 8270D

Low Level Polynuclear Aromatics	
Benzo(k)fluoranthene Low Level	EPA 8270D
Chrysene Low Level	EPA 8270D
Dibenzo(a,h)anthracene Low Level	EPA 8270D
Fluoranthene Low Level	EPA 8270D
Fluorene Low Level	EPA 8270D
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270D
Naphthalene Low Level	EPA 8270D
Phenanthrene Low Level	EPA 8270D
Pyrene Low Level	EPA 8270D
Metals I	
Barium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Cadmium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Calcium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D

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Metals I		**Metals I**	
Chromium, Total	EPA 200.7, Rev. 4.4 (1994)	Manganese, Total	EPA 6010D
	EPA 6010C		EPA 6020A
	EPA 6010D		EPA 6020B
	EPA 6020A		EPA 200.8, Rev. 5.4 (1994)
	EPA 6020B	Nickel, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 200.8, Rev. 5.4 (1994)		EPA 6010C
Copper, Total	EPA 200.7, Rev. 4.4 (1994)		EPA 6010D
	EPA 6010C		EPA 6020A
	EPA 6010D		EPA 6020B
	EPA 6020A		EPA 200.8, Rev. 5.4 (1994)
	EPA 6020B	Potassium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 200.8, Rev. 5.4 (1994)		EPA 6010C
Iron, Total	EPA 200.7, Rev. 4.4 (1994)		EPA 6010D
	EPA 6010C	Silver, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D		EPA 6010C
Lead, Total	EPA 200.7, Rev. 4.4 (1994)		EPA 6010D
	EPA 6010C		EPA 6020A
	EPA 6010D		EPA 6020B
	EPA 6020A		EPA 200.8, Rev. 5.4 (1994)
	EPA 6020B	Sodium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 200.8, Rev. 5.4 (1994)		EPA 6010C
Magnesium, Total	EPA 200.7, Rev. 4.4 (1994)		EPA 6010D
	EPA 6010C	**Metals II**	
	EPA 6010D	Aluminum, Total	EPA 200.7, Rev. 4.4 (1994)
Manganese, Total	EPA 200.7, Rev. 4.4 (1994)		EPA 6010C
	EPA 6010C		

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Metals II	
Aluminum, Total	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Antimony, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Arsenic, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Beryllium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Chromium VI	EPA 7196A
	SM 3500-Cr B-2011
Mercury, Total	EPA 245.1, Rev. 3.0 (1994)
	EPA 245.2 (Issued 1974, Rev. 1983)
Metals II	
Mercury, Total	EPA 7470A
	EPA 7473
Selenium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Vanadium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Zinc, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Metals III	
Cobalt, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A

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Metals III	
Cobalt, Total	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Molybdenum, Total	EPA 6020A
	EPA 200.8, Rev. 5.4 (1994)
Thallium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010C
	EPA 6010D
	EPA 6020A
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Tin, Total	EPA 6020A
	EPA 200.8, Rev. 5.4 (1994)
Titanium, Total	EPA 6020A
	EPA 200.8, Rev. 5.4 (1994)
Mineral	
Alkalinity	SM 2320B-2011
Calcium Hardness	EPA 200.7, Rev. 4.4 (1994)
Chloride	EPA 300.0, Rev. 2.1 (1993)
Fluoride, Total	EPA 300.0, Rev. 2.1 (1993)
Hardness, Total	EPA 200.7, Rev. 4.4 (1994)
Sulfate (as SO4)	EPA 300.0, Rev. 2.1 (1993)
Miscellaneous	
Boron, Total	EPA 6020A
	EPA 200.8, Rev. 5.4 (1994)
Bromide	EPA 300.0, Rev. 2.1 (1993)

Miscellaneous	
Color	SM 2120B-2011
Cyanide, Total	SM 4500-CN E-2011
Oil and Grease Total Recoverable (HEM)	EPA 1664A
Organic Carbon, Total	SM 5310C-2011
Phenols	EPA 420.1 (Rev. 1978)
Specific Conductance	EPA 120.1 (Rev. 1982)
Sulfide (as S)	SM 4500-S2- F-2011
Surfactant (MBAS)	SM 5540C-2011
Turbidity	EPA 180.1, Rev. 2.0 (1993)
Nitroaromatics and Isophorone	
2,4-Dinitrotoluene	EPA 625.1
	EPA 8270D
2,6-Dinitrotoluene	EPA 625.1
	EPA 8270D
Isophorone	EPA 625.1
	EPA 8270D
Nitrobenzene	EPA 625.1
	EPA 8270D
Nitrosoamines	
N-Nitrosodimethylamine	EPA 625.1
	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 625.1
	EPA 8270D
N-Nitrosodiphenylamine	EPA 625.1
	EPA 8270D

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Nutrient	
Ammonia (as N)	SM 4500-NH3 D-2011 or E-2011
Kjeldahl Nitrogen, Total	SM 4500-N Org D-2011
	SM 4500-NH3 D-2011 or E-2011
Nitrate (as N)	EPA 300.0, Rev. 2.1 (1993)
Nitrate-Nitrite (as N)	EPA 300.0, Rev. 2.1 (1993)
Nitrite (as N)	EPA 300.0, Rev. 2.1 (1993)
Orthophosphate (as P)	EPA 300.0, Rev. 2.1 (1993)
	SM 4500-P E-2011
Phosphorus, Total	SM 4500-P E-2011
Organophosphate Pesticides	
Atrazine	EPA 8270D
Parathion ethyl	EPA 8270D
Petroleum Hydrocarbons	
Diesel Range Organics	EPA 8015D
Gasoline Range Organics	EPA 8015D
Phthalate Esters	
Benzyl butyl phthalate	EPA 625.1
	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 625.1
	EPA 8270D
Diethyl phthalate	EPA 625.1
	EPA 8270D
Dimethyl phthalate	EPA 625.1
	EPA 8270D
Phthalate Esters	
Di-n-butyl phthalate	EPA 625.1
	EPA 8270D
Di-n-octyl phthalate	EPA 625.1
	EPA 8270D
Polychlorinated Biphenyls	
Aroclor 1016 (PCB-1016)	EPA 8082A
	EPA 608.3
Aroclor 1221 (PCB-1221)	EPA 8082A
	EPA 608.3
Aroclor 1232 (PCB-1232)	EPA 8082A
	EPA 608.3
Aroclor 1242 (PCB-1242)	EPA 8082A
	EPA 608.3
Aroclor 1248 (PCB-1248)	EPA 8082A
	EPA 608.3
Aroclor 1254 (PCB-1254)	EPA 8082A
	EPA 608.3
Aroclor 1260 (PCB-1260)	EPA 8082A
	EPA 608.3
Aroclor 1262 (PCB-1262)	EPA 8082A
Aroclor 1268 (PCB-1268)	EPA 8082A
Polynuclear Aromatics	
Acenaphthene	EPA 625.1
	EPA 8270D
Acenaphthylene	EPA 625.1

Serial No.: 59448

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2020
Issued April 01, 2019

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. ROBERT Q. BRADLEY
YORK ANALYTICAL LABORATORIES INC
120 RESEARCH DRIVE
STRATFORD, CT 06615

NY Lab Id No: 10854

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Polynuclear Aromatics	
Acenaphthylene	EPA 8270D
Anthracene	EPA 625.1
	EPA 8270D
Benzo(a)anthracene	EPA 625.1
	EPA 8270D
Benzo(a)pyrene	EPA 625.1
	EPA 8270D
Benzo(b)fluoranthene	EPA 625.1
	EPA 8270D
Benzo(g,h,i)perylene	EPA 625.1
	EPA 8270D
Benzo(k)fluoranthene	EPA 625.1
	EPA 8270D
Chrysene	EPA 625.1
	EPA 8270D
Dibenzo(a,h)anthracene	EPA 625.1
	EPA 8270D
Fluoranthene	EPA 625.1
	EPA 8270D
Fluorene	EPA 625.1
	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 625.1
	EPA 8270D
Naphthalene	EPA 625.1
	EPA 8270D
Phenanthrene	EPA 625.1

Polynuclear Aromatics	
Phenanthrene	EPA 8270D
Pyrene	EPA 625.1
	EPA 8270D
Priority Pollutant Phenols	
2,3,4,6 Tetrachlorophenol	EPA 8270D
2,4,5-Trichlorophenol	EPA 625.1
	EPA 8270D
2,4,6-Trichlorophenol	EPA 625.1
	EPA 8270D
2,4-Dichlorophenol	EPA 625.1
	EPA 8270D
2,4-Dimethylphenol	EPA 625.1
	EPA 8270D
2,4-Dinitrophenol	EPA 625.1
	EPA 8270D
2-Chlorophenol	EPA 625.1
	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 625.1
	EPA 8270D
2-Methylphenol	EPA 625.1
	EPA 8270D
2-Nitrophenol	EPA 625.1
	EPA 8270D
4-Chloro-3-methylphenol	EPA 625.1
	EPA 8270D

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Priority Pollutant Phenols	
4-Methylphenol	EPA 625.1
	EPA 8270D
4-Nitrophenol	EPA 625.1
	EPA 8270D
Cresols, Total	EPA 8270D
Pentachlorophenol	EPA 625.1
	EPA 8270D
Phenol	EPA 625.1
	EPA 8270D
Residue	
Settleable Solids	SM 2540 F-2011
Solids, Total	SM 2540 B-2011
Solids, Total Dissolved	SM 2540 C-2011
Solids, Total Suspended	SM 2540 D-2011
Semi-Volatile Organics	
1,1'-Biphenyl	EPA 8270D
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
Acetophenone	EPA 8270D
alpha-Terpineol	EPA 625.1
Benzaldehyde	EPA 8270D
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Semi-Volatile Organics	
Caprolactam	EPA 8270D
Dibenzofuran	EPA 8270D
Volatile Aromatics	
1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C
	EPA 624.1
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 8260C
	EPA 624.1
1,4-Dichlorobenzene	EPA 8260C
	EPA 624.1
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
	EPA 624.1
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 8260C
	EPA 624.1
Ethyl benzene	EPA 8260C
	EPA 624.1
Isopropylbenzene	EPA 8260C
m/p-Xylenes	EPA 8260C
	EPA 624.1
Naphthalene, Volatile	EPA 8260C

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Volatile Aromatics	
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
o-Xylene	EPA 8260C
	EPA 624.1
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 8260C
	EPA 624.1
tert-Butylbenzene	EPA 8260C
Toluene	EPA 8260C
	EPA 624.1
Total Xylenes	EPA 8260C
	EPA 624.1
Volatile Halocarbons	
1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 8260C
	EPA 624.1
1,1,2,2-Tetrachloroethane	EPA 8260C
	EPA 624.1
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 8260C
	EPA 624.1
1,1-Dichloroethane	EPA 8260C
	EPA 624.1
1,1-Dichloroethene	EPA 8260C

Volatile Halocarbons	
1,1-Dichloroethene	EPA 624.1
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260C
1,2-Dibromoethane	EPA 8260C
1,2-Dichloroethane	EPA 8260C
	EPA 624.1
1,2-Dichloropropane	EPA 8260C
	EPA 624.1
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260C
	EPA 624.1
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 8260C
	EPA 624.1
Bromoform	EPA 8260C
	EPA 624.1
Bromomethane	EPA 8260C
	EPA 624.1
Carbon tetrachloride	EPA 8260C
	EPA 624.1
Chloroethane	EPA 8260C
	EPA 624.1
Chloroform	EPA 8260C
	EPA 624.1

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Volatile Halocarbons	
Chloromethane	EPA 8260C
	EPA 624.1
cis-1,2-Dichloroethene	EPA 8260C
	EPA 624.1
cis-1,3-Dichloropropene	EPA 8260C
	EPA 624.1
Dibromochloromethane	EPA 8260C
	EPA 624.1
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
	EPA 624.1
Hexachlorobutadiene, Volatile	EPA 8260C
Methylene chloride	EPA 8260C
	EPA 624.1
Tetrachloroethene	EPA 8260C
	EPA 624.1
trans-1,2-Dichloroethene	EPA 8260C
	EPA 624.1
trans-1,3-Dichloropropene	EPA 8260C
	EPA 624.1
trans-1,4-Dichloro-2-butene	EPA 8260C
Trichloroethene	EPA 8260C
	EPA 624.1
Trichlorofluoromethane	EPA 8260C
	EPA 624.1
Vinyl chloride	EPA 8260C

Volatile Halocarbons	
Vinyl chloride	EPA 624.1
Volatiles Organics	
1,4-Dioxane	EPA 8260C
	EPA 8270D SIM
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
Acetone	EPA 8260C
Carbon Disulfide	EPA 8260C
Cyclohexane	EPA 8260C
Methyl acetate	EPA 8260C
Methyl cyclohexane	EPA 8260C
Vinyl acetate	EPA 8260C
Sample Preparation Methods	
	SM 4500-P B(5)-2011
	EPA 5030C
	SM 4500-CN B-2011 and C-201
	EPA 3015A
	EPA 3010A
	EPA 3005A
	EPA 3510C
	SM 4500-N Org B-2011 or C-20

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Acrylates

Acrolein (Propenal)	EPA 8260C
Acrylonitrile	EPA 8260C
Methyl methacrylate	EPA 8260C

Amines

1,2-Diphenylhydrazine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
Aniline	EPA 8270D
Carbazole	EPA 8270D
Diphenylamine	EPA 8270D

Benzidines

3,3'-Dichlorobenzidine	EPA 8270D
Benzidine	EPA 8270D

Characteristic Testing

Corrosivity	EPA 9045D
Free Liquids	EPA 9095B
Ignitability	EPA 1010A
Synthetic Precipitation Leaching Proc.	EPA 1312
TCLP	EPA 1311

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B
4,4'-DDE	EPA 8081B

Chlorinated Hydrocarbon Pesticides

4,4'-DDT	EPA 8081B
Aldrin	EPA 8081B
alpha-BHC	EPA 8081B
alpha-Chlordane	EPA 8081B
Atrazine	EPA 8270D
beta-BHC	EPA 8081B
Chlordane Total	EPA 8081B
delta-BHC	EPA 8081B
Dieldrin	EPA 8081B
Endosulfan I	EPA 8081B
Endosulfan II	EPA 8081B
Endosulfan sulfate	EPA 8081B
Endrin	EPA 8081B
Endrin aldehyde	EPA 8081B
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
Heptachlor epoxide	EPA 8081B
Lindane	EPA 8081B
Methoxychlor	EPA 8081B
Mirex	EPA 8081B
Toxaphene	EPA 8081B

Chlorinated Hydrocarbons

1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D

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Chlorinated Hydrocarbons		**Metals I**	
1,2,4-Trichlorobenzene	EPA 8270D	Cadmium, Total	EPA 6020A
2-Chloronaphthalene	EPA 8270D		EPA 6020B
Hexachlorobenzene	EPA 8270D	Calcium, Total	EPA 6010C
Hexachlorobutadiene	EPA 8270D		EPA 6010D
Hexachlorocyclopentadiene	EPA 8270D	Chromium, Total	EPA 6010C
Hexachloroethane	EPA 8270D		EPA 6010D
			EPA 6020A
Chlorophenoxy Acid Pesticides			EPA 6020B
2,4,5-T	EPA 8151A	Copper, Total	EPA 6010C
2,4,5-TP (Silvex)	EPA 8151A		EPA 6010D
2,4-D	EPA 8151A		EPA 6020A
Dicamba	EPA 8151A		EPA 6020B
Haloethers		Iron, Total	EPA 6010C
2,2'-Oxybis(1-chloropropane)	EPA 8270D		EPA 6010D
4-Bromophenylphenyl ether	EPA 8270D	Lead, Total	EPA 6010C
4-Chlorophenylphenyl ether	EPA 8270D		EPA 6010D
Bis(2-chloroethoxy)methane	EPA 8270D		EPA 6020A
Bis(2-chloroethyl)ether	EPA 8270D		EPA 6020B
Metals I		Magnesium, Total	EPA 6010C
Barium, Total	EPA 6010C		EPA 6010D
	EPA 6010D	Manganese, Total	EPA 6010C
	EPA 6020A		EPA 6010D
	EPA 6020B		EPA 6020A
Cadmium, Total	EPA 6010C		EPA 6020B
	EPA 6010D	Nickel, Total	EPA 6010C
			EPA 6010D

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Metals I		**Metals II**	
Nickel, Total	EPA 6020A	Chromium VI	EPA 7196A
	EPA 6020B	Mercury, Total	EPA 7471B
Potassium, Total	EPA 6010C		EPA 7473
	EPA 6010D	Selenium, Total	EPA 6010C
Silver, Total	EPA 6010C		EPA 6010D
	EPA 6010D		EPA 6020A
Sodium, Total	EPA 6010C		EPA 6020B
	EPA 6010D	Vanadium, Total	EPA 6010C
Metals II			EPA 6010D
Aluminum, Total	EPA 6010C		EPA 6020A
	EPA 6010D		EPA 6020B
	EPA 6020A	Zinc, Total	EPA 6010C
	EPA 6020B		EPA 6010D
Antimony, Total	EPA 6010C		EPA 6020A
	EPA 6010D		EPA 6020B
	EPA 6020A	**Metals III**	
	EPA 6020B	Cobalt, Total	EPA 6010C
Arsenic, Total	EPA 6010C		EPA 6010D
	EPA 6010D		EPA 6020A
	EPA 6020A		EPA 6020B
	EPA 6020B	Molybdenum, Total	EPA 6010D
Beryllium, Total	EPA 6010C		EPA 6020A
	EPA 6010D	Thallium, Total	EPA 6010C
	EPA 6020A		EPA 6010D
	EPA 6020B		EPA 6020A

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Metals III	
Thallium, Total	EPA 6020B
Tin, Total	EPA 6020A
	EPA 6020B
Titanium, Total	EPA 6020A
Miscellaneous	
Boron, Total	EPA 6020A
	EPA 6020B
Cyanide, Total	EPA 9014
Extractable Organic Halides	EPA 9023
Lead in Dust Wipes	EPA 6010C
Lead in Paint	EPA 6010C
Nitroaromatics and Isophorone	
2,4-Dinitrotoluene	EPA 8270D
2,6-Dinitrotoluene	EPA 8270D
Isophorone	EPA 8270D
Nitrobenzene	EPA 8270D
Pyridine	EPA 8270D
Nitrosoamines	
N-Nitrosodimethylamine	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 8270D
N-Nitrosodiphenylamine	EPA 8270D
Organophosphate Pesticides	
Parathion ethyl	EPA 8270D
Petroleum Hydrocarbons	
Diesel Range Organics	EPA 8015D
Gasoline Range Organics	EPA 8015D
Phthalate Esters	
Benzyl butyl phthalate	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 8270D
Diethyl phthalate	EPA 8270D
Dimethyl phthalate	EPA 8270D
Di-n-butyl phthalate	EPA 8270D
Di-n-octyl phthalate	EPA 8270D
Polychlorinated Biphenyls	
Aroclor 1016 (PCB-1016)	EPA 8082A
Aroclor 1016 (PCB-1016) in Oil	EPA 8082A
Aroclor 1221 (PCB-1221)	EPA 8082A
Aroclor 1221 (PCB-1221) in Oil	EPA 8082A
Aroclor 1232 (PCB-1232)	EPA 8082A
Aroclor 1232 (PCB-1232) in Oil	EPA 8082A
Aroclor 1242 (PCB-1242)	EPA 8082A
Aroclor 1242 (PCB-1242) in Oil	EPA 8082A
Aroclor 1248 (PCB-1248)	EPA 8082A
Aroclor 1248 (PCB-1248) in Oil	EPA 8082A
Aroclor 1254 (PCB-1254)	EPA 8082A
Aroclor 1254 (PCB-1254) in Oil	EPA 8082A
Aroclor 1260 (PCB-1260)	EPA 8082A
Aroclor 1260 (PCB-1260) in Oil	EPA 8082A
Aroclor 1262 (PCB-1262)	EPA 8082A

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Polychlorinated Biphenyls	
Aroclor 1262 (PCB-1262) in Oil	EPA 8082A
Aroclor 1268 (PCB-1268)	EPA 8082A
Aroclor 1268 (PCB-1268) in Oil	EPA 8082A
Polynuclear Aromatic Hydrocarbons	
Acenaphthene	EPA 8270D
Acenaphthylene	EPA 8270D
Anthracene	EPA 8270D
Benzo(a)anthracene	EPA 8270D
Benzo(a)pyrene	EPA 8270D
Benzo(b)fluoranthene	EPA 8270D
Benzo(g,h,i)perylene	EPA 8270D
Benzo(k)fluoranthene	EPA 8270D
Chrysene	EPA 8270D
Dibenzo(a,h)anthracene	EPA 8270D
Fluoranthene	EPA 8270D
Fluorene	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D
Naphthalene	EPA 8270D
Phenanthrene	EPA 8270D
Pyrene	EPA 8270D
Priority Pollutant Phenols	
2,3,4,6 Tetrachlorophenol	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270D
2,4-Dichlorophenol	EPA 8270D

Priority Pollutant Phenols	
2,4-Dimethylphenol	EPA 8270D
2,4-Dinitrophenol	EPA 8270D
2-Chlorophenol	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 8270D
2-Methylphenol	EPA 8270D
2-Nitrophenol	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D
4-Methylphenol	EPA 8270D
4-Nitrophenol	EPA 8270D
Pentachlorophenol	EPA 8270D
Phenol	EPA 8270D
Semi-Volatile Organics	
1,1'-Biphenyl	EPA 8270D
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
Acetophenone	EPA 8270D
Benzaldehyde	EPA 8270D
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Caprolactam	EPA 8270D
Dibenzofuran	EPA 8270D
Volatile Aromatics	
1,2,4-Trichlorobenzene, Volatile	EPA 8260C

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Volatile Aromatics

1,2,4-Trimethylbenzene	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 8260C
1,4-Dichlorobenzene	EPA 8260C
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 8260C
Ethyl benzene	EPA 8260C
Isopropylbenzene	EPA 8260C
m/p-Xylenes	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
o-Xylene	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 8260C
tert-Butylbenzene	EPA 8260C
Toluene	EPA 8260C
Total Xylenes	EPA 8260C

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 8260C

Volatile Halocarbons

1,1,1-Trichloroethane	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 8260C
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 8260C
1,1-Dichloroethane	EPA 8260C
1,1-Dichloroethene	EPA 8260C
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260C
1,2-Dibromoethane	EPA 8260C
1,2-Dichloroethane	EPA 8260C
1,2-Dichloropropane	EPA 8260C
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260C
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 8260C
Bromoform	EPA 8260C
Bromomethane	EPA 8260C
Carbon tetrachloride	EPA 8260C
Chloroethane	EPA 8260C
Chloroform	EPA 8260C
Chloromethane	EPA 8260C
cis-1,2-Dichloroethene	EPA 8260C
cis-1,3-Dichloropropene	EPA 8260C
Dibromochloromethane	EPA 8260C

Serial No.: 59449

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2020
Issued April 01, 2019

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. ROBERT Q. BRADLEY
YORK ANALYTICAL LABORATORIES INC
120 RESEARCH DRIVE
STRATFORD, CT 06615

NY Lab Id No: 10854

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Volatile Halocarbons	
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260C
Methylene chloride	EPA 8260C
Tetrachloroethene	EPA 8260C
trans-1,2-Dichloroethene	EPA 8260C
trans-1,3-Dichloropropene	EPA 8260C
Trichloroethene	EPA 8260C
Trichlorofluoromethane	EPA 8260C
Vinyl chloride	EPA 8260C

Volatile Organics	
1,4-Dioxane	EPA 8260C
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
Acetone	EPA 8260C
Carbon Disulfide	EPA 8260C
Cyclohexane	EPA 8260C
Methyl acetate	EPA 8260C
Methyl cyclohexane	EPA 8260C
Methyl tert-butyl ether	EPA 8260C
tert-butyl alcohol	EPA 8260C
Vinyl acetate	EPA 8260C

Sample Preparation Methods

EPA 5035A-L

Sample Preparation Methods

EPA 5035A-H
EPA 3580A
EPA 3010A
EPA 3050B
EPA 3550C
EPA 3546
EPA 3545A
EPA 3060A
EPA 9010C

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WADSWORTH CENTER

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MS. MICHELLE FREEMAN
YORK ANALYTICAL LABORATORIES, INC. (II)
132-02 89TH AVENUE SUITE 217
RICHMOND HILL, NY 11418

NY Lab Id No: 12058

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Perfluorinated Alkyl Acids

Perfluorooctanesulfonic acid (PFOS)	EPA 537
Perfluorooctanoic acid (PFOA)	EPA 537

Serial No.: 60019

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132-02 89TH AVENUE SUITE 217
RICHMOND HILL, NY 11418

NY Lab Id No: 12058

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Acrylates	
Acrolein (Propenal)	EPA 8260C
Acrylonitrile	EPA 8260C
Methyl methacrylate	EPA 8260C
Chlorinated Hydrocarbons	
1,2,3-Trichlorobenzene	EPA 8260C
Fuel Oxygenates	
Di-isopropyl ether	EPA 8260C
Ethanol	EPA 8260C
Methyl tert-butyl ether	EPA 8260C
tert-amyl alcohol	EPA 8260C
tert-amyl methyl ether (TAME)	EPA 8260C
tert-butyl alcohol	EPA 8260C
tert-butyl ethyl ether (ETBE)	EPA 8260C
Volatile Aromatics	
1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 8260C
1,4-Dichlorobenzene	EPA 8260C
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
Bromobenzene	EPA 8260C

Volatile Aromatics	
Chlorobenzene	EPA 8260C
Ethyl benzene	EPA 8260C
Isopropylbenzene	EPA 8260C
m/p-Xylenes	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
o-Xylene	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 8260C
tert-Butylbenzene	EPA 8260C
Toluene	EPA 8260C
Total Xylenes	EPA 8260C
Volatile Halocarbons	
1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 8260C
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 8260C
1,1-Dichloroethane	EPA 8260C
1,1-Dichloroethene	EPA 8260C
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260C

Serial No.: 60020

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

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Issued April 01, 2019

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MS. MICHELLE FREEMAN
YORK ANALYTICAL LABORATORIES, INC. (II)
132-02 89TH AVENUE SUITE 217
RICHMOND HILL, NY 11418

NY Lab Id No: 12058

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Volatile Halocarbons	
1,2-Dibromoethane	EPA 8260C
1,2-Dichloroethane	EPA 8260C
1,2-Dichloropropane	EPA 8260C
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260C
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 8260C
Bromoform	EPA 8260C
Bromomethane	EPA 8260C
Carbon tetrachloride	EPA 8260C
Chloroethane	EPA 8260C
Chloroform	EPA 8260C
Chloromethane	EPA 8260C
cis-1,2-Dichloroethene	EPA 8260C
cis-1,3-Dichloropropene	EPA 8260C
Dibromochloromethane	EPA 8260C
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260C
Methylene chloride	EPA 8260C
Tetrachloroethene	EPA 8260C
trans-1,2-Dichloroethene	EPA 8260C
trans-1,3-Dichloropropene	EPA 8260C
trans-1,4-Dichloro-2-butene	EPA 8260C
Trichloroethene	EPA 8260C
Trichlorofluoromethane	EPA 8260C
Vinyl chloride	EPA 8260C
Volatiles Organics	
1,4-Dioxane	EPA 8260C
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
Acetone	EPA 8260C
Carbon Disulfide	EPA 8260C
Cyclohexane	EPA 8260C
Methyl acetate	EPA 8260C
Methyl cyclohexane	EPA 8260C
Vinyl acetate	EPA 8260C
Sample Preparation Methods	
	EPA 5030C

Serial No.: 60020

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All approved analytes are listed below:

Acrylates	
Acrolein (Propenal)	EPA 8260C
Acrylonitrile	EPA 8260C
Methyl methacrylate	EPA 8260C
Chlorinated Hydrocarbons	
1,2,3-Trichlorobenzene	EPA 8260C
Volatile Aromatics	
1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 8260C
1,4-Dichlorobenzene	EPA 8260C
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 8260C
Ethyl benzene	EPA 8260C
Isopropylbenzene	EPA 8260C
m/p-Xylenes	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
o-Xylene	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260C
Volatile Aromatics	
sec-Butylbenzene	EPA 8260C
Styrene	EPA 8260C
tert-Butylbenzene	EPA 8260C
Toluene	EPA 8260C
Total Xylenes	EPA 8260C
Volatile Halocarbons	
1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 8260C
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 8260C
1,1-Dichloroethane	EPA 8260C
1,1-Dichloroethene	EPA 8260C
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260C
1,2-Dibromoethane	EPA 8260C
1,2-Dichloroethane	EPA 8260C
1,2-Dichloropropane	EPA 8260C
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260C
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 8260C
Bromoform	EPA 8260C

Serial No.: 60021

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

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MS. MICHELLE FREEMAN
YORK ANALYTICAL LABORATORIES, INC. (II)
132-02 89TH AVENUE SUITE 217
RICHMOND HILL, NY 11418

NY Lab Id No: 12058

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Volatile Halocarbons

Bromomethane	EPA 8260C
Carbon tetrachloride	EPA 8260C
Chloroethane	EPA 8260C
Chloroform	EPA 8260C
Chloromethane	EPA 8260C
cis-1,2-Dichloroethene	EPA 8260C
cis-1,3-Dichloropropene	EPA 8260C
Dibromochloromethane	EPA 8260C
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260C
Methylene chloride	EPA 8260C
Tetrachloroethene	EPA 8260C
trans-1,2-Dichloroethene	EPA 8260C
trans-1,3-Dichloropropene	EPA 8260C
Trichloroethene	EPA 8260C
Trichlorofluoromethane	EPA 8260C
Vinyl chloride	EPA 8260C

Volatile Organics

1,4-Dioxane	EPA 8260C
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
Acetone	EPA 8260C
Carbon Disulfide	EPA 8260C

Volatile Organics

Cyclohexane	EPA 8260C
Methyl acetate	EPA 8260C
Methyl cyclohexane	EPA 8260C
Methyl tert-butyl ether	EPA 8260C
tert-butyl alcohol	EPA 8260C
Vinyl acetate	EPA 8260C

Sample Preparation Methods

EPA 5035A-L
EPA 5035A-H

Serial No.: 60021

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RICHMOND HILL, NY 11418

NY Lab Id No: 12058

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES AIR AND EMISSIONS
All approved analytes are listed below:

Acrylates	
Acrylonitrile	EPA TO-15
Methyl methacrylate	EPA TO-15
Chlorinated Hydrocarbons	
1,2,4-Trichlorobenzene	EPA TO-15
Hexachlorobutadiene	EPA TO-15
Hexachloroethane	EPA TO-15
Purgeable Aromatics	
1,2,4-Trimethylbenzene	EPA TO-15
1,2-Dichlorobenzene	EPA TO-15
1,3,5-Trimethylbenzene	EPA TO-15
1,3-Dichlorobenzene	EPA TO-15
1,4-Dichlorobenzene	EPA TO-15
Benzene	EPA TO-15
Chlorobenzene	EPA TO-15
Ethyl benzene	EPA TO-15
Isopropylbenzene	EPA TO-15
m/p-Xylenes	EPA TO-15
o-Xylene	EPA TO-15
Styrene	EPA TO-15
Toluene	EPA TO-15
Total Xylenes	EPA TO-15
Purgeable Halocarbons	
1,1,1-Trichloroethane	EPA TO-15
1,1,2,2-Tetrachloroethane	EPA TO-15

Purgeable Halocarbons	
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA TO-15
1,1,2-Trichloroethane	EPA TO-15
1,1-Dichloroethane	EPA TO-15
1,1-Dichloroethene	EPA TO-15
1,2-Dibromoethane	EPA TO-15
1,2-Dichloroethane	EPA TO-15
1,2-Dichloropropane	EPA TO-15
3-Chloropropene (Allyl chloride)	EPA TO-15
Bromodichloromethane	EPA TO-15
Bromoform	EPA TO-15
Bromomethane	EPA TO-15
Carbon tetrachloride	EPA TO-15
Chloroethane	EPA TO-15
Chloroform	EPA TO-15
Chloromethane	EPA TO-15
cis-1,2-Dichloroethene	EPA TO-15
cis-1,3-Dichloropropene	EPA TO-15
Dibromochloromethane	EPA TO-15
Dichlorodifluoromethane	EPA TO-15
Methylene chloride	EPA TO-15
Tetrachloroethene	EPA TO-15
trans-1,2-Dichloroethene	EPA TO-15
trans-1,3-Dichloropropene	EPA TO-15
Trichloroethene	EPA TO-15
Trichlorofluoromethane	EPA TO-15
Vinyl bromide	EPA TO-15

Serial No.: 60022

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WADSWORTH CENTER

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YORK ANALYTICAL LABORATORIES, INC. (II)
132-02 89TH AVENUE SUITE 217
RICHMOND HILL, NY 11418

NY Lab Id No: 12058

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES AIR AND EMISSIONS
All approved analytes are listed below:

Purgeable Halocarbons	
Vinyl chloride	EPA TO-15
Volatile Chlorinated Organics	
Benzyl chloride	EPA TO-15
Volatile Organics	
1,2-Dichlorotetrafluoroethane	EPA TO-15
1,3-Butadiene	EPA TO-15
1,4-Dioxane	EPA TO-15
2-Butanone (Methylethyl ketone)	EPA TO-15
4-Methyl-2-Pentanone	EPA TO-15
Acetone	EPA TO-15
Carbon Disulfide	EPA TO-15
Cyclohexane	EPA TO-15
Hexane	EPA TO-15
Isopropanol	EPA TO-15
Methyl tert-butyl ether	EPA TO-15
n-Heptane	EPA TO-15
Vinyl acetate	EPA TO-15

Serial No.: 60022

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Appendix 11
Management Forms
for On-Site ECs

ANNUAL COMPLIANCE INSPECTION FORM - Interim SVE System	
77-57 Vleigh Place **Flushing, Queens, NY** **NYSDEC Site Number: C241168**	
Name of Inspector:	
Remedial Action Completion Date:	
COC Issuance Date	
Inspection Date	
Date of Last Periodic Compliance Inspection:	
Operators Name and Tel #	
Persons Present During Inspection include Affiliations:	
A. Remedy Description of Cover Systems	
1. Review of the current remedy	
Identify the current remedy:	
□ Cover Slab/ Top Soil	
□ SVE	
B. Remedy Performance Assessment	
1. Evaluate remedy effectiveness:	
Based on information collected since the last O&M review, do monitoring data indicate that the system is failing or could eventually fail to meet remedy goals?	□ Yes □ No
Since the last O&M review, have monitoring data exhibited trends indicative of a new or renewed release?	□ Yes □ No
Since the last O&M review, have changes in land and/or ground water use been suggested and or implemented that have the potential to reduce the protectiveness of the SSDS remedy?	□ Yes □ No
Since the last O&M review, have contaminants been identified in new locations or at higher concentrations where they pose or have the potential to pose unacceptable risks to receptors?	□ Yes □ No
If you answered yes to any of the above questions, did the information suggest the need for immediate action or is the condition being monitored to evaluate the need for future action? Use this space to comment. What actions, if any, have been taken and/or are planned in response to the new	□ Immediate Action □ Monitor for future □ N/A
Based on your answers to the above questions, is there reason to evaluate the need for a contingent remedy at this time? If yes, use this space to comment.	□ Yes □ No
SVE blower and Piping	
Since the last O&M review for this system, has evidence of damages to system components been observed?	□ Yes □ No
Since the last O&M review, have system blower and piping components been consistently operational	□ Yes □ No

SVE	
PID Level at effluent	PPM
Vacuum Reading at Vacuum monitorig points	
PT-1	Inch WC
PT-2	Inch WC
PT-7	Inch WC
SV-8	Inch WC
SV-9	Inch WC
SV-KG-1	Inch WC
Vacuum Gauge	Inch WC
Alarm Condition	□ Operational □ Damaged
Was the Subslab Depressurization System (SSDS) operating upon arrival? If "No," explain below why the system was not running, efforts taken to restart the SSDS and if the	□ Yes □ No
Carbon Activated Carbon (GAC)drums	
Is breakthrough detector on GAC drum for SSDS-1 turning from violet to brow/black	□ Yes □ No
Is breakthrough detector on GAC drum for SSDS-1 turning from violet to brow/black	□ Yes □ No
List below all pertinent observations and actions taken during this Inspection:	
Cover System	
Did you observe breaking of slab cover l?	□ Yes □ No
If yes describe the level of alteration needed for repairs and remedies?	

Monitoring Data Log Sheet - Interim SVE System Beneath Building Slab

77-57 Vleigh Place (77-39/63 Vleigh Place a.k.a. 141-15 78th Avenue)
Flushing, New York, NYSDEC Site Number: C241168

Date/Time	SVE Vacuum	Blower Effluent			SVE wells				Vaccum Monitoring Points						Weather Conditons					
					EW-4		EW-5		PT-1	PT-2	PT-7	SV-8	SV-9	SV-KG-1						
		Flow	PID	Temp	PID	Vacuum	PID	Vacuum	Vacuum						Temp	Rain	Snow	Cloudy	Sunny	Windy

Vacuum --- Inch Water
PID --- ppm
Flow --- CFM
Temperature --- ◦F

ANNUAL COMPLIANCE INSPECTION FORM - Final SVE System Beneath Buildig Slab	
77-57 Vleigh Place **Flushing, Queens, NY** **NYSDEC Site Number: C241168**	
Name of Inspector:	
Remedial Action Completion Date:	
COC Issuance Date	
Inspection Date	
Date of Last Periodic Compliance Inspection:	
Operators Name and Tel #	
Persons Present During Inspection include Affiliations:	
A. Remedy Description of Cover Systems	
1. Review of the current remedy	
Identify the current remedy:	
□ Cover Slab/ Top Soil	
□ SVE	
B. Remedy Performance Assessment	
1. Evaluate remedy effectiveness:	
Based on information collected since the last O&M review, do monitoring data indicate that the system is failing or could eventually fail to meet remedy goals?	□ Yes □ No
Since the last O&M review, have monitoring data exhibited trends indicative of a new or renewed release?	□ Yes □ No
Since the last O&M review, have changes in land and/or ground water use been suggested and or implemented that have the potential to reduce the protectiveness of the SSDS remedy?	□ Yes □ No
Since the last O&M review, have contaminants been identified in new locations or at higher concentrations where they pose or have the potential to pose unacceptable risks to receptors?	□ Yes □ No
If you answered yes to any of the above questions, did the information suggest the need for immediate action or is the condition being monitored to evaluate the need for future action? Use this space to comment. What actions, if any, have been taken and/or are planned in response to the new	□ Immediate Action □ Monitor for future □ N/A
Based on your answers to the above questions, is there reason to evaluate the need for a contingent remedy at this time? If yes, use this space to comment.	□ Yes □ No
SVE blower and Piping	
Since the last O&M review for this system, has evidence of damages to system components been observed?	□ Yes □ No
Since the last O&M review, have system blower and piping components been consistently operational	□ Yes □ No

SVE	
PID Level at effluent	PPM
Vacuum Reading at Vacuum monitorig points	
PT-1	Inch WC
PT-2	Inch WC
PT-3	Inch WC
PT-4	Inch WC
PT-5	Inch WC
PT-6	Inch WC
PT-7	Inch WC
Vacuum Gauge	Inch WC
Alarm Condition	□ Operational □ Damaged
Was the Subslab Depressurization System (SSDS) operating upon arrival? If "No," explain below why the system was not running, efforts taken to restart the SSDS and if the	□ Yes □ No
Carbon Activated Carbon (GAC)drums	
Is breakthrough detector on GAC drum for SSDS-1 turning from violet to brow/black	□ Yes □ No
Is breakthrough detector on GAC drum for SSDS-1 turning from violet to brow/black	□ Yes □ No
List below all pertinent observations and actions taken during this Inspection:	
Cover System	
Did you observe breaking of slab cover l?	□ Yes □ No
If yes describe the level of alteration needed for repairs and remedies?	

Monitoring Data Log Sheet - Final SVE System Beneath Building Slab

77-57 Vleigh Place (77-39/63 Vleigh Place a.k.a. 141-15 78th Avenue)
Flushing, New York, NYSDEC Site Number: C241168

Date/Time	SVE Vacuum	Blower Effluent			Vaccum Monitoring Points							Weather Conditons				
					PT-1	PT-2	PT-3	PT-4	PT-5	PT-6	PT-7					
		Flow	PID	Temp	Vacuum							Rain	Snow	Cloudy	Sunny	Barometer

Vacuum --- Inch Water Flow
PID --- ppm
Flow --- CFM
Temperature --- ◦F

WELL MONITORING LOG SHEET

Project Name: NYSDEC Site Number: C241168
77-57 Vleigh Place,Queens, New York

Date: _____

Client: _____

Instrument: _____

Site Location: 77-57 Vleigh Place
77-39/63 Vleigh Place a.k.a. 141-15 78th Avenue

Monitoring Schedule: Monthly : _____ Quartely : _____ Bi-Annually :_____

Legend

S = Snow D = Dry G = Gone C = Can't Locate
DTW = Depth to Water DTP = Depth to Product PT = Product Thickness ND = None Detected

Monitoring Well	D.T.P.	D.T.W.	PID screening
MW-1			
MW-2			
MW-3S			
MW-3D			
MW-5D			
MW-6			
MW-7D			
MW-9			
MW-11			
MW-12			
MW-13			

Notes: All measurements in feet, below the nortnern top of well casing
Notes:
All measurements are reported in feet
ND=none detected
D=destroyed

Reported By:

_____ _____

Appendix 12
Management Forms for Off-Site SSDS

Site Management Inspection Form

141-05, 141-12, 141-18 & 141-24 78th Avenue
Flushing, New York

Name of Inspector:		**Inspection Date:**	
Construction Completion Date:		**Date of Last Periodic Compliance Inspection:**	
Name and Address Current Property Owner(s):			
Name of Site Contact:		**Telephone Number:**	
Operators Name: (if applicable)		**Telephone Number:**	
Persons Present During Inspection include Affiliations:			

Date	Site Address	Inspector name and title
	141-05, 141-12, 141-18 & 141-24 78th Avenue, Flushing, New York	

Remedy Description of Cover Systems

1. Review of the current remedy

Identify the current remedy:

□ SSDS		

How many SSDS Systems are used ? SSDS-1; SSDS-2; SSDS-3 and SSDS-4

2. Review of the current remedy goals

What schedule has been established for monitoring of SSDS ?

B. Summary of Remedy Performance Assessment

1. Evaluate remedy effectiveness:

Based on information collected since the last O&M review, do monitoring data indicate that the system is failing or could eventually fail to meet remedy goals?	□ Yes □ No
Since the last O&M review, have monitoring data exhibited trends indicative of a new or renewed release?	□ Yes □ No
Since the last O&M review, have changes in landuse been suggested and or implemented that have the potential to reduce the protectiveness of the SSDS remedy?	□ Yes □ No
Since the last O&M review, have contaminants been identified in new locations or at higher concentrations where they pose or have the potential to pose unacceptable risks to receptors?	□ Yes □ No
If you answered yes to any of the above questions, did the information suggest the need for immediate action or is the condition being monitored to evaluate the need for future action? Use this space to comment. What actions, if any, have been taken and/or are planned in response to the new information?	□ Immediate Action □ Monitor for future □ N/A
Based on your answers to the above questions, is there reason to evaluate the need for a contingent remedy at this time? If yes, use this space to comment.	□ Yes □ No

SSDS

PID at effluent - SSDS-1 = ; SSDS-2 = ; SSDS-3 = ; SSDS-4 =	PPM
Vacuum guage - SSDS-1 = ; SSDS-2 = ; SSDS-3 = ; SSDS-4 =	Inch H20
Vacuum Reading at the 8 vacuum monitorinbg points : PTP-1= ; PTP-2= ; PTP-3= ; PTP-4= ; PTP-5= ; PTP-6= ; PTP-7= ; PTP-8=	Inch H20
Fan Condition	□ Function □ Damage
Alarm Condition	□ Function □ Damage
Was the Subslab Depressurization System (SSDS) operating upon arrival? If "No," explain below why the system was not running, efforts taken to restart the SSDS and if the system was operational when leaving. If successful in making the SSDS operational, complete the remainder of the checklist.	□ Yes □ No
If measured, were all subslab probe vacuum readings greater than 0.004 inches of water? If "Yes," the SSDS is deemed still effective and the vacuum readings taken during this inspection are now the new baseline readings.	□ Yes

If "No," system must be adjusted/amended and the SSDS re-commissioned Discuss adjustments and amendments below:	□ No
List below all pertinent observations and actions taken during this Inspection: i.e., sagging/damaged pipes, construction changes to building that may affect the system, pipe leaks that may need smoke test, is building still vacant, has occupancy zoning changed (i.e. commercial to residential), are non-SSDS engineered systems still functioning as designed etc. Add additional pages as needed.	
Cover slab	
Did you observe breaking or cracks in the slab cover	□ Yes □ No
If yes describe the level of alteration needed for repairs and remedies?	

Appendix 13
Remedial System Optimization Table of Contents

REMEDIAL SYSTEM OPTIMIZATION

77-57 Vleigh Place
77-39/63 Vleigh Place a.k.a. 141-15 78th Avenue
Queens, New York
NYSDEC Site Number: C241168