



77-57 VLEIGH PLACE

QUEENS, NEW YORK

Remedial Action Work Plan

NYSDEC BCP Site Number: C241168

Prepared for:

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CERTIFICATIONS

I, Tarek Z. Khouri , certify that I am currently a NYS registered professional engineer and that this Remedial Action Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class “A” misdemeanor, pursuant to Section 210.45 of the Penal Law.

086611

21 December 2017



NYS Professional Engineer #

Date

Signature

It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

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LIST OF ACRONYMS

Acronym	Definition
AOC	Area of Concern
CAMP	Community Air Monitoring Plan
C/D	Construction/Demolition
COC	Certificate of Completion
CQAP	Construction Quality Assurance Plan
CSOP	Contractors Site Operation Plan
DCR	Declaration of Covenants and Restrictions
ECs/ICs	Engineering and Institutional Controls
HASP	Health and Safety Plan
IRM	Interim Remedial Measure
BCA	Brownfield Cleanup Agreement
MNA	Monitored Natural Attenuation
NOC	Notice of Completion
NYC BCP	New York City Brownfield Cleanup Program
NYC DEP	New York City Department of Environmental Protection
NYC DOHMH	New York State Department of Health and Mental Hygiene
NYCRR	New York Codes Rules and Regulations
NYC OER	New York City Office of Environmental Remediation
NYS DEC	New York State Department of Environmental Conservation
NYS DEC DER	New York State Department of Environmental Conservation Division of Environmental Remediation
NYS DOH	New York State Department of Health
NYS DOT	New York State Department of Transportation
ORC	Oxygen-Release Compound

OSHA	United States Occupational Health and Safety Administration
PAH	Poly Aromatic Hydrocarbons
PCE	Tetrachloroethylene
PE	Professional Engineer
PGWSCO's	Protection of Groundwater Soil Cleanup Objectives
PID	Photo Ionization Detector
QEP	Qualified Environmental Professional
QHHEA	Qualitative Human Health Exposure Assessment
RAOs	Remedial Action Objectives
RAR	Remedial Action Report
RAWP	Remedial Action Work Plan or Plan
RCA	Recycled Concrete Aggregate
RD	Remedial Design
RI	Remedial Investigation
RMZ	Residual Management Zone
SCOs	Soil Cleanup Objectives
SCG	Standards, Criteria and Guidance
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SVOC	Semi-Volatile Organic Compound
TCE	Trichloroethylene
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

Site Description/Physical Setting/Site History

Aldrich Management Co., LLC filed an application to enter into the Brownfield Cleanup Program (BCP) Agreement with the New York State Department of Environmental Conservation (NYSDEC) as a Participant for a site located at 77-39/63 Vleigh Place, Flushing, New York (the “Site”). A Site number C241168 was issued to this BCP project on March 19, 2015 and a Brownfield Cleanup Agreement (BCA) was executed on April 6, 2015.

The Site is approximately 39,000 square feet (0.9 acres) in area. Originally, the Site consisted of an approximately 11,500 square foot one-story commercial building with full basement along the western portion and an open unpaved yard in the eastern portion. The building was completely destroyed by a fire, on December 30, 2016. Prior to the fire incident at the Site, the 1-story building housed thirteen (13) tenant spaces and the open yard was utilized for parking by on-Site tenants.

Originally, the Site consisted of an approximately 11,500 square foot one-story commercial building with full basement along the western portion and an open unpaved yard in the eastern portion. This building was completely destroyed by a fire on December 30, 2016 and was immediately condemned by the NYCDOB. Prior to the fire incident, the 1-story building housed thirteen (13) tenant spaces and the open yard was utilized for parking by on-Site tenants.

The building was demolished and removed of between August 8 and 21, 2017. Demolition activities consisted of the disposal of trash consisting of destroyed commercial belongings of former tenants and 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 former parking area in the open unpaved yard was utilized as a staging area of equipment during demolition activities.

The Site is currently vacant and is covered by a sub-grade concrete slab in poor condition and sub-grade stone foundation sidewalls in the area of the basement of the former building and a bare surface in the former parking area. The Site is also secured by plywood fence along Vleigh Place, 78th Avenue and 77th Road and a wire fence around the former parking area along 77th Road and the eastern boundary of the property.

Summary of the Remedial Investigation

A remedial investigation was performed and the results are documented in companion documents called “Phase II Environmental Site Assessment” (Phase II ESA) report dated October 2013, “Focused Subsurface Investigation” report dated February 2014, “Focused Subsurface Investigation” report dated August 2014, “Subsurface Investigation” report dated January 2015, “Subsurface Investigation” report dated April 2015, and a “Remedial Investigation Report” (RIR) dated December 2016. These remedial investigations focused on the following areas of concern for this Site:

1. The historical and most recent use of a tenant space at the Site identified 77-57 Vleigh Place at the Site as a drycleaner.

In addition, three off-site investigations were performed at three adjacent properties based on the findings of the RIR:

1. The first investigation was performed at a west-adjacent sensitive receptor identified as Steppingstone Day School (a pre-school) and located at 77-40 Vleigh Place. This investigation was performed on April 2, 2016 and was reported in a “Sub-slab Vapor, Indoor and Outdoor Air Sampling Results” report dated August 2016.
2. The second investigation was performed at the east-adjacent property consisting of three adjoining residential buildings identified as Kew Gardens Owners. Corp. and located at 141-27 77th Road, 141-23 & 141-25 78th Avenue.
3. The third investigation was performed at the south-adjacent property consisting of four adjoining residential buildings identified as Regency Gardens Company and located at 141-05, 141-12, 141-18 & 141-24 78th Avenue.

The second and third off-site investigations were performed at Kew Gardens Owners. Corp. and Regency Gardens Company on April 4, 2017 and were reported in two separate “Sub-slab Vapor, Indoor and Outdoor Air Sampling Results” reports dated May 2017.

1. Scope of Remedial Investigations

On-Site RI:

1. Site inspection to identify AOCs and physical obstructions (i.e. structures, buildings, etc.);
2. Installation of twenty six (26) soil borings across the entire project Site and the collection of forty two (42) soil samples for chemical analysis from the soil borings to evaluate soil quality;
3. Installation of one (1) groundwater probe and thirteen (13) groundwater monitoring wells including two (2) monitoring well nests throughout the Site to establish groundwater flow and the collection of twenty three (23) groundwater samples for chemical analysis to evaluate groundwater quality;
4. Installation of three sub-slab vapor points in the basements of the commercial building at the Site, seven (7) soil vapor probes throughout parking area at the Site and six off-site soil vapor probes in adjacent sidewalks to the north and south of the Site and the collection of sixteen (16) soil vapor samples, three (3) indoor air samples and two (2) outdoor ambient air samples for chemical analysis;
5. Collection of one (1) sediment samples from the drywell located beneath the commercial building at the Site for chemical analysis to evaluate the sediment quality;
6. Performance of a Qualitative Human Health Exposure Assessment

Off-Site Investigation at Steppingstone Day School:

1. Installation of three (3) sub-slab vapor points throughout the basement at this facility and the collection of three vapor samples, seven (7) basement indoor air samples and one (1) outdoor ambient air samples for chemical analysis;

Off-Site Investigation at Kew Gardens:

1. Installation of two (2) soil vapor probes and collected 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;

Off-Site Investigation at Regency Gardens:

1. 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;

2. Findings of Remedial Investigations:

On-site RIR:

1. Elevation of the property is approximately 77 feet above mean sea level.
2. Depth to groundwater ranges from 29.84 to 36.60 feet at the Site.
3. Groundwater flow is generally from southeast to northwest beneath the Site.
4. Bedrock was not encountered at the Site at the depth of 48 feet.
5. The stratigraphy of the site, from the ground surface down to approximately 10 feet bgs, is classified as fill consisting of a mixture of fine- to coarse-grained sand with bricks, glass and concrete. The fill layer is underlain by fine-grained silt to variable depth ranging between 32 and 34 feet bgs
6. Soil/fill sample results were compared to NYSDEC Unrestricted Use Soil Cleanup objectives (UUSCOs) and Restricted Residential Soil Cleanup Objectives (RRSCO) as presented in 6NYCRR Part 375-6.8 and CP51. Analytical results of soil/fill samples reported PCE (max. 94 mg/kg) was detected at concentrations exceeding its respective Track 1 UUSCO in eight soil samples collected from six soil probes installed on-site including one shallow sample in SP-3 (0.2 feet bbs) installed beneath the basement slab of the drycleaners and seven other samples from soil probes installed in the southeastern

portion of the parking area at the Site including one shallow sample in SP-22 (6-8 feet bgs), three deep dry samples in SP-18 (16-18 feet bgs), SP-20 (10-12 feet bgs) and SP-23 (22-24 feet bgs) and three deep samples collected in the soil-groundwater interface in SP-18 (30-32 feet bgs), SP-22 (28-30 feet bgs), and SP-24 (28-30 feet bgs). Three of these PCE concentrations also exceeded the Track 2 Restricted Residential SCOs in the shallow sample collected at 6 to 8 feet bgs in SP-22, and the deep samples collected at 10 to 12 feet in SP-20 and 22 to 24 feet in SP-23. PCE is also detected at concentrations below its respective Track 1 UUSCO in five shallow soil samples collected beneath the basement slab of the drycleaners in SP-1, SP-2, SP-3a, SP-4 and SP-5, in two deep dry samples beneath the parking area in SP-24 and SP-25 and seven other deep soil samples collected at the soil-groundwater interface beneath the parking area in SP-14, SP-15, SP-17, SP-20, SP-23 and SP-25 and off-site in SP-21. Other chlorinated VOCs are also present in soil samples below UUSCOs; trichloroethylene (TCE) (max. 0.0073 mg/kg) was detected in shallow and in deep dry soil samples in SP-22, cis-1,2-dichloroethylene (cis-1,2-DCE) (0.0057 mg/kg) was detected in deep dry soil sample in SP-15 and methylene chloride (0.0087 mg/kg) was detected in deep dry soil sample in basement in SP-12. SVOCs were detected in four deep samples and one intermediate depth sample at concentrations less than their respective Track 1 SCOs. Two pesticides, 4,4'-DDE (0.0175 mg/kg) and 4,4'-DDT (0.026 mg/kg) were detected in one deep dry soil sample collected in the basement at 18 to 20 feet in SP-11 at concentrations exceeding their respective Track 1 SCOs but below its Track 2 SCO. Total PCBs and Herbicides were not detected in any soil samples. Metals were detected in all soil samples at concentrations below their respective Track 1 SCOs.

7. Groundwater samples results were compared to New York State 6NYCRR Part 703.5 Class GA groundwater quality standards (GQS). Groundwater samples collected during the 2017 RI showed no PCBs pesticides or herbicides in any samples. PCE and trichloroethylene (TCE) are detected in the groundwater samples collected from the groundwater probe and on-site and off-site twelve monitoring wells, cis-1,2-DCE was detected in six on-site monitoring wells, 1,1,1,2-Tetrachloroethane (1,1,1,2-TCA) is

detected in one on-site monitoring well and chloroform is present in eleven on-site and off-site monitoring wells. The detected concentrations of PCE in the groundwater probe and the monitoring wells exceeded its GQS. PCE is identified in groundwater beneath the Site at a maximum concentration of 11,000 ug/L in MW-11. PCE was also detected off-site at a concentration of 130 ug/L in upgradient monitoring well MW-12 and at a maximum concentration of 31 ug/L in downgradient monitoring well MW-2.

Concentrations of TCE exceeded its GQS in two on-site wells MW-9 and MW-11 with a maximum concentration of 75 ug/L detected in MW-11. Chloroform exceeded its GQS in upgradient monitoring well MW-3S and in downgradient monitoring well MW-2. None of the remaining chlorinated VOCs concentrations exceeded their GQS. The VOC 2,2-dichloropropane was detected in off-site monitoring well MW-7D at a concentration below its GQS. 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. Acetone was also detected in groundwater samples and was also detected in the laboratory batch blank. SVOCs were detected in four monitoring wells at concentrations below their respective GQS. Metals including magnesium, manganese and sodium were detected in all filtered and unfiltered groundwater samples at concentrations exceeding their respective GQS.

8. PCE and TCE are present in all on-site and off-site soil vapor samples. PCE was the most abundant compound in on-site soil vapors and was detected at a concentration of 740,000 ug/m³ in the parking area in southeastern portion of the site in SV-4. PCE was also detected in the eight off-site soil vapors; a maximum concentration of 280,000 ug/m³ is detected in SV-9 located across the southern vicinity of the site, a maximum concentration of 2,100 ug/m³ is detected in SV-11 located across the northern vicinity and a maximum of 130 ug/m³ in SV-6 located across the western vicinity of the site. TCE ranked the second highest soil vapor compound with a maximum on-site concentration of

26,000 ug/m³ detected in sub-slab vapor sample SSB-1. TCE is present in one of the two off-site vapor samples installed in the western vicinity at a trace concentration of 4.1 ug/m³ in SV-7 and in all three off-site vapor samples installed in the southern vicinity at a maximum concentration of 6,000 ug/m³ in SV-8. TCE was also detected in off-site soil vapors located in the south-adjacent vicinity at concentrations of 900 ug/m³ in SV-9 and 13 ug/m³ in SV-10. No TCE was detected in the three off-site vapor samples installed in the northern vicinity. PCE and TCE were also detected in the three indoor air samples at maximum concentrations of 1,100 ug/m³ and 57 ug/m³, respectively. PCE and TCE concentrations in indoor air samples exceeded their respective NYSDOH guidance values of 30 ug/m³ and 2 ug/m³. PCE and TCE were not detected in the outdoor air sample OA-1. Additional chlorinated compounds were also detected in the on-site and off-site soil vapor samples including 1,1,1-trichloroethane (65 ug/m³), 1,1-dichloroethane (15 ug/m³), acetone (maximum 96 ug/m³), carbon tetrachloride (9.5 ug/m³), chloroform (maximum 320 ug/m³) and cis-1,2-DCE (7,400 ug/m³). Of these compounds, carbon tetrachloride (0.85 ug/m³), and chloroform (maximum 4.6 ug/m³) were also detected in indoor air samples collected at the Site.

9. Sediment sample results were compared to NYSDEC Unrestricted Use Soil Cleanup objectives and Restricted Residential Soil Cleanup Objectives (SCOs) as presented in 6NYCRR part 375-6.8 and CP51. Analytical results of the sediment sample reported no VOCs including chlorinated compounds in sample collected in the dry well.

Off-Site Investigation at Steppingstone Day School:

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

Off-Site Investigation at Kew Gardens Owners. Corp:

1. 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 ug/m³). Only PCE was detected and in the indoor air samples at a maximum concentration of 3.6 ug/m³. The reported concentrations of PCE in these air samples are below the NYSDOH air guideline values

Off-Site Investigation at Regency Garden Company:

1. PCE (max. 1,300 ug/m³) was detected in 4 sub-slab vapor sample and TCE (max. 1.9 ug/m³) was detected in 2 vapor samples. PCE and TCE also occurred in indoor air samples at maximum concentrations of 13 ug/m³ and 0.97 ug/m³, respectively. PCE and TCE concentrations in indoor air samples at this property do not exceed their respective NYSDOH guidance values of 30 ug/m³ and 2 ug/m³.

Qualitative Human Health Exposure Assessment

Prior to the fire, the potential exposures pathway were considered complete at the Site, a fact that warranted the implementation and operation of mitigation systems consisting aeration and ventilation systems in the basement each of the former tenant spaces and an active sub-slab depressurization system (SSDS) beneath the tenant space located in the southernmost portion of the building.

Under current site conditions, human exposure to contaminants in Site soils may occur through direct contact or airborne transport. Construction and remedial workers are expected to be exposed to surface and subsurface soils and groundwater. Their greatest exposure to contaminated materials will be during excavation. Therefore, all construction activities related to excavation will be subject to strict health and safety and air monitoring procedures.

There will be no future human exposures to contaminated soils at the Site. The entire site will be excavated for the layout of building foundations to 12 feet bgs. The excavation for the elevator pit in the area of the PCE hot spot in the southeastern portion of the Site will extend to the depth of 20 feet bgs. When completed, the Site will contain a 5-story building with a full basement used as a sub-grade parking space. The first floor will consist of commercial use and

the upper floors will consist of residential apartments. The potential for soil vapor intrusion from elevated levels of VOCs in remaining soil and groundwater into the new building will be prevented through the installation of a soil vapor extraction (SVE) system and the implementation of a groundwater treatment program along with other development elements including a vapor barrier and a subgrade parking ventilation system. No groundwater is expected to be encountered during Site remedial excavation. Therefore, potential exposure pathways are considered incomplete for future conditions.

As such, potential exposures would only occur during site remediation and construction but not under future use scenarios, thus not impacting the public or future occupants of the Site.

The primary human health concern associated with groundwater contamination is the use of groundwater as a potable water supply. No significant human exposure to contaminated groundwater from the Site is occurring at present nor will it occur in the future because the area is served by a public water supply.

Incidental exposure to contaminants in groundwater beneath the Site will not occur during excavation and construction activities since the Site will be subject to strict health and safety and air monitoring procedures detailed in the site-specific Construction health and safety plan and the community air monitoring plan.

Construction workers could be exposed to airborne contamination (volatile organics or fugitive dust) during construction activities. To protect construction workers from ingestion and inhalation of dust or volatiles, dust monitoring and dust suppression measures will be implemented based on the procedures outlined in the Site Construction Health and Safety Plan (CHASP).

Under future conditions, there will be no potential exposures via transport of fugitive dust or vapors in ambient air because the Site will be covered by a building, pavement or clean fill. Additionally, elements of the remedy including a soil vapor extraction (SVE) system and the implementation of a groundwater treatment program along with other redevelopment elements including a vapor barrier and a subgrade parking ventilation system will prevent potential exposures.

All individuals visiting the Site could also be exposed to vapors or fugitive dust released during construction activities. However, their exposures would be occasional (during a visit) and for relatively short periods of time (e.g., one to two hours) so that the overall exposures would be less than the exposures to construction workers and nearby residents.

Under current conditions, potential exposure of nearby occupants to soil vapor emanating from the Site is negligible at the east-adjacent property, consistent with the conclusion of an indoor air assessment study conducted in the west-adjacent sensitive receptor identified as Stepping Stone Day School. The potential exposure pathways at the nearby residents/occupants at the adjacent properties identified as Kew Gardens Owners and the Regency Gardens Company and located in the east- and south-adjacent vicinities of the Site are determined to be complete as confirmed by the soil vapor intrusion studies conducted at these two properties. The potential for off-site public exposure at these nearby residential properties will be addressed during this remedial action by implementing an on-site soil vapor extraction system and a groundwater remediation program and will need further monitoring before this potential impact can be dismissed. Nearby residents (i.e., those living along adjoining sides of the site) may also be exposed to either volatile or dust emissions during the construction activities via the inhalation exposure route. As such, continuous air monitoring will be conducted during construction. Measures to suppress either volatile or dust emissions will be also implemented based on the air monitoring data.

Summary of the Remedy

The elements of the selected remedy are as follows:

1. Remedial Design

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows;

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

2. Excavation

The existing on-site building foundations will be demolished and materials which can't be beneficially reused on site will be taken off-site for proper disposal in order to implement the remedy.

Excavation and off-site disposal of contaminant source areas, including:

- Grossly contaminated soil, as defined in 6 NYCRR Part 375-1.2(u); and
- Soils which exceed the Protection of Groundwater Soil Cleanup Objectives (PGWSCOs), as defined by 6 NYCRR Part 375-6.8 for those contaminants found in site groundwater above standards. These source areas are defined as the soils beneath the former drycleaners establishment and the soils in the southeast corner of the site.

Excavation and off-site disposal of all on-site soils which exceed restricted-residential SCOs, as defined by 6 NYCRR Part 375-6.8 in the upper 12 feet in the majority of the site to achieve the Protection of Groundwater Soil Cleanup Objectives (PGWSCOs). The excavation will be extended to a depth of 20 feet-below ground surface (bgs) in the southeast corner of the site to achieve the PGWSCOs. Following the completion of the

excavation, post- excavation end-point soil samples and side wall samples will be collected and analyzed to ensure removal of all source areas and document site conditions.

Approximately 18,213 tons (13,010 cubic yards) of contaminated soil will be removed from the site.

If encountered, excavation and removal of any underground storage tanks (USTs), underground piping or other structures associated with a source of contamination will be disposed of off-site

3. Backfill

Clean fill meeting the requirements of 6 NYCRR Part 375-6.7(d) PGWSCOs will be brought in to complete the backfilling of the excavation and establish the designed grades at the site.

4. Vapor Mitigation

Since the exposure pathways from on-site soil vapors is deemed to be complete on-site and off-site under current site conditions, a soil vapor extraction system or a similar engineered system will be required to mitigate vapors intrusion into the new building and also surrounding buildings to the south and east from elevated levels of VOCs in residual soil and in groundwater beneath the Site.

5. Soil Vapor Extraction

Soil vapor extraction (SVE) will be implemented to remove volatile organic compounds (VOCs) from the subsurface. VOCs will be physically removed from the soil by applying a vacuum to wells that have been installed into the vadose zone (the area below the ground but above the water table). The vacuum draws air through the soil matrix which carries the VOCs from the soil to the SVE well. The air extracted from the SVE wells is then treated as necessary prior to being discharged to the atmosphere.

The SVE system will consist of three soil vapor extraction (SVE) wells installed within the southeastern corner of the Site, where the source of TCE and PCE contamination was identified. The three SVE wells will be clustered in a specific configuration so that their radius of influence will intersect to cover the main area of concern. The SVE wells will be installed utilizing a track rig unit equipped with 6-inch diameter hollow-stem augers. Each well will be constructed using 4-inch diameter schedule 80 PVC pipes and will be installed at three different depths; i.e. 25 feet bgs, 34 feet bgs and 30 feet bgs. Each SVE well will have a 5-foot screen with a screen slot of 0.030 inch and will be placed at the bottom of the well. The SVE wells will be connected to a regenerative blower. Six vacuum pressure monitoring ports clustered within the area of influence of the SVE wells will be installed beneath the slab of proposed building slab or 5 feet if no building slab exists. The purpose of the vacuum pressure monitoring ports is to verify the zone of influence exercised by the suction blower at the three vapor extraction wells and the vacuum communication at the pressure test ports. The installation and start-up of the SVE system will be subject to a Site Management Plan that will define the protocol and duration of system parameters monitoring.

The air containing VOCs extracted from the SVE wells will be treated by passing the air stream through activated carbon, which removes the VOCs from the air prior to it being discharged to the atmosphere. The operation of the components of the remedy will continue until the remedial objectives have been achieved, or until the Department determines that continued operation is technically impracticable or not feasible.

6. Groundwater Remedy

An in-situ chemical oxidation and a bioremediation mechanism will be implemented to treat to treat volatile organic compounds (VOCs) in groundwater and prevent further off-site migration of contaminated groundwater. A chemical oxidant identified as PersulfOx will be injected into the subsurface to destroy the contaminants in an approximately 800 square foot area located in the southeastern portion of the Site. A bioremedial agent 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) will be applied 3 months the application of PersulfOx. 3DME and additions will be injected into the subsurface to treat residual contaminants in an area approximately 4,900 square foot in the southeastern portion of the Site. Both injections will target a treatment zone approximately 16-foot thick below the soil and groundwater interface.

7. Cover System

A site cover will be required to allow for restricted residential use of the site in areas where the upper two feet of exposed surface soil will exceed the applicable soil cleanup objectives (SCOs). Where a soil cover is to be used it will be a minimum of two feet of soil placed over a demarcation layer, with the upper six inches of soil of sufficient quality to maintain a vegetative layer. Soil cover material, including any fill material brought to the site, will meet the SCOs for cover material for the use of the site as set forth in 6 NYCRR Part 375-6.7(d). Substitution of other materials and components may be allowed where such components already exist or are a component of the tangible property to be placed as part of site redevelopment. Such components may include, but are not necessarily limited to: pavement, concrete, paved surface parking areas, sidewalks, building foundations and building slabs.

8. Institutional Controls

Imposition of an institutional control in the form of an environmental easement for the controlled property that:

- Requires the remedial party or site owner to complete and submit to the Department a periodic certification of institutional controls in accordance with Part 375-1.8 (h)(3);
- Allows the use and development of the controlled property for restricted residential, commercial and industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws;

- Restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or NYCDOH; and
- Requires compliance with the Department approved Site Management Plan.

9. Site Management Plan

A Site Management Plan is required, which includes the following:

- a. An Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

Institutional Controls: The Environmental Easement discussed in Paragraph 8 above.

Engineering Controls: The SVE system discussed in Paragraph 5, the Groundwater remedial system discussed in Paragraph 6 and the cover system discussed in Paragraph 7 above.

This plan includes, but may not be limited to:

- An Excavation Plan which details the provisions for management of future excavations in areas of remaining contamination;
- Descriptions of the provisions of the environmental easement including any land use, and groundwater restrictions;
- A provision for evaluation of the potential for soil vapor intrusion for any occupied buildings on the site and off-site to the east and southeast, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;

- A provision that should a building foundation or building slab be removed in the future, a cover system consistent with that described in Paragraph 7 above will be placed in any areas where the upper two feet of exposed
 - Surface soil exceeding the applicable soil cleanup objectives (SCOs)
 - Provisions for the management and inspection of the identified engineering controls;
 - Maintaining site access controls and Department notification; and
 - The steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.
- b. A Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to
- Monitoring of soil, soil vapor and groundwater to assess the performance and effectiveness of the remedy;
 - A schedule of monitoring and frequency of submittals to the Department;
 - Monitoring for vapor intrusion for any buildings on the site and off-site, as may be required by the Institutional and Engineering Control Plan discussed above;
 - Assess the performance and effectiveness of the SVE system by monitoring for vapor intrusion at adjacent buildings located off-site.
- c. An Operation and Maintenance (O&M) Plan to ensure continued operation, maintenance, optimization, monitoring, inspection, and reporting of any mechanical or physical components of the remedy. The plan includes, but is not limited to:

- Procedures for operating and maintaining the remedy;
- Compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;
- Maintaining site access controls and Department notification; and
- Providing the Department access to the site and O&M records.

REMEDIAL ACTION WORK PLAN

1.0 INTRODUCTION

Aldrich Management Co., LLC entered into a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC) in March 2015, to investigate and remediate a 0.9-acre property located at 77-39/63 Vleigh Place in Kew Garden Hills neighborhood of Flushing Section of the County of Queens, New York. Aldrich Management Co., LLC is a Participant in the Brownfield Cleanup Program. Residential and commercial use is proposed for the property in deviation from the commercial use presented in the Brownfield Cleanup Program (BCP) application as a results of a contemplated redevelopment plan of the Site following the destruction of existing building by a fire. A Change of Use Notification along with demolition plans of the ruined building were received by NYSDEC on 2/14/2017 and approved by NYSDEC in a letter dated 2/17/2017. When completed, the Site will contain a 5-story building with a full basement used as a sub-grade parking space. The first floor will consist of commercial use and the upper floors will consist of residential apartments.

This Remedial Action Work Plan (RAWP) summarizes the nature and extent of contamination as determined from data gathered during the Remedial Investigation (RI), performed between October 2013 and October 2016 and off-site investigations performed between April 2016 and April 2017. It provides an evaluation of a Track 4 cleanup and other applicable Remedial Action alternatives, their associated costs, and the recommended and preferred remedy. The remedy described in this document is consistent with the procedures defined in DER-10 and complies with all applicable standards, criteria and guidance. The remedy described in this document also complies with all applicable Federal, State and local laws, regulations and requirements. The NYSDEC and New York State Department of Health (NYSDOH) have determined that this Site does pose a significant threat to human health and the environment. The RI for this Site did not identify fish and wildlife resources.

1.1 SITE LOCATION AND DESCRIPTION

The Site is located in the County of Queens, New York and is identified as Block 6630 and Lot 1 on the New York City Tax Map. A United States Geological Survey (USGS) topographical quadrangle or other suitable type map (Figure 1) shows the Site location. The Site is situated on an approximately 0.9-acre area 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 2A boundary map is attached to the BCA as required by Environmental Conservation Law (ECL) Title 14 Section 27-1419. The 0.9-acre property is fully described in Appendix 1 – Property Metes and Bounds.

1.2 CONTEMPLATED REDEVELOPMENT PLAN

The Remedial Action to be performed under the RAWP is intended to make the Site protective of human health and the environment consistent with the contemplated end use. The proposed redevelopment plan and end use is described here to provide the basis for this assessment. However, the Remedial Action contemplated under this RAWP may be implemented independent of the proposed redevelopment plan.

The proposed future use of the Site will consist of residential and commercial use. The is anticipated to be developed into of a 5-story building with a full basement. The proposed building footprint will occupy 100% of the lot area. The basement will be used for sub-grade parking space, common storage space and building mechanics. The first floor will be used for as a commercial space and a residential lobby. Floors 2 to 5 will consist of residential units. A layout of the proposed site development is presented in Figure 3. The current zoning designation is R3-2 residential district with C1-2 commercial overlay. The proposed use is consistent with existing zoning for the property.

1.3 DESCRIPTION OF SURROUNDING PROPERTY

The Site is located in the Kew Garden Hills neighborhood of the Flushing Section in the County of Queens, which consists of residential, commercial and institutional properties. A Receptor Survey was performed within a 1000 radius of the Site. The Site is located along the eastern front of New York City tax Block 6630 and is bounded by Vleigh Place to the west, 77th Road to the south and 78th Avenue to the north and is bordered by three 3-story multi-family building complexes (Kew Gardens) to the east. A park (Judge Moses Weinstein Playground) is located to the southwest of the Site. The results of the sensitive receptor database search indicate there are two sensitive receptors located in the immediate vicinity of the Site including a childcare facility identified as Steppingstone Day School located within less than 60 feet to the west of the Site and an institutional facility identified as North Queens High School and located within 200 feet to the north and northeast of the Site. Another sensitive receptor identified by the survey is Public School PS/MS-164 located within 600 feet to the northwest of the Site. Other potential sensitive receptors include residential facilities situated in the immediate southern vicinity of the Site at Regency Gardens and east-adjacent vicinity at Kew Gardens. No other sensitive receptors including schools, day care, hospitals, rivers or streams were identified within the search distance of 1,000 feet from the Site.

2.0 DESCRIPTION OF REMEDIAL INVESTIGATION FINDINGS

The Site was investigated for Site environmental due diligence purposes following the identification of on-site drycleaners as a Recognized Environmental Condition in a Phase I Environmental Site Assessment dated August 2013 and also in accordance with the scope of BCP work presented in the NYSDEC-approved Remedial Investigation (RI) Work Plan (RIWP) dated July 2015 and NYSDEC-approved Remedial Investigation Addendum Work Plan (RIAWP) dated March 2016. The Site investigations were conducted between October 2013 and October 2016.

Based on the RI findings, off-site vapor investigations were performed at the three adjacent sensitive receptors identified as Steppingstone Day School located to the west of the Site at 77-40 Vleigh Place, at a residential development composed of three adjoining buildings identified as Kew Gardens located to the east at 141-27 77th Road, 141-23 & 141-25 78th Avenue and a second residential development composed of four adjoining residential buildings identified as Regency Gardens and located to the south at 141-05, 141-12, 141-18 & 141-24 78th Avenue. The scope of these investigation was communicated with and approved by NYSDEC via electronic correspondences. The off-site vapor investigations were conducted between April 2016 and April 2017.

2.1 SUMMARY REMEDIAL INVESTIGATIONS PERFORMED

Table 1 provides the number, location and sampling criteria of soil probes;

Table 2 provides the number and location of the groundwater monitoring wells;

Table 3 provides the number, location and sampling criteria of soil vapor probes;

Table 4 provides the number, location and sampling criteria of sediment from drywell.

2.1.1. Borings and Wells

1. Installed twenty six (26) soil borings across the entire project Site;
2. Installed one (1) groundwater probe and thirteen (13) on-site and off-site groundwater monitoring wells including two (2) on-site monitoring well nests to establish groundwater flow;
3. Installed of three sub-slab vapor points in the basements of commercial building at the Site, seven (7) soil vapor probes throughout parking area at the Site and six off-site soil vapor probes in adjacent sidewalks to the north and south of the Site.

2.1.2 Samples Collected

1. Collected of forty two (42) soil samples for chemical analysis from the soil borings to evaluate soil quality;
2. Collected twenty three (23) groundwater samples for chemical analysis to evaluate groundwater quality;
3. Collected sixteen (16) soil vapor samples, three (3) indoor air samples and two (2) outdoor ambient air samples for chemical analysis;
4. Collected one (1) sediment samples from the drywell located beneath the beneath the commercial building at the Site for chemical analysis to evaluate the sediment quality.

2.1.3 Chemical Analytical Work Performed

All forty two soil samples were analyzed for volatile organic compounds (VOCs) via EPA Method 8260. Ten of the soil samples were also analyzed for semi-volatile organic compounds (SVOCs) via EPA Method 8270, Pesticides and Polychlorinated Biphenyls (PCBs) via EPA Method 8081/8082, herbicides via EPA Method 8151 and Target Analyte List (TAL) Metals.

All twenty three groundwater samples collected on-Site were analyzed for VOCs via EPA Method 8260. Nine of the groundwater samples were also analyzed for SVOCs via EPA Method

8270, Pesticides and PCBs via EPA Method 8081/8082, herbicides via EPA Method 8151 and total/dissolved TAL Metals.

Sub-slab vapor samples, soil vapor samples and indoor/outdoor air samples were analyzed for VOCs via EPA TP-15.

2.1.4 Documentation

Investigations performed for Site environmental due diligence purposes were documented in a Phase II Environmental Site Assessment” (Phase II ESA) report dated October 2013, “Focused Subsurface Investigation” report dated February 2014, “Focused Subsurface Investigation” report dated August 2014, “Subsurface Investigation” report dated January 2015 and “Subsurface Investigation” report dated April 2015, which were submitted to NYSDEC along the BCP application for this Site on January 23, 2015. The final BCP RI summarizing the work described in the RIWP and RIAWP was submitted to NYSDEC on December 20, 2016.

The three off-site vapor investigations were documented in three separate “Sub-slab Vapor, Indoor and Outdoor Air Sampling Results” reports dated August 2016 at Steppingstone Day School and May 2017 at Kew Gardens and Regency Gardens. Figure 4 provides a sampling plan at the Site.

Below is a summary of RI findings:

2.2 SIGNIFICANT THREAT

The NYSDEC and NYSDOH have determined that this Site poses a significant threat to human health and the environment on-site and off-site and therefore, on-site mitigation measures are required in this remedial action. Notice of that determination has been made via NYSDOH correspondence dated February 11, 2016, NYSDEC correspondence dated February 12, 2016 and also via a Fact Sheet dated September 2017. Copies of the notices and the Fact Sheet are included in Appendix 2.

2.3 SITE HISTORY

2.3.1 Past Uses and Ownership

The Site was historically a vacant land that was partially developed with the current 1-story commercial building during 1939. 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. Currently the property is owned by Aldrich Management Co., LLC, by deed dated June 19, 2007.

2.3.2 Phase I and Phase II Reports

- Remedial Investigation (RI), 77-57 Vleigh Place, Flushing, NY, December 19, 2016, Hydro Tech Environmental, Corp.
- Subsurface Investigation, 77-57 Vleigh Place, Flushing, NY, April 6, 2015, Hydro Tech Environmental, Corp.
- Focused Subsurface Investigation, 77-57 Vleigh Place, Flushing, NY, August 19, 2014, Hydro Tech Environmental, Corp.
- Focused Subsurface Investigation, 77-57 Vleigh Place, Flushing, NY, February 14, 2014, Hydro Tech Environmental, Corp.
- Phase II Environmental Site Assessment (ESA), 77-39 to 77-63 Vleigh Place, Flushing, NY October 15, 2013, Hydro Tech Environmental, Corp.
- Phase I Environmental Site Assessment, 77-39 to 77-63 Vleigh Place, Flushing, NY, August 6, 2013, Environmental Affiliates, Inc.
- Phase I Environmental Site Assessment Report, 77-39 to 77-63 Vleigh Place, Flushing, NY, July 22, 1999, Middleton, Konekosta Associates., Ltd.

- Environmental Property Assessment, 77-39 to 77-63 Vleigh Place, Flushing, NY, July 16, 1993, Merritt Engineering Consultants, P.C.

2.3.3 Sanborn Maps

All Sanborn Maps available for this Site were reviewed prior to preparation of the RAWP. The Site was a vacant lot that was developed along the western portion with the current 1-story commercial building with basement around 1939. The building consisted of 15 storefronts in 1950. No other information was provided on the evaluated Sanborn Maps.

2.4 GEOLOGICAL CONDITIONS

1. Elevation of the property is approximately 77 feet above mean sea level.
2. Depth to groundwater ranges from 29.84 to 36.60 feet at the Site.
3. Groundwater flow is generally from southeast to northwest beneath the Site.
4. Bedrock was not encountered at the Site at the depth of 48 feet.
5. The stratigraphy of the site, from the ground surface down to approximately 10 feet bgs, is classified as fill consisting of a mixture of fine- to coarse-grained sand with bricks, glass and concrete. The fill layer is underlain by fine-grained silt to variable depth ranging between 32 and 34 feet bgs.

A groundwater flow map is shown in Figure 5a to Figure 5d for well monitoring performed during the RI. Groundwater monitoring and surveying data is provided in Table 5.

2.5 CONTAMINATION CONDITIONS

Four Areas of Concerns were identified based on the review of historical Site records, previous investigations and field observations. These AOCs included the following:

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

2.5.1 Conceptual Model of Site Contamination

The contamination present beneath the Site is associated with chlorinated hydrocarbons including PCE and its degradation products in soil, groundwater and in soil vapor beneath the property. The highest dissolved concentrations of PCE and its degradation products occurred in the upgradient southeastern portion of the Site and beneath the former drycleaner. Three areas of concern are identified at the Site as follows:

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

2.5.2 Description of Areas of Concern

1. AOC -1: Presence of chlorinated solvents in shallow and deep soil

Investigations indicate PCE was detected at concentrations exceeding the Restricted Residential SCOs in shallow soil beneath southeastern portion of the parking area at the Site as well as in deep soil samples at the interface with groundwater beneath the southeastern portion of the Site. PCE concentrations in deep soil above the interface with groundwater in the southeastern portion of the parking area also exceeded the Track 2 Restricted Residential SCOs.

2. AOC-2: Presence of chlorinated solvents in groundwater

A groundwater plume consisting of chlorinated hydrocarbons at concentrations exceeding their respective GA Groundwater Standards originates in the southeastern corner of the Site, where the highest concentrations were detected. This plume extends off-site to the east, west and northwest as evidenced by off-site monitoring wells in those directions.

3. AOC 3: Presence of Soil gas at the Site and immediately off-Site

Analytical results of soil vapor indicate elevated levels of VOCs consisting of chlorinated solvents are present beneath Site and also off-site to the south and east. Soil vapor concentrations of chlorinated solvents were highest in the southeastern portion of the Site.

2.5.3 Identification of Standards, Criteria and Guidance

In accordance with DER-10 and ECL § 27-1415, the objectives of the remedial action are to: (1) reduce the concentrations of contaminants of concern at the Site to meet those levels that will protect public health and the environment, and (2) isolate the Site from migration of contaminated groundwater and soil vapor from potential on- and off-site sources. Where identifiable sources of contamination are found on the Site, the sources will be removed or eliminated to the greatest extent feasible, regardless of presumed risk or intended use of the Site. Also in accordance with DER-10, the Remedial Action Objectives (RAO) for this Site are defined as medium-specific objectives for the protection of public health and the environment and are developed based on contaminant-specific standards, criteria, and guidance (SCGs). The SCGs for the Site include:

- NYSDEC Draft Brownfield Cleanup Program Guide – May 2004;
- NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (2010);
- NYSDEC TAGM No. 4031– Fugitive Dust Suppression and Particulate Monitoring

- NYSDEC TOGS 1.1.1 – Ambient Water Quality Standards and Guidance Values and
- Groundwater Effluent Limitations (1998);
- NYSDOH – Guidance for Evaluating Soil Vapor Intrusions in the State of New York
- (2006);
- New York State Codes, Rules and Regulations (NYCRR) Title 6 Part 364 – Waste
- Transporter Permits;
- 6 NYCRR Part 370 – Hazardous Waste Management System;
- 6 NYCRR Part 375 – Environmental Remediation Program (December 2006);
- Code of Federal Regulations (CFR) Title 29 Part 1910.120 - Hazardous Waste Operations and Emergency Response Standard;
- CFR Title 29 Part 1926 – Safety and Health Regulations for Construction; and
- NYSDEC CP-51 – Soil Cleanup Guidance (2010).
- Permanent Closure of Petroleum Storage Tanks
- 6 NYCRR Part 612 - Registration of Petroleum Storage Facilities (February 1992)
- 6 NYCRR Part 613 - Handling and Storage of Petroleum (February 1992)

The proposed soil remediation will occur coincident with the redevelopment of the Site. The proposed Site development will require excavation across the property to a minimum depth of 12 feet bgs. However, two areas will be excavated deeper than twelve feet to address two hot spots of PCE contamination in soils identified during the RI. The first hot spot will be excavated to the depth of 4 feet below the floor of excavation at the location of the former drycleaner. The second hot spot will be excavated beneath the southeastern portion of the former parking area at the Site which corresponds to the proposed location of the proposed elevator pit, and will extend to the depth of 20 feet bgs, and possibly slightly deeper, if possible. However, the site excavation activities are not anticipated to extend into deeper contaminated soil below 20 feet across the hot spot area located in the southeastern portion of the Site, which represents a source of PCE and

TCE contamination to groundwater. The potential health impacts associated with residual contamination following completion of this soil remedial action will be addressed consistent with the RAOs through the installation of a soil vapor extraction (SVE) system and the implementation of a groundwater treatment program.

2.5.4 Soil/Fill Contamination

Soil characterization indicated soil beneath the Site consists of coarse-grained sand with fill material from approximately 10 feet bgs. The fill layer is underlain by fine-grained silt to variable depth ranging between 32 and 34 feet bgs.

2.5.4.1 Summary of Soil/Fill Data

PCE was detected in **seven** locations on-site at concentrations in exceedance of UUSCO. These locations are SP-3 from 0 to 2 feet below basement slab (bbs) (14.6 mg/kg), 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 of 19 mg/kg 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 UUSCO in 5 locations at shallow depths in SP-1, SP-2, SP-3a, SP-4 and SP-5, and 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 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. Deep soil in one location in SP-12 exceeded UUSCO of 0.0033 mg/kg and for the pesticides, 4,4'-DDE (0.0175 mg/kg) and 4,4'-DDT (0.026 mg/kg).

2.5.4.2 Comparison of Soil/Fill with SCGs

Table 6 shows soil results compared to Unrestricted SCOs and Restricted Residential SCOs for all soil/fill at the Site. Figure 6 and Figure 7 are spider maps that show the location and summarize the exceedances from Track 1 Unrestricted SCOs and Restricted Residential SCOs for all soil/fill.

As this data indicates, the soil contamination at the Site in exceedance of Unrestricted SCOs is present in two isolated hot spots at the Site. The first hot spot is characterized in shallow soil beneath the basement slab of former location of drycleaner. The second hot spot is located beneath the southeastern portion of the former parking area and this contamination is characterized to extend vertically from shallow depth to the soil and groundwater interface. Exceedance of Restricted Residential SCOs from Part 375.6(b) does occur in shallow and deep soil above the groundwater interface in the southeastern portion of the former parking area at the Site.

2.5.5 On-Site and Off-Site Groundwater Contamination

2.5.5.1 Summary of Groundwater Data

Groundwater investigations performed at the Site involved the sampling of a groundwater probe and a network of thirteen monitoring wells including two well nests currently present at the Site and in sidewalks located in the Site vicinity. These investigations 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 groundwater beneath the Site at concentrations exceeding their respective GA Standards.

2.5.5.2 Comparison of Groundwater with SCGs

Exceedances from GA groundwater standards in monitoring wells prior to the remedy are shown in Table 7. A spider map that indicates the locations of and summarizes exceedances from GA groundwater standards prior to the remedy is shown in Figure 8.

The plume of chlorinated solvents at concentrations exceeding their respective GA Standards is present beneath the southeastern upgradient portion of the Site and extends off-site into the west-adjacent sidewalk along the northwest Side of Vleigh Place. The PCE concentrations within the plume range from 16 µg/L to 11,000 µg/L. The source of the plume was delineated the beneath the far southeastern portion of the Site where PCE was also detected above the soil and groundwater interface.

2.5.6 On-Site and Off-Site Soil Vapor Contamination

2.5.6.1 Summary of Soil Vapor Data

Chlorinated hydrocarbons including 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/m³ 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/m³ detected to the south in SV-9, 2,100 ug/m³ detected to the north in SV-11 and 130 ug/m³ 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/m³ detected in sub-slab vapor sample SSB-1. TCE was also detected at a trace concentration of 4.1 ug/m³ to the west in SV-7 and at a maximum concentration of 6,000 ug/m³ to the north in SV-8. TCE was detected at concentrations of 900 ug/m³ and 13 ug/m³ 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/m³ and 2 ug/m³.

Additional chlorinated compounds were also detected in the on-site and off-site soil vapor samples including 1,1,1-trichloroethane (65 ug/m³), 1,1-dichloroethane (15 ug/m³), acetone (maximum 96 ug/m³), carbon tetrachloride (9.5 ug/m³), chloroform (maximum 320 ug/m³) and cis-1,2-DCE (7,400 ug/m³). Of these compounds, carbon tetrachloride (0.85 ug/m³), and chloroform (maximum 4.6 ug/m³) were also detected in indoor air samples collected at the Site.

PCE and TCE were commonly detected in soil vapor samples collected at adjacent properties to the west, south and east. PCE was the more abundant compound detected in soil vapors samples with maximum concentrations of 0.38 ug/m³ detected at the west-adjacent property, 1,300 ug/m³ detected at the south-adjacent property, and 13,000 ug/m³ detected at the

east-adjacent property. PCE and TCE were also detected individually or collectively in indoor air at these adjacent properties at concentrations that did not exceed their respective NYSDOH guidance values.

2.5.6.2 Comparison of Soil Vapor with SCGs

A table of soil vapor data collected prior to the remedy is shown in Table 8. A spider map that indicates the location(s) of and summarizes soil vapor data prior to the remedy is shown in Figure 9.

Significant levels of PCE and its derivative compounds including were detected in on-site and off-site soil vapors. PCE and TCE were also detected in indoor air samples collected in structures located on-site and off-site at concentrations that are below the NYSDOH Guidance values. A variety of other VOCs including gasoline vapors and associated derivatives were detected in soil vapors at the Site. Gasoline compounds were identified in soil and in groundwater beneath the Site at concentrations below their respective standards.

2.5.7 On-Site Sediment Contamination

2.4.7.2 Summary of Sediment Data

No VOCs including chlorinated hydrocarbons occurred in the sediment sample collected from the drywell located at the Site.

2.4.7.2 Comparison of Sediment Sample with SCGs

A table of sediment sample data collected prior to remedy is shown in Table 9.

2.6 ENVIRONMENTAL AND PUBLIC HEALTH ASSESSMENTS

2.6.1 Qualitative Human Health Exposure Assessment

Based on the results of the previous subsurface investigation reports including the RIR, potential human exposures to the exceedances of SCOs for PCE and its derivative compounds

TCE and cis-1,2-DCE in soil, to dissolved PCE and TCE in groundwater and PCE and TCE in on-site and off-site soil vapors will be addressed in this section. Potential human exposures to these contaminants will be addressed in this RAWP as follows:

Nature, Extent, Fate and Transport of Contaminants

The presence of PCE and derivative compounds TCE and cis-1,2-DCE, which were delineated vertically in on-Site soil from the depth of 6 feet below grade surface to the soil and groundwater interface beneath the southeastern portion of the Site are likely to be indicative of a source of improper discharges of dry cleaning solvents by the historic or current drycleaners identified at the Site. PCE and TCE were also identified in a dissolved phase in groundwater across the entire Site and off-site with maximum concentrations detected in the southeastern portion of the Site, where PCE was also detected in deep soil at and above the soil-groundwater interface. PCE and TCE were also detected in on-site and off-site soil vapors and the distribution pattern of their concentrations is consistent with the presence of PCE and TCE in dry soil and in the groundwater plume. PCE and TCE vapors originating on-Site appear to migrate laterally with a decreasing trend of concentrations towards and beyond the Site boundaries as evidenced by the soil vapors detected to the south and north of the Site.

Potential Routes of Exposure

The five elements of an exposure pathway are: (1) a contaminant source; (2) contaminant release and transport mechanisms; (3) a point of exposure; (4) a route of exposure; and (5) a receptor population. An exposure pathway is considered complete when all five elements of an exposure pathway are documented. A potential exposure pathway exists when any one or more of the five elements comprising an exposure pathway cannot be documented. An exposure pathway may be eliminated from further evaluation when any one of the five elements comprising an exposure pathway has not existed in the past, does not exist in the present, and will never exist in the future. Three potential primary routes exist by which chemicals can enter the body:

- Ingestion of water, fill or soil;
- Inhalation of vapors and particulates; and
- Dermal contact with water, fill and soil.

Existence of Human Health Exposure

Past – Prior to the fire incident in December 2016, the western portion of the Site was developed with a one-story commercial building housing thirteen (13) tenant spaces with full basements capped with concrete slabs. The eastern portion of the Site consisted of a private open yard covered by bare soil and utilized for parking by former on-Site tenants. According to Table 8, indoor air samples in the former commercial building at the Site exhibited PCE and TCE concentrations ranging up to 1,100 $\mu\text{g}/\text{m}^3$ and 57 $\mu\text{g}/\text{m}^3$, respectively, which exceeded both their respective NYSDOH Indoor Air Guidance levels of 30 $\mu\text{g}/\text{m}^3$ and 2 $\mu\text{g}/\text{m}^3$ as well as the NYSDOH immediate and effective action recommendation levels of 300 $\mu\text{g}/\text{m}^3$ and 20 $\mu\text{g}/\text{m}^3$. These levels warranted the implementation of immediate mitigation action, which were then constructed at the Site as interim remedial measures in accordance with NYSDEC-approved Interim Remedial Measure & Remedial Investigation Addendum Work Plan dated March 1, 2016. These systems were intended to reduce the potential for exposure of former on-site receptors consisting of tenants, workers, delivery personnel and clients to vapors of chlorinated solvent identified in indoor air at the Site. These mitigation measures consisted of an aeration and ventilation systems installed in the basement each of the former tenant spaces. An active sub-slab depressurization system (SSDS) was also operating beneath a tenant space located in the southernmost portion of the building in order to complement the aeration and ventilation system by mitigating the potential for soil vapor intrusion into this indoor space.

Existing – Since the fire, the building was condemned by the NYCDOB and was then demolished and removed during August 2017. The Site is currently vacant and is covered by a sub-grade concrete slab in poor condition and sub-grade stone foundation sidewalls in the area of the basement of the former building and a bare surface in the former parking area. The Site is

also secured by a plywood fence along the northern, southern and western boundaries and wire fence around the former parking area along the southern and eastern boundary. Therefore, currently the only potential on-Site receptors are trespassers and Site representatives.

Groundwater is not exposed at the Site, and because the Site is served by the public water supply and groundwater use for potable supply is prohibited. Thus, groundwater is not used at the Site and there is no potential for exposure to contaminated groundwater.

Three indoor air assessments were performed at the adjacent properties to the west, south and east of the Site. The first investigation was performed at a west-adjacent sensitive receptor identified as Steppingstone Day School (a pre-school) and located at 77-40 Vleigh Place. This investigation was reported in a “Sub-slab Vapor, Indoor and Outdoor Air Sampling Results” report dated August 2016. The second investigation was performed at the east-adjacent property consisting of three adjoining residential buildings identified as Kew Gardens Owners. Corp. and located at 141-27 77th Road, 141-23 & 141-25 78th Avenue. The third investigation was performed at the south-adjacent property consisting of four adjoining residential buildings identified as Regency Gardens Company and located at 141-05, 141-12, 141-18 & 141-24 78th Avenue. The second and third off-site investigations were reported in two separate “Sub-slab Vapor, Indoor and Outdoor Air Sampling Results” reports dated May 2017.

The results of these air assessments at adjacent properties are presented in Table 8. As Table 10 indicates, the detected COCs in the indoor air at the three adjacent properties were below the NYSDOH Indoor Air Guidance levels and therefore, no immediate mitigation actions were required. However, elevated levels of COCs were detected in soil vapor at Kew Gardens Owners. Corp. (maximum PCE of 13,000 ug/m³ and TCE of 13 ug/m³) as well as and sub-slab vapors at Regency Gardens Company (maximum PCE of 1,300 ug/m³ and TCE of 1.9 ug/m³).

Based on their review of these assessments, the NYSDOH confirmed that no mitigation or monitoring actions were required at Steppingstone Day School. However, the NYSDOH required a continuous monitoring of the soil vapor and indoor air quality at the Kew Gardens Owners and the Regency Gardens Company in order to assess the potential for exposure pathways at this two adjacent properties.

Construction/ Remediation Activities– Once redevelopment activities begin, construction workers will come into direct contact with surface and subsurface soils because of on-Site construction/excavation activities. Similarly, off-Site receptors could be exposed to dust from onsite activities. During construction, on-Site and off-Site exposures to contaminated dust from on-Site will be addressed through dust controls, and through the implementation of the Community Air Monitoring Plan and a Construction Health and Safety Plan. Site remedial construction activities will require dewatering to lower the natural level of groundwater for the excavation of a deep soil hot spot and the layout of foundations of the partial basement. As such, there will be no structures on site where soil vapor could accumulate.

Proposed Future Conditions – Once the remedial actions and redevelopment of the Site have been completed, there will be no potential onsite or off-site exposure pathways. Soils exceeding the residential SCOs will be removed to extent possible for the layout of the new building foundations. Any exposures to vapors from contaminated soil and groundwater will be prevented through the installation of a soil vapor extraction (SVE) system and the implementation of a groundwater treatment program. The SVE system and groundwater monitoring program will be subject to an Operation and Maintenance Plan in the FER. No human exposure to contaminated soil, contaminated groundwater or contaminated vapors from the Site is occurring will it occur in the future on-Site or off-site.

Receptor Populations

The immediate areas adjacent to the Site include mixed use residential/institutional uses and are anticipated to remain as such. The new building at the site will be utilized as residential and commercial facility. Potential receptor populations are as follows:

On-Site Receptors - The Site is currently vacant with open space that is partially covered with concrete slab in poor condition. The has been secured by a plywood fence along the northern, southern and western boundaries and wire fence around the former parking area along the southern and eastern boundary. Prior to the fire incident, the building was occupied by thirteen commercial tenant spaces. Currently, the only potential on-Site receptors are trespassers

and site representatives. During redevelopment, the on-Site potential receptors will include construction workers, site representatives, and visitors. Once the Site is redeveloped, the on-Site potential sensitive receptors will include adult and child building residents and visitors.

Off-Site Receptors - Potential offsite receptors within a 0.25-mile radius of the Site include: adult and child residents, commercial and construction workers, pedestrians, trespassers, and cyclists, based on the following:

1. Commercial Businesses (up to 0.25 mile) – existing and future
2. Residential Buildings (up to 0.25 mile) – existing and future
3. Building Construction/Renovation (up to 0.25 mile) – existing and future
4. Pedestrians, Trespassers, Cyclists (up to .25 mile) – existing and future
5. Childcare facilities and Schools (up to .25 mile) – existing and future
6. Community (up to .25 mile) – existing and future

Overall Human Health Exposure Assessment

Based upon this analysis, the potential for complete on-site exposure pathways to contaminated sub-surface soil beneath the entire Site appears to be present under current site conditions and will be absent under future conditions. On-site exposure pathways will be incomplete under future conditions by implementing remedial elements that will consist of a soil vapor extraction (SVE) system and a groundwater treatment program along with other redevelopment elements including a vapor barrier and a subgrade parking ventilation system that will prevent any soil vapor intrusion vapors impacting the indoor air quality inside the building. Potential use of groundwater is not considered an option because groundwater in this area of New York City is not used as a potable water source. There are no surface waters in close proximity to the Site that could be impacted or threatened.

Potential exposure of nearby residents/occupants to soil vapor emanating from the Site is negligible at the east-adjacent property consistent with the conclusion of an indoor air assessment study conducted in the west-adjacent sensitive receptor identified as Stepping Stone Day School. Potential exposure of nearby residents/occupants at the adjacent properties to the

east and south of the Site at Kew Gardens Owners and the Regency Gardens Company will also be addressed during Site remedial development by implementing an the on-site remedies.

Based on this QHHHA, potential exposures pathways are considered complete on-site and off-site under current conditions. Notice of that determination has been made via NYSDOH correspondence dated February 11, 2016, NYSDEC correspondence dated February 12, 2016 and also via a Fact Sheet dated September 2017. Copies of the notices and the Fact Sheet are included in Appendix 2.

2.6.2 Fish & Wildlife Remedial Impact Analysis

NYSDEC DER-10 requires an on-site and off-site Fish and Wildlife Resources Impact Analysis (FWRIA). However, based on the requirements stipulated in Section 3.10 -Appendix 3C of DER-10, there was no need to prepare an FWRIA for The Site. A completed form of DER-10 Appendix 3C is enclosed as Appendix 3.

2.7 REMEDIAL ACTION OBJECTIVES

Based on the results of the Remedial Investigation, the following Remedial Action Objectives (RAOs) have been identified for this Site.

2.7.1 Groundwater

RAOs for Public Health Protection

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

RAOs for Environmental Protection

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

2.7.2 Soil

RAOs for Public Health Protection

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

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater contamination.
- Prevent impacts to biota due to ingestion/direct contact with contaminated soil that would cause toxicity or bioaccumulation through the terrestrial food chain.

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 the Site and off-site.

3.0 DESCRIPTION OF REMEDIAL ACTION PLAN

3.1 EVALUATION OF REMEDIAL ALTERNATIVES

The goal of the remedy selection process is to select a remedy that is protective of human health and the environment taking into consideration the current, intended and reasonably anticipated future use of the property. The remedy selection process begins by establishing remedial action objectives (RAOs) for media in which chemical constituents were found in exceedance of applicable standards, criteria and guidance values (SCGs). A remedy is then developed based on the following ten criteria:

- Protection of human health and the environment;
- Compliance with standards, criteria, and guidelines (SCGs);
- Short-term effectiveness and impacts;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contaminated material;
- Implementability;
- Cost effectiveness;
- Community Acceptance; and
- Land use.

The following is a detailed description of the alternatives analysis and remedy selection to address impacted media at the Site. As required, a minimum of two remedial alternatives (including a Track 1 scenario) are evaluated, as follows:

Alternative 1 involves:

- Establishment of Unrestricted Use Track 1 SCOs for the Site.
- Removal of all soil/ fill exceeding Unrestricted Use (Track 1) Soil Cleanup Objective (SCOs) throughout the Site to the depth of bedrock.
- Remediation of contaminated soil vapors and contaminated groundwater are the remedial goals for these two contaminated media should be met within 5 years both on-site and off-site. ; and
- Performance of a post-excavation soil vapor intrusion evaluation in order to confirm the Track 1 Remedial Action. The Site will not have EC or SMP under this remedial alternative

Alternative 2 involves:

- Establishment of Track 4 SCOs by removal of soil contaminated with VOCs in excess of Protection of Groundwater SCOs to the water table across the Site and removal of soil contaminated with all other compounds (metals, SVOCs, pesticides and PCBs) in excess of restricted residential SCOs in the upper two feet across the Site. For development purposes, the site would be excavated to a depth of approximately 12 feet throughout the property and to 20 feet for the elevator pit beneath the southeastern portion.
- Placement of engineered composite cover system over the entire property consisting of the building slab and other paved or properly backfilled surfaces;
- Implementation of a groundwater remedy beneath the southeastern corner of the property to achieve the RAOs for groundwater and also to stop continued

migration of groundwater off-site and also to reduce the potential for soil vapor intrusion on-site and also off-site.

- Installation of a soil vapor extraction (SVE) system beneath the southeastern portion of the property to prevent soil vapor entering the new building or migrating off-site;
- Establishment of use restrictions including prohibitions on the use of groundwater from the site and prohibitions on sensitive site uses, such as farming or vegetable gardening, to eliminate future exposure pathways; and prohibition of a higher level of land use without NYSDEC approval;
- Establishment of a Site Management Plan to ensure long-term management of these engineering and institutional controls including the performance of periodic inspections and certification that the controls are performing as they were intended.

3.2 THRESHOLD CRITERIA

Protection of Public Health and the Environment

This criterion is an evaluation of the remedy's ability to protect public health and the environment, and an assessment of how risks posed through each existing or potential pathway of exposure are eliminated, reduced or controlled through removal, treatment, and implementation of Engineering Controls or Institutional Controls. Protection of public health and the environment must be achieved for all approved remedial actions.

Alternative 1 would result in removal of all soil/fill with contaminant concentration above Track 1 SCO. This alternative would be consistent with the RAOs and provide

overall protection of public health and the environment in consideration of current and potential future land use by:

- Eliminating the potential for direct contact with contaminated on-site soils, and
- Eliminating potential on-site sources for production of soil vapors.
- Reducing groundwater contamination and eliminating the migration of contaminated groundwater off-site

Alternative 2 would:

- Establish Track 4 SCOs and remove soil in excess of the PGWSCOs;
- Cover of entire property consisting of the building slabs and other paved surfaces to prevent exposure to residual contamination;
- Install an SVE system beneath the southeastern portion of the Site to eliminate potential exposures to soil vapor on-site and off-site;
- Implementation of groundwater remediation and monitoring program to reduce contaminants levels on groundwater and prevent any migration of dissolved contaminants off-site;
- Establish a Site Management Plan to ensure that all Engineering and Institutional Controls are inspected periodically and require certification that the remedy continues to perform as it was designed, thus ensuring that the protections achieved for public health and the environment remain in perpetuity;
- Place a deed restriction to memorialize these controls in order to decrease the risk of future exposures with contaminated media consistent with remedial action objectives. This would memorialize the remedial action and ensure that these controls will be appropriately managed by future owners of the Site.

During remedial and construction activity, workers and area residents may be exposed to impacted soil, ground water and vapors. Worker exposure to soil and vapors will be minimized through implementation of a site-specific Construction Health and Safety Plan (CHASP). Exposures to area residents from dust and/or vapors will be minimized through the use of engineering controls and through implementation of a Community Air Monitoring Plan (CAMP).

For both Alternatives, potential exposure to contaminated soils or groundwater during construction would be minimized by implementing a Construction Health and Safety Plan, an approved Soil and Materials Management Plan and Community Air Monitoring Plan (CAMP) would minimize potential exposure to contaminated soils during construction. Potential contact with contaminated groundwater would be prevented as City laws and regulations prohibit its use, and it is not anticipated to be encountered during construction. Potential future migration of on-site soil vapors into the new building would be prevented by installing the SVE system. The SVE system would also prevent migration of on-site vapors off-site.

3.3 BALANCING CRITERIA

Compliance with Standards, Criteria and Guidance (SCGs)

This evaluation criterion assesses the ability of the alternative to achieve applicable standards, criteria and guidance.

Alternative 1 Alternative 1 would achieve compliance with the remedial goals, SCGs and RAOs for soil through source removal to Track 1 unrestricted cleanup levels. Given the depths of contaminated soil at the Site that represents a source to groundwater contamination, excavation to depths of at least 32 feet would be required over the southeastern portion of the site. Groundwater contamination will be remediated via in-situ chemical injections and it is unlikely that this groundwater remedial action will achieve its goal prior to the completion of remedial construction and thus continued monitoring will be required. SCGs for groundwater may not be achieved; however, bulk reduction in groundwater contamination will be realized under this

remedial action and would be consistent with the RAOs established for the Site. Volatilization of chlorinated hydrocarbons to soil vapor on-site and off-site would be managed by installing an SVE system. Compliance with SCGs for soil vapor is expected following completion of the remedial action but like groundwater remediation may take time to achieve. However, potential for impacts from residual soil vapor offsite will continue if such soil vapor impacts persist.

Alternative 2 would achieve compliance with the remedial goals, SCGs and RAOs for soil through removal of soil exceeding site specific SCOs and removal of impacted soil/fill for purposes of construction, and placement of a permanent engineered composite cover over the entire Site. Groundwater impacts would be managed via chemical oxidants and bioremedial agents. SCGs for groundwater may not be achieved; however, bulk reduction in groundwater contamination will be realized during this remedy and would be consistent with the RAOs established for the Site. Soil vapor sources are largely related soil and groundwater contamination and would be managed via an SVE system that would prevent vapor migration on-site and also off-site. A Site Management Plan would ensure that these controls remained protective for the long term.

Health and safety measures contained in the HASP and CAMP that comply with the applicable SCGs would be implemented during Site redevelopment under this RAWP. For both Alternatives, focused attention on means and methods employed during the remedial action would ensure that handling and management of contaminated material would follow applicable SCGs. These measures will protect on-site workers and the surrounding community from exposure to any Site-related concerns.

Short-term effectiveness and impacts

This evaluation criterion assesses the effects of the alternatives during the construction and implementation phase until remedial action objectives (RAOs) are met. Under this criterion, alternatives are evaluated with respect to their effects on public health and the environment during implementation of the remedial action, including protection of the community, environmental impacts, time until remedial response objectives are achieved, and protection of workers during remedial actions.

Alternative 1 would create the potential for short-term impacts through the removal of large amounts of contaminated soils to depths in excess of 32 feet in the southeastern corner of the Site. Implementation of this RAWP including provision for health and safety protection and community air monitoring would prevent unacceptable exposure during remediation and construction activities. Short-term exposure to on-site workers during excavation and loading activities will be addressed with a CHASP and mitigated through the use of personal protective equipment, monitoring and engineering controls. Potential short-term exposure to the surrounding community will also be addressed through the implementation of a CAMP which will require air monitoring activities during all excavation and soil disturbance activities.

Alternative 2 would result in fewer short-term impacts associated with excavation, handling, load out of materials, and truck traffic than a Track 1 remediation. However, removal of soils that exceed site specific SCOs will still result in the potential for short-term impacts. Similar to Alternative 1, implementation of this RAWP including provision for health and safety protection and community air monitoring would prevent unacceptable exposure during remediation and construction activities.

Both alternatives would employ appropriate measures to prevent short-term impacts, including a Construction Health and Safety Plan, a CAMP and a Soil/Materials Management Plan (SMMP), during all on-Site soil disturbance activities and would minimize the release of contaminants into the environment. Both alternatives provide short-term effectiveness in protecting the surrounding community by decreasing the risk of contact with on-Site contaminants. Construction workers operating under appropriate management procedures and a Health and Safety Plan (CHASP) will be protected from on-Site contaminants (personal protective equipment would be worn consistent with the documented risks within the respective work zones).

Long-term effectiveness and permanence

This evaluation criterion addresses the results of a remedial action in terms of its permanence and quantity/nature of waste or residual contamination remaining at the Site after response objectives have been met, such as permanence of the remedial alternative, magnitude of

remaining contamination, adequacy of controls including the adequacy and suitability of ECs/ICs that may be used to manage contaminant residuals that remain at the Site and assessment of containment systems and ICs that are designed to eliminate exposures to contaminants, and long-term reliability of Engineering Controls.

Alternative 1 would achieve long-term effectiveness and permanence by permanently removing and/or remediating all soils affected by Site contaminant. Groundwater impacts would be managed in-situ via remedial injections. Similarly, soil vapor impacts would be managed in-situ via a an SVE system. Groundwater and soil vapor impacts would be expected to dissipate after the removal of onsite sources in soil.

Alternative 2 would achieve long-term effectiveness and permanence by removing all soils exhibiting contaminants above site specific SCOs, and permanently covering all remaining soils with an engineered composite cover. Groundwater impacts would be managed in-situ via remedial injections. Similarly, soil vapor impacts would be managed in-situ via a an SVE system. Residual soil vapor caused by remaining soil contamination or groundwater contamination will be addressed through the installation of an SVE system and an engineered cover system.

Reduction of toxicity, mobility, or volume of contaminated material

This evaluation criterion assesses the remedial alternative's use of remedial technologies that permanently and significantly reduce toxicity, mobility, or volume of contaminants as their principal element. The following is the hierarchy of source removal and control measures that are to be used to remediate a Site, ranked from most preferable to least preferable: removal and/or treatment, containment, elimination of exposure and treatment of source at the point of exposure. It is preferred to use treatment or removal to eliminate contaminants at a Site, reduce the total mass of toxic contaminants, cause irreversible reduction in contaminants mobility, or reduce of total volume of contaminated media.

Alternative 1 would achieve the greatest measure of long-term effectiveness and permanence related to on-Site contamination by permanently removing all impacted soil/fill above Track 1 Unrestricted Use SCOs. Removal of on-Site contaminant sources will prevent further groundwater contamination. However, a Track 1 Remedial Action would not be achieved because an SVE system as Engineering Control and groundwater monitoring program would be required, pending completion of the removal action and additional post-remediation on-site and off-site soil vapor evaluation.

Alternative 2 would provide long-term effectiveness by permanently removing most on-Site contamination, treatment of residual contamination in soil, groundwater and soil vapor and attaining Track 4 remedial objective; maintaining use restrictions, establishing an SMP to ensure long-term management of Institutional Controls (ICs) as well as Engineering Controls (ECs). The SMP would ensure long-term effectiveness of all ECs and ICs by requiring periodic inspection and certification that these controls and restrictions continue to be in place and are functioning as they were intended assuring that protections designed into the remedy will provide continued high level of protection in perpetuity. Alternative 1 would eliminate a greater total mass of contaminants from soil on Site.

Both alternatives would result in removal of soil contamination exceeding the SCOs providing the highest level, most effective and permanent remedy over the long-term with respect to a remedy for contaminated soil, which will eliminate or minimize any migration to groundwater. Potential sources of soil and groundwater contamination as well as soil vapor will be minimized as part of the remedy.

Implementability

This evaluation criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation, including technical feasibility of construction and operation, reliability of the selected technology, ease of undertaking remedial action, monitoring considerations,

administrative feasibility (e.g. obtaining permits for remedial activities), and availability of services and materials.

Alternative 1 would be difficult to implement because much contamination is present below the water table in the southeastern portion of the Site and its removal would require extensive dewatering, sheeting and shoring. However, standard excavation technology would be utilized. Removal of all contamination above Track 1 SCO's would ultimately achieve GQS and eliminate the source of contamination to groundwater and further emissions to soil vapor.

Alternative 2 is feasible and implementable. It uses standard materials and services and well established technology. The contaminated soil can be readily removed using standard excavation technology to the required depth of building foundations. Other areas exceeding site specific SCO's would be readily removed when encountered. The reliability of the remedy is also high. There are no special difficulties associated with any of the activities proposed, which utilize standard industry methods. Covering of soils with a composite cover including a foundation slab uses standard technology common in the industry and is a reliable method which has a long and proven track record in preventing direct contact with affected soils. The implementation of an SVE system is a common and highly effective method of preventing vapor intrusion. The proposed groundwater treatment and monitoring program is also implemented using standard technology and common materials.

Cost effectiveness

This evaluation criterion addresses the cost of alternatives, including capital costs (such as construction costs, equipment costs, and disposal costs, engineering expenses) and site management costs (costs incurred after remedial construction is complete) necessary to ensure the continued effectiveness of a remedial action.

Costs associated with Alternative 1 could potentially be higher than Alternative 2 if soil with analytes above Unrestricted Use SCO's will be removed during site development to the depth of groundwater. However, costs associated with Alternative 2 would be considerably lower as soil

exceeding SCOs can only be removed to a designated depth during the remedial action for the layout of the new building foundations. Long-term costs for Alternative 2 are likely higher than Alternative 1 based on implementation of a Site Management Plan.

Community Acceptance

This evaluation criterion addresses community opinion and support for the remedial action. Observations here will be supplemented by public comment received on the RAWP.

Based on the overall goals of the remedial program and the intended Site use, it is anticipated that Alternatives 1 and 2 for the Site would be acceptable to the community. This RAWP will be subject to public review and will provide the opportunity for detailed public input on the remedial alternatives and the selected remedial action. Observations here will be supplemented by public comment received on the RAWP.

Land use

This evaluation criterion addresses the proposed use of the property. This evaluation has considered reasonably anticipated future uses of the Site and takes into account: current use and historical and/or recent development patterns; applicable zoning laws and maps; NYS Department of State's Brownfield Opportunity Areas (BOA) pursuant to section 970-r of the general municipal law; applicable land use plans; proximity to real property currently used for residential use, and to commercial, industrial, agricultural, and/or recreational areas; environmental justice impacts, Federal or State land use designations; population growth patterns and projections; accessibility to existing infrastructure; proximity of the site to important cultural resources and natural resources, potential vulnerability of groundwater to contamination that might emanate from the site, proximity to flood plains, geography and geology; and current Institutional Controls applicable to the site.

The proposed redevelopment of the Site is compatible with its current R3-2 residential district with C1-2 commercial overlay designation and is consistent with recent development patterns. Following remediation, the Site will meet the Track 4 remedial objective, which is appropriate for its planned residential and commercial use. Improvements in the current environmental condition of the property achieved by both alternatives are also consistent with the BCP goals for cleanup of contaminated land and bringing such properties into productive reuse. Both alternatives are equally protective of natural resources and cultural resources.

Applicable Regulations

- 6 NYCRR Part 375-6 Soil Cleanup Objectives

Based upon 6 NYCRR Part 375-6 Soil Cleanup Objectives for this project will be the Unrestricted Use Soil Cleanup Objective (6 NYCRR Part 375-6.8;

- New York State Groundwater Quality Standards – 6 NYCRR Part 703;
- NYSDEC Ambient Water Quality Standards and Guidance Values – TOGS 1.1.1;
- NYSDEC CP-51 – Soil Cleanup Guidance (2010).

This guidance will be followed during the remediation of the Site. This guidance will be further discussed in Section 5.2 of this report.

- Underground Injection Control Program – NYSDEC 40 CFR Part 144

This guidance will be followed during the performance of ISCO injections to remediate groundwater.

- NYSDEC Draft Brownfield Cleanup Program Guide – May 2004;
- Environmental Remediation Program (December 2006) – 6 NYCRR Part 375

This guidance will be followed during the remediation of the Site and will be further discussed in Section 4.1.6 of this report.

- NYS Waste Transporter Permits – 6 NYCRR Part 364;

These permits will be held by haulers of the petroleum-contaminated soil/fill material. These permits will be provided in the Final Engineering Report.

- NYS Solid Waste Management Requirements – 6 NYCRR Part 360 and Part 364;
- Hazardous Waste Management System – 6 NYCRR Part 370;
- Hazardous Waste Operations and Emergency Response Standard – Code of Federal Regulations (CFR) Title 29 Part 1910.120;

Where applicable these regulations will be followed by the soil disposal facility.

3.3 SELECTION OF THE PREFERRED REMEDY

3.3.1 Zoning;

The new development at the Site will consist of a 5-story residential and commercial building. This development follows the NYC local zoning designation R3-2 district with C1-2 commercial provided in the NYC planning commission.

3.3.2 Applicable comprehensive community master plans or land use plans;

As discussed in the BCA, The Site remedial construction is an as-of right development that is consistent with local city resolutions and local community plans.

3.3.3 Surrounding property uses;

The remedial method selected for the Site will not impact upon surrounding property uses.

3.3.4 Citizen participation;

The citizens are likely to welcome the proposed remedial action because it will allow for the Site to be remediated to Track 4 cleanup objective, under which, engineering controls (ECs) consisting of an SVE system and a groundwater remediation program will be implemented and these ECs will eliminate the exposure of contaminated soil vapors on-site and also off-site as well as the migration of contaminated groundwater off-site. Any new remedial development at the Site will help reinstate the commercial use that was a landmark for the community prior to the fire with added residential use, which would reinforce the neighborhood character of a residential district.

3.3.5 Environmental justice concerns;

No Environmental justice concerns are currently foreseeable since the goal of the remediation is to mitigate the soil vapor intrusion impact associated with chlorinated solvents to render the Site protective to public health and environmental.

3.3.6 Land use designations;

As previously discussed, utilization of the Site for residential and commercial is consistent with the New York City zoning regulations and as such it will meet the goals of the New York City Department of Planning.

3.3.7 Population growth patterns;

As previously discussed, utilization of the Site for residential and commercial is consistent with the New York City zoning regulations and as such it will meet the goals of the New York City Department of Planning.

3.3.8 Accessibility to existing infrastructure;

The Site remedial construction will ultimately minimize the soil and groundwater impact beneath the site and would also prevent impacts associated with soil vapor intrusion of chlorinated solvents.

3.3.9 Proximity to cultural resources;

Site remediation will protect future inhabitants from exposure to chlorinated compounds present in on-site soil and groundwater and therefore, no impact to cultural resources present near the Site will occur.

3.3.10 Proximity to natural resources;

Site remediation will protect future inhabitants from exposure to chlorinated compounds present in on-site soil and groundwater and therefore, no impact to natural resources present near the Site will occur.

3.3.11 Off-Site groundwater impacts;

The groundwater plume of chlorinated hydrocarbons was delineated beneath the southeastern portion of the Site. Based upon groundwater mapping programs, it appears that this plume is in fact generated in the southeast-upgradient portion of the Site and extends radially off-site toward the southeast and southwest of the Site.

3.3.12 Proximity to floodplains;

The groundwater present beneath the Site is not impacting nor does it have the potential to impact upon any floodplains.

3.3.13 Geography and geology of the Site; and

As part of Site remedial construction, the entire Site will be excavated to 12 feet bgs. An elevator pit located beneath the southeastern portion will be excavated to 20 feet bgs. This new

development will be in compliance with NYC building codes, and therefore Site remedial construction is not expected to undermine the geography and geology of the Site.

3.3.14 Current Institutional Controls.

There are currently no institutional controls on the Site. However, Interim Remedial Measures (IRM) were implemented in the former tenants spaces prior to the fire incident at the Site. These measures were implemented at the Site in accordance with NYSDEC-approved IRM-Remedial Investigation Addendum Work Plan (IRM-RIWP) dated March 2016. The purpose of these measures was to provide immediate mitigation remedy to reduce exposure of site tenants and visitors to chlorinated contaminants of concern identified in indoor air at the Site. As part of the IRM, an individual mitigation system consisting of aeration and ventilation systems was installed in each of the former eleven tenant spaces. An active sub-slab depressurization system (SSDS) was also installed beneath the tenant space located in the southernmost portion of the building in order to complement the aeration and ventilation system. The installation of the IRM at the Site was documented in an IRM Construction Completion Report (CCR) dated June 2016. These mitigation systems operated from May 2, 2016 until December 30, 2016.

3.4 SUMMARY OF SELECTED REMEDIAL ACTIONS

The elements of the selected remedy are as follows:

1. Remedial Design

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows;

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;

- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

2. Excavation

The existing on-site building foundations will be demolished and materials which can't be beneficially reused on site will be taken off-site for proper disposal in order to implement the remedy.

Excavation and off-site disposal of contaminant source areas, including:

- grossly contaminated soil, as defined in 6 NYCRR Part 375-1.2(u); and
- soils which exceed the Protection of Groundwater Soil Cleanup Objectives (PGWSCOs), as defined by 6 NYCRR Part 375-6.8 for those contaminants found in site groundwater above standards. These source areas are defined as the soils beneath the former drycleaners establishment and the soils in the southeast corner of the site.

Excavation and off-site disposal of all on-site non-VOC contaminated soils which exceed Restricted Residential SCOs, as defined by 6 NYCRR Part 375-6.8 in the upper 12 feet in the majority of the site. The excavation will be extended to a depth of 20 feet-below ground surface (bgs) in the southeast corner of the site to achieve the PGWSCOs for VOCs. Following the completion of the excavation, post-excavation end-point samples and side wall samples will be collected and analyzed to ensure removal of all source areas and document site conditions.

Approximately 18,213 tons (13,010 cubic yards) of contaminated soil will be removed from the site.

If encountered, excavation and removal of any underground storage tanks (USTs), underground piping or other structures associated with a source of contamination will be disposed of off-site

3. Backfill

Clean fill meeting the requirements of 6 NYCRR Part 375-6.7(d) PGWSCO's will be brought in to complete the backfilling of the excavation and establish the designed grades at the site.

4. Vapor Mitigation

Since the exposure pathways from on-site soil vapors is deemed to be complete on-site and off-site under current site conditions, a soil vapor extraction system or a similar engineered system will be required to mitigate vapors intrusion into the new building and also surrounding buildings to the south and east from elevated levels of VOCs in residual soil and in groundwater beneath the Site.

5. Soil Vapor Extraction

Soil vapor extraction (SVE) will be implemented to remove volatile organic compounds (VOCs) from the subsurface. VOCs will be physically removed from the soil by applying a vacuum to wells that have been installed into the vadose zone (the area below the ground but above the water table). The vacuum draws air through the soil matrix which carries the VOCs from the soil to the SVE well. The air extracted from the SVE wells is then treated as necessary prior to being discharged to the atmosphere.

The SVE system will consist of three soil vapor extraction (SVE) wells installed within the southeastern corner of the Site, where the source of TCE and PCE contamination was identified. The three SVE wells will be clustered in a specific configuration so that their

radius of influence will intersect to cover the main area of concern. The SVE wells will be installed utilizing a track rig unit equipped with 6-inch diameter hollow-stem augers. Each well will be constructed using 4-inch diameter schedule 40 PVC pipes and will be installed at three different depths; i.e. 25 feet bgs, 34 feet bgs and 30 feet bgs. Each SVE well will have a 5-foot screen with a screen slot of 0.030 inch and will be placed at the bottom of the well. The SVE wells will be connected to EN 707 5-HP Rotron blower. Six vacuum pressure monitoring ports clustered within the area of influence of the SVE wells will be installed beneath the slab of proposed building slab or 5 feet if no building slab exists. The purpose of the vacuum pressure monitoring ports is to verify the zone of influence exercised by the suction blower at the three vapor extraction wells and the vacuum communication at the pressure test ports. The installation and start-up of the SVE system will be subject to a Site Management Plan that will define the protocol and duration of system parameters monitoring.

The air containing VOCs extracted from the SVE wells will be treated by passing the air stream through activated carbon, which removes the VOCs from the air prior to it being discharged to the atmosphere. The operation of the components of the remedy will continue until the remedial objectives have been achieved, or until the Department determines that continued operation is technically impracticable or not feasible.

6. Groundwater Remedy

An in-situ chemical oxidation and a bioremediation mechanism will be implemented to treat to treat volatile organic compounds (VOCs) in groundwater and prevent further off-site migration of contaminated groundwater. A chemical oxidant identified as PersulfOx will be injected into the subsurface to destroy the contaminants in an approximately 800 square foot area located in the southeastern portion of the Site. A bioremedial agent identified as 3_D Microemulsion Factory Elumlsified (3DME) mixed with additives identified as Bio-Dechlor Innoculum Plus (BDI Plus) and CRS Chemical Reducing Solution (CRS) will be applied 3 months the application of PersulfOx. 3DME and add-ons will be injected into the subsurface to treat residual contaminants in an area

approximately 4,900 square foot in the southeastern portion of the Site. Both injections will target a treatment zone approximately 16-foot thick below the soil and groundwater interface

7. Cover System

A site cover will be required to allow for restricted residential use of the site in areas where the upper two feet of exposed surface soil will exceed the applicable soil cleanup objectives (SCOs). Where a soil cover is to be used it will be a minimum of two feet of soil placed over a demarcation layer, with the upper six inches of soil of sufficient quality to maintain a vegetative layer. Soil cover material, including any fill material brought to the site, will meet the SCOs for cover material for the use of the site as set forth in 6 NYCRR Part 375-6.7(d). Substitution of other materials and components may be allowed where such components already exist or are a component of the tangible property to be placed as part of site redevelopment. Such components may include, but are not necessarily limited to: pavement, concrete, paved surface parking areas, sidewalks, building foundations and building slabs.

8. Institutional Controls

Imposition of an institutional control in the form of an environmental easement for the controlled property that:

- Requires the remedial party or site owner to complete and submit to the Department a periodic certification of institutional controls and engineering controls in accordance with Part 375-1.8 (h)(3);
- Allows the use and development of the controlled property for restricted residential, commercial and industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- Restricts the use of groundwater as a source of potable or process water, without

necessary water quality treatment as determined by the NYSDOH or NYCDOH;
and

- Requires compliance with the Department approved Site Management Plan.

9. Site Management Plan

A Site Management Plan is required, which includes the following:

- a. an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

Institutional Controls: The Environmental Easement discussed in paragraph 8 above. Engineering Controls: The SVE system discussed in Paragraph 5, the Groundwater remedial system discussed in Paragraph 6 and the cover system discussed in Paragraph 7 above.

This plan includes, but may not be limited to:

- an Excavation Plan which details the provisions for management of future excavations in areas of remaining contamination;
- descriptions of the provisions of the environmental easement including any land use, and groundwater restrictions;
- a provision for evaluation of the potential for soil vapor intrusion for any occupied buildings on the site and off-site to the east and southeast, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;
- a provision that should a building foundation or building slab be removed in the future, a cover system consistent with that described in Paragraph 7 above will be placed in any areas where the upper two feet of exposed

- surface soil exceed the applicable soil cleanup objectives (SCOs)
 - provisions for the management and inspection of the identified engineering controls;
 - maintaining site access controls and Department notification; and
 - the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.
- b. A Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to
- monitoring of soil, soil vapor and groundwater to assess the performance and effectiveness of the remedy;
 - a schedule of monitoring and frequency of submittals to the Department;
 - monitoring for vapor intrusion for any buildings on the site and off-site, as may be required by the Institutional and Engineering Control Plan discussed above;
 - Assess the performance and effectiveness of the SVE system by monitoring for vapor intrusion at adjacent buildings located off-site.
- c. an Operation and Maintenance (O&M) Plan to ensure continued operation, maintenance, optimization, monitoring, inspection, and reporting of any mechanical or physical components of the remedy. The plan includes, but is not limited to:
- procedures for operating and maintaining the remedy;
 - compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;

- maintaining site access controls and Department notification; and
- providing the Department access to the site and O&M records.

4.0 REMEDIAL ACTION PROGRAM

4.1 GOVERNING DOCUMENTS

4.1.1 Site Specific Health & Safety Plan (HASP)

All remedial work performed under this plan will be in full compliance with governmental requirements, including Site and worker safety requirements mandated by Federal OSHA.

The Participant and associated parties preparing the remedial documents submitted to the State and those performing the construction work, are completely responsible for the preparation of an appropriate Health and Safety Plan and for the appropriate performance of work according to that plan and applicable laws.

The Health and Safety Plan (HASP) and requirements defined in this Remedial Action Work Plan pertain to all remedial and invasive work performed at the Site until the issuance of a Certificate of Completion.

The Site Safety Coordinator will be Paul I. Matli. A resume will be provided to NYSDEC prior to the start of remedial construction.

Confined space entry will comply with all OSHA requirements to address the potential risk posed by combustible and toxic gasses.

4.1.2 Quality Assurance Project Plan (QAPP)

The QAPP is provided under Appendix 4.

4.1.3 Construction Quality Assurance Plan (CQAP)

The Construction Quality Assurance Plan (CQAP) will be provided by the Construction Manager. This document will be submitted prior to the start of remedial construction.

4.1.4 Soil/Materials Management Plan (SoMP)

This document is included as Section 5.2 and includes detailed plans for managing all soils/materials that are disturbed at the Site, including excavation, handling, storage, transport and disposal. It also includes all of the controls that will be applied to these efforts to assure effective, nuisance-free performance in compliance with all applicable Federal, State and local laws and regulations.

4.1.5 Storm-Water Pollution Prevention Plan (SWPPP)

The erosion and sediment controls will be in conformance with requirements presented in the New York State Guidelines for Urban Erosion and Sediment Control. A Storm Water Pollution Prevention Plan (SWPPP) is provided under Appendix 5.

4.1.6 Community Air Monitoring Plan (CAMP)

A Community Air Monitoring Plan (CAMP) is provided under Appendix 6.

4.1.7 Contractors Site Operations Plan (SOP);

The Remedial Engineer has reviewed all plans and submittals for this remedial project (including those listed above and contractor and sub-contractor document submittals) and confirms that they are in compliance with this RAWP. The Remedial Engineer is responsible to ensure that all later document submittals for this remedial project, including contractor and sub-contractor document submittals, are in compliance with this RAWP. All remedial documents will be submitted to NYSDEC and NYSDOH in a timely manner and prior to the start of work.

A detailed remedial construction design document will be submitted to NYSDEC for approval upon its completion.

4.1.8 Community Participation Plan

A Community Participation Plan (CPP) has been developed for this project. The public will be notified through fact sheets of the various stages of the project. These stages will include the

submittal of the RAWP, the commencement of the remedial actions at the Site and any other stage indicated by the NYSDEC. The Fact Sheets will be mailed to the NYSDEC approved contact list.

A certification of mailing will be sent by the Participant to the NYSDEC project manager following the distribution of all Fact Sheets and notices that includes: (1) certification that the Fact Sheets were mailed, (2) the date they were mailed; (3) a copy of the Fact Sheet, (4) a list of recipients (contact list); and (5) a statement that the repository was inspected on (specific date) and that it contained all applicable project documents.

No changes will be made to approved Fact Sheets authorized for release by NYSDEC without written consent of the NYSDEC. No other information, such as brochures and flyers, will be included with the Fact Sheet mailing.

The approved Citizen Participation Plan for this project is attached in Appendix 7.

Document repositories have been established at the following locations and contain all applicable project documents:

Queens Library – Kew Garden Hill Branch

72-33 Vleigh Place, Flushing, NY

Attn: Susan Wetjen

Phone: (718) 278-2220

Library Hours:

Monday; 12:00 AM to 8:00 PM

Tuesday: 1:00 PM to 6:00 PM

Wednesday: 10:00 PM to 6:00 PM

Thursday: 12:00 PM to 8:00 PM



Friday: 10:00 PM to 6:00 PM

Saturday and Sunday Closed

Queens Community Board 8,
197-15 Hillside Avenue, Hollis, NY 11423

Chairperson : Mr. Alvin Warshaviak

(718) 264-7895

4.2 GENERAL REMEDIAL CONSTRUCTION INFORMATION

4.2.1 Project Organization

Individual Name	Title
Tarek Z. Khouri	Remedial Engineer
Mark Robbins	Project Geologist/Quality Assurance Officer
Paul Matli	Project Coordinator/Health and Safety Officer
Dorina Aliu	Project Coordinator/Health and Safety Officer (Alternate)

Resumes of key personnel involved in the Remedial Action are included in the QAPP in Appendix 4.

4.2.2 Remedial Engineer

The Remedial Engineer for this project will be Tarek Z. Khouri. The Remedial Engineer is a registered professional engineer licensed by the State of New York. The Remedial Engineer will have primary direct responsibility for implementation of the remedial program for the 77-39/63 Vleigh Place Site (NYSDEC BCA Index No. C241168-03-15 Site No. C241168). The Remedial Engineer will certify in the Final Engineering Report that the remedial activities were observed by qualified environmental professionals under his supervision and that the remediation

requirements set forth in the Remedial Action Work Plan and any other relevant provisions of ECL 27-1419 have been achieved in full conformance with that Plan. Other Remedial Engineer certification requirements are listed later in this RAWP.

The Remedial Engineer will coordinate the work of other contractors and subcontractors involved in all aspects of remedial construction, including soil excavation, stockpiling, characterization, removal and disposal, air monitoring, emergency spill response services, import of back fill material, and management of waste transport and disposal. The Remedial Engineer will be responsible for all appropriate communication with NYSDEC and NYSDOH.

The Remedial Engineer will review all pre-remedial plans submitted by contractors for compliance with this Remedial Action Work Plan and will certify compliance in the Final Engineering Report.

The Remedial Engineer will provide the certifications listed in Section 10.1 in the Final Engineering Report.

4.2.3 Remedial Action Construction Schedule

Currently, a 12-month remediation construction schedule is anticipated. Refer to Section 10.

4.2.4 Work Hours

The hours for operation of remedial construction will conform to the New York City Department of Buildings construction code requirements or according to specific variances issued by that agency. DEC will be notified by the Participant of any variances issued by the Department of Buildings. NYSDEC reserves the right to deny alternate remedial construction hours.

4.2.5 Site Security

The Site will be secured at night in accordance with New York City Department of Building Construction Codes.

4.2.6 Traffic Control

Proper traffic control will be performed in accordance with New York City Department of Buildings Construction Codes.

4.2.7 Health and Safety Plan

The Construction Health and Safety Plan is provided under Appendix 8.

4.2.8 Worker Training and Monitoring

Remedial work performed under this RAWP will be in full compliance with applicable health and safety laws and regulations, including Site and OSHA worker safety requirements and HAZWOPER requirements. All workers will be trained in accordance with New York City Department of Building Construction Codes and in accordance with the Construction Health and Safety Plan provided under Appendix 8.

4.2.9 Agency Approvals

The Participant has addressed all SEQRA requirements for this Site. All permits or government approvals required for remedial construction have been, or will be, obtained prior to the start of remedial construction.

The planned end use for the Site is in conformance with the current zoning for the property as determined by New York City Department of Planning. A Certificate of Completion will not be issued for the project unless conformance with zoning designation is demonstrated.

A complete list of all local, regional and national governmental permits, certificates or other approvals or authorizations required to perform the remedial and development work is attached in Appendix 9. This list includes a citation of the law, statute or code to be complied with, the originating agency, and a contact name and phone number in that agency. This list will be updated in the Final Engineering Report.

All planned remedial or construction work in regulated wetlands and adjacent areas will be specifically approved by the NYSDEC Division of Natural Resources to ensure that it meets the requirements for substantive compliance with those regulations prior to the start of construction. Nothing in the approved Remedial Action Work Plan or its approval by NYSDEC should be construed as an approval for this purpose.

4.2.10 Pre-Construction Meeting with NYSDEC

This meeting must take place prior to the start of invasive construction activities. The meeting will be scheduled with the NYSDEC at least 5 days prior to its occurrence

4.2.11 Emergency Contact Information

An emergency contact sheet with names and phone numbers is included in the HASP provided under Appendix 8. That document will define the specific project contacts for use by NYSDEC and NYSDOH in the case of a day or night emergency.

4.2.12 Remedial Action Costs

An itemized and detailed summary of estimated costs for all remedial activity is attached as Appendix 10. This will be revised based on actual costs and submitted as an Appendix to the Final Engineering Report.

4.3 SITE PREPARATION

4.3.1 Mobilization

All equipment will be brought to the Site. The equipment will be maintained on-site and will be checked out as operational prior to the mobilization.

4.3.2 Erosion and Sedimentation Controls

The entire Site will be excavated for development during the remediation process. Any necessary Erosion and Sediment Controls are detailed in the Storm-Water Pollution Prevention Plan (SWPPP) provided in Appendix 5.

4.3.3 Stabilized Construction Entrance(s)

As indicated in the SWPPP a temporary gravel construction entrance will be installed on the west side of the property towards Vleigh. This will be done to reduce the amount of sediment transported onto roads by construction vehicles and run-off. The entrance will be graded so that runoff water will be directed to an inlet protection structure and away from the steep fill area.

4.3.4 Utility Marker and Easements Layout

The Participant and its contractors are solely responsible for the identification of utilities that might be affected by work under the RAWP and implementation of all required, appropriate, or necessary health and safety measures during performance of work under this RAWP. The Participant and its contractors are solely responsible for safe execution of all invasive and other work performed under this RAWP. The Participant and its contractors must obtain any local, State or Federal permits or approvals pertinent to such work that may be required to perform work under this RAWP. Approval of this RAWP by NYSDEC does not constitute satisfaction of these requirements.

The presence of utilities and easements on the Site has been investigated by the Remedial Engineer. It has been determined that no risk or impediment to the planned work under this Remedial Action Work Plan is posed by utilities or easements on the Site.

4.3.5 Sheet piling and Shoring

Appropriate management of structural stability of on-Site or off-Site structures during on-Site activities include excavation is the sole responsibility of the Participant and its contractors. The Participant and its contractors are solely responsible for safe execution of all invasive and

other work performed under this Plan. The Participant and its contractors must obtain any local, State or Federal permits or approvals that may be required to perform work under this Plan. Further, the Participant and its contractors are solely responsible for the implementation of all required, appropriate, or necessary health and safety measures during performance of work under the approved Plan.

4.3.6 Equipment and Material Staging

All equipment and material will be staged onsite as per the New York City Department of Building Requirements.

4.3.7 Decontamination Area

A Decontamination Area will be staged at the Site.

4.3.8 Site Fencing

Currently a security fence is installed around the perimeter of the property in accordance with New York City Department of Building requirements.

4.3.9 Demobilization

The Demobilization plan will be submitted and will include :

- Restoration of areas that may have been disturbed to accommodate support areas (e.g., staging areas, decontamination areas, storage areas, temporary water management area[s], and access area);
- Removal of temporary access areas (whether on-Site or off-Site) and restoration of disturbed access areas to pre-remediation conditions;
- Removal of sediment and erosion control measures and disposal of materials in accordance with acceptable rules and regulations;

- Equipment decontamination;
- General refuse disposal.

4.4 REPORTING

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

4.4.1 Daily Reports

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

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

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

Daily Reports will include a description of daily activities keyed to an alpha-numeric map for the Site that identifies work areas. These reports will include a summary of air sampling results, odor and dust problems and corrective actions, and all complaints received from the public.

A Site map that shows a predefined alpha-numeric grid for use in identifying locations described in reports will be submitted to NYSDEC prior to the start of invasive remedial activities.

The NYSDEC assigned project number will appear on all reports.

4.4.2 Monthly Reports

Monthly reports will be submitted to NYSDEC and NYSDOH Project Managers within one week following the end of the month of the reporting period and will include:

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

4.4.3 Other Reporting

Photographs will be taken of all remedial activities and submitted to NYSDEC in digital (JPEG) format. Photos will illustrate all remedial program elements and will be of acceptable

quality. Representative photos of the Site prior to any Remedial Actions will be provided. Representative photos will be provided of each contaminant source, source area and Site structures before, during and after remediation. Photos will be submitted to NYSDEC on CD or other acceptable electronic media and will be sent to NYSDEC's Project Manager (2 copies) and to NYSDOH's Project Manager (1 copy). CD's will have a label and a general file inventory structure that separates photos into directories and sub-directories according to logical Remedial Action components. A photo log keyed to photo file ID numbers will be prepared to provide explanation for all representative photos. For larger and longer projects, photos should be submitted monthly or another agreed upon time interval.

Job-site record keeping for all remedial work will be appropriately documented. These records will be maintained on-Site always during the project and be available for inspection by NYSDEC and NYSDOH staff.

4.4.4 Complaint Management Plan

If public complaints are made, the public will be directed to the project manager whom will be on-site during construction. The project manager will be able to explain the results of the measurements and the actions taken if the measurements are elevated.

4.4.5 Deviations from the Remedial Action Work Plan

If conditions arise that require deviation from this Work Plan, the Remedial Engineer will contact NYSDEC immediately to notify for conditions requiring immediate action (i.e. conditions judged to be danger to the surrounding community) and what changes are required and request approval. All changes will be thoroughly documented in the Final Engineering Report and include a discussion of its effect on the remedy.

5.0 REMEDIAL ACTION: MATERIAL REMOVAL FROM SITE

As part of the proposed remedial construction at the Site, demolition of the existing building will be necessary to accommodate for the excavation and off-site disposal of contaminant source areas. The footings for the new building will be installed at approximately 12 bgs, and therefore, the top 12 feet across the entire Site will be excavated and removed. An elevator pit will be excavated to 20 feet beneath the southeastern portion. No groundwater is expected to be encountered during Site invasive activities. A Qualified Environmental Professional (QEP) under the supervision of the Remedial Engineer will be on-site during all excavation activities to supervise the excavation, document the fieldwork and provide progress report(s) and to insure the proper implementation of a CAMP. All soil that is excavated will be visually examined by the QEP for the presence of visual/olfactory evidence of contamination. Additionally, select soil samples will be screened for the presence of organic vapors utilizing a Photoionization Detector (PID). A Map of Site excavation is provided in Figure 10.

A total of approximately 18,213 tons (13,010 cubic yards) of soil/fill material will be excavated at the Site and disposed at permitted facilities in accordance with all Federal, State laws and regulations for handling, transport, and disposal. The soil is expected to be disposed as non-hazardous material. Final volumes for all waste(s) or soil that is disposed will be provided in the form of waste manifests.

5.1 SOIL CLEANUP OBJECTIVES

The Soil Cleanup Objectives for this Site are the Protection of Groundwater SCOs (PGWSCOs) listed in Table 10.

Soil and materials management on-Site and off-Site will be conducted in accordance with the Soil Management Plan as described below.

Table 6 summarizes all soil samples that exceed the SCOs proposed for this Remedial Action. Spider maps that shows all soil samples that exceed the SCOs proposed for this Remedial Action is shown in Figure 6 and Figure 7.

UST closures will, at a minimum, conform to criteria defined in DER-10.

5.2 REMEDIAL PERFORMANCE EVALUATION (POST EXCAVATION END-POINT SAMPLING)

Soil removal actions under this plan will be performed in conjunction with confirmation post-excavation end point soil sampling. Confirmation samples and testing will be performed promptly following materials removal and completed prior to import of backfill material. End point samples will be collected in accordance with DER-10 and with the QAPP in Appendix 4 and consistent with the NYSDEC Bureau of Spill Prevention & Response Sampling Guidelines and Protocols, March 1991, NYSDEC CP-51/Soil Cleanup Guidance (October 2010) and NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, May 2010.

5.2.1 End-Point Sampling Frequency

General requirements of the NYSDEC DER-10 mandate sampling for every 30 linear feet of each sidewall and bottom sampling for every 900 square feet of bottom of excavation pit for excavations with up to 300 feet of perimeter sidewall. A reduction of sampling frequency is allowed for excavations exceeding 300 feet of perimeter sidewall. Consistent with the former Site characterization sampling reported in previous subsurface investigation including the RIR and in consultation with NYSDEC, thirty nine (39) end point samples shall be collected from the Site. Prior to sample collection, all visual contamination at the Site will be over excavated to ensure a complete remediation. Soil end point samples results will be compared to the Protection of Groundwater SCOs (PGWSCOs).

The proposed maximum excavation depth is expected to extend to the depth 12 feet bgs across the entire Site and to the depth of 20 feet beneath the elevator pit beneath the southeastern portion. The excavation for the elevator pit coincides with the excavation of PCE hot spot

delineated in the southwestern portion of the Site. The PCE hot spot beneath the former drycleaner will be removed during excavation to 4 feet beneath the floor of excavation at the Site.

End point soil samples will be collected in the areas of two soil hot spots identified beneath the former drycleaners and beneath the southeastern portion of the former parking area at the Site and will be obtained from the bottom and sidewalls of these two excavations. Additional endpoint samples will also be collected at the floor of excavation across the Site.

A map of end point sampling locations is provided in Figure 11.

5.2.2 Methodology

Soil end point samples will be collected by hand directly from undisturbed soil at bottom of and sidewalls of excavation. Per DER-10, grab VOC samples will be collected from zero to 6 inches at the excavation floor within 24 hours of completing the excavation, or from 6 to 12 inches if collected over 24 hours after completing the excavation. The end point sample locations and depth will be biased towards the areas and depths of highest contamination identified during previous sampling episodes unless field indicators such as field instrument measurements or visual contamination identified during the remedial action indicate that other locations and depths may be more heavily contaminated. In all cases, post-remediation samples should be biased toward locations and depths of the highest expected contamination.

Each grab end point sample will be placed into appropriately labeled laboratory containers. New York State ELAP certified labs will be used for all end-point sample analyses. End point samples will be analyzed for the USEPA target compound list/target analyte list (TCL/TAL) following methodology:

Soil analytical methods will include:

- Volatile organic compounds by EPA Method 8260;
- Semi-volatile organic compounds by EPA Method 8270;

- Target Analyte List metals; and
- Pesticides/PCBs by EPA Method 8081/8082.

5.2.3 Reporting of Results

A summary of end point samples results will be provided in a tabular format and compared to PGWSCO's. All results will also be provided to NYSDEC in the appropriate electronic data deliverable (EDD) format.

5.2.4 QA/QC

All field sampling will be performed in accordance with the QAPP provided in Appendix 4. Samples will be properly handled and placed into the appropriate labeled containers. The samples will be placed in a cooler filled with ice and maintained at a maximum 4 degrees Celsius. All samples will be transmitted under proper chain of custody procedures to a State-certified (ELAP) laboratory for confirmatory laboratory analyses. All holding times for each matrix and analysis will be met.

Additionally, trip blanks will be provided with all laboratory transmittals. Field blanks will be prepared associated with all field samples. Matrix Spike and Matrix Spike Duplicate samples will be obtained throughout the sampling at a rate of 1 per 20 samples for each group of analytes

5.2.5 DUSR

The final FER will provide a Data Usability Summary Report (DUSR). The DUSR will compare all sampling results to the QAPP provided under Appendix 4.

5.2.6 Reporting of End-Point Data in FER

Chemical labs used for all end-point sample results and contingency sampling will be NYSDOH ELAP certified.

End point sampling will be limited to thirty nine (39) samples that will be collected from the bottom of excavation, as well as from the sidewall of deep hot spot in the southeastern portion of

the Site only. The FER will provide a tabular and map summary of all end-point sample results and exceedances of SCOs.

5.3 ESTIMATED MATERIAL REMOVAL QUANTITIES

The estimated quantity of soil/fill to be removed from the Site is 18,213 tons (13,010 cubic yards). The estimated quantity of soil to be imported into the Site for backfill and cover soil is 334 tons. No soil/fill is expected to be reused on Site.

5.4 SOIL/MATERIALS MANAGEMENT PLAN

During site construction activities, an excavator will remove contaminated soil under the direction of a QEP, who will work under the supervision of the Remedial Engineer. The soil will be “live loaded” onto appropriate trucks and transported directly to an approved disposal facility. Waste characterization samples will be obtained and analyzed prior to excavation activities. Final volumes for all waste(s) or soil that is disposed will be provided in the form of waste manifests.

5.4.1 Soil Screening Methods

Visual, olfactory and PID soil screening and assessment will be performed by a qualified environmental professional during all remedial and development excavations into known or potentially contaminated material (Residual Contamination Zone). Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during the remedy and during development phase, such as excavations for foundations and utility work, prior to issuance of the COC.

All primary contaminant sources (including but not limited to tanks and hotspots) identified during Site Characterization, Remedial Investigation, and Remedial Action will be surveyed by a surveyor licensed to practice in the State of New York. This information will be provided on maps in the Final Engineering Report.

Screening will be performed by qualified environmental professionals. Resumes will be provided for all personnel responsible for field screening (i.e. those representing the Remedial

Engineer) of invasive work for unknown contaminant sources during remediation and development work.

5.4.2 Stockpile Methods

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

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

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

A dedicated water truck equipped with a water cannon will be available on-Site for dust control.

5.4.3 Materials Excavation and Load Out

The Remedial Engineer or a qualified environmental professional under his/her supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The Participant and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the Site has been investigated by the Remedial Engineer. It has been determined that no risk or impediment to the planned work under this Remedial Action Work Plan 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. The Remedial Engineer will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the Site until the remedial construction is complete.

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

The Remedial Engineer will be responsible for ensuring that all egress points for truck and equipment transport from the Site will be clean of dirt and other materials derived from the Site during Site remediation and development. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site -derived materials.

The Participant and associated parties preparing the remedial documents submitted to the State, and parties performing this work, are completely responsible for the safe performance of all invasive work, the structural integrity of excavations, and for structures that may be affected by excavations (such as building foundations and bridge footings).

The Remedial Engineer will ensure that Site development activities will not interfere with, or otherwise impair or compromise, remedial activities proposed in this Remedial Action Work Plan.

Each hotspot and structure to be remediated (USTs, vaults and associated piping, transformers, etc.) will be removed and end-point remedial performance sampling completed before excavations related to Site development commence proximal to the hotspot or structure.

Development-related grading cuts and fills will not be performed without NYSDEC approval and will not interfere with, or otherwise impair or compromise, the performance of remediation required by this plan.

Mechanical processing of historical fill and contaminated soil on-Site is prohibited.

All primary contaminant sources (including but not limited to tanks and hotspots) identified during Site Characterization, Remedial Investigation, and Remedial Action will be surveyed by a

surveyor licensed to practice in the State of New York. The survey information will be shown on maps to be reported in the Final Engineering Report.

5.4.4 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.

Truck transport routes are provided in Figure 12. All trucks loaded with Site materials will exit the vicinity of the Site using only these approved truck routes.

The Site will have one access gate from Vleigh Place to the west, which will accommodate the entry and exit of a single truck at a time. The truck transport routes identified in Figure 12 are the most appropriate routes and take 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.

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.

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.

All trucks will be washed prior to leaving the Site. Truck wash waters will be collected and disposed of off-Site in an appropriate manner.

5.4.5 Materials Disposal Off-Site

Disposal location(s) established later will be reported to the NYSDEC Project Manager. The total quantity of material expected to be disposed off-Site is approximately 18,213 tons (13,010 cubic yards) of contaminated soil will be removed from the site. Of this quantity, approximately 373 tons are expected to be disposed as hazardous waste material.

All soil/fill/solid waste excavated and removed from the Site will be treated as contaminated and regulated material and will be disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from this Site is proposed for unregulated disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to NYSDEC's Project Manager. Unregulated off-Site management of materials from this Site is prohibited without formal NYSDEC approval.

Material that does not meet Track 1 unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

The following documentation will be obtained and reported by the Remedial Engineer for each disposal location used in this project to fully demonstrate and document that the disposal of material derived from the Site conforms with all applicable laws: (1) a letter from the Remedial Engineer or BCP Participant to the receiving facility describing the material to be disposed and requesting formal written acceptance of the material. This letter will state that material to be disposed is contaminated material generated at an environmental remediation Site in New York State. The letter will provide the project identity and the name and phone number of the Remedial Engineer. The letter will include as an attachment a summary of all chemical data for the material being transported (including Site Characterization data); and (2) a letter from all receiving facilities stating it is in receipt of the correspondence (above) and is approved to accept the material. These documents will be included in the FER.

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

Historical fill and contaminated soils from the Site are prohibited from being disposed at Part 360-16 Registration Facilities (also known as Soil Recycling Facilities).

Soils that are contaminated but non-hazardous and are being removed from the Site are considered by the Division of Materials Management (DMM) in NYSDEC to be Construction and Demolition (C/D) materials with contamination not typical of virgin soils. These soils may be sent to a permitted Part 360 landfill. They may be sent to a permitted C/D processing facility without permit modifications only upon prior notification of NYSDEC Region 2 DMM. This material is prohibited from being sent or redirected to a Part 360-16 Registration Facility. In this case, as dictated by DMM, special procedures will include, at a minimum, a letter to the C/D facility that provides a detailed explanation that the material is derived from a DER remediation Site, that the soil material is contaminated and that it must not be redirected to on-Site or off-Site Soil Recycling Facilities. The letter will provide the project identity and the name and phone number of the Remedial Engineer. The letter will include as an attachment a summary of all chemical data for the material being transported.

The Final Engineering Report will include an accounting of the destination of all material removed from the Site during this Remedial Action, including excavated soil, contaminated soil, historic fill, solid waste, and hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. This information will also be presented in a tabular form in the FER.

Bill of Lading system or equivalent will be used for off-Site movement of non-hazardous wastes and contaminated soils. This information will be reported in the Final Engineering Report.

Hazardous wastes derived from on-Site will be stored, transported, and disposed of in full compliance with applicable local, State, and Federal regulations.

Appropriately licensed haulers will be used for material removed from this Site and will be in full compliance with all applicable local, State and Federal regulations.

Waste characterization will be performed for off-Site disposal in a manner suitable to the receiving facility and in conformance with applicable permits. Sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the FER. All data available for soil/material to be disposed at a given facility must be submitted to the disposal facility with suitable explanation prior to shipment and receipt.

5.4.6 Materials Reuse On-Site

No on-Site reuse of soil fill material is planned as part of Site remedial activities.

Concrete crushing or processing on-Site is prohibited.

Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the Site is prohibited for reuse on-Site.

Contaminated on-Site material, including historic fill and contaminated soil, removed for grading or other purposes will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines. This will be expressed in the final Site Management Plan.

5.4.7 Fluids Management

All liquids to be removed from the Site, including dewatering fluids, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Liquids discharged into the New York City sewer system will be addressed through approval by NYCDEP.

Dewatered fluids will not be recharged back to the land surface or subsurface of the Site. Dewatering fluids will be managed off-Site.

Discharge of water generated during remedial construction to surface waters (i.e. a local pond, stream or river) is prohibited without a SPDES permit.

5.4.8 Demarcation

After the completion of soil removal and any other invasive remedial activities and prior to backfilling, a land survey will be performed by a New York State licensed surveyor. The survey will define the top elevation of residual contaminated soils. A physical demarcation layer, consisting of orange snow fencing material or equivalent material will be placed on this surface to provide a visual reference. This demarcation layer will constitute the top of the ‘Residuals Management Zone’, the zone that requires adherence to special conditions for disturbance of contaminated residual soils defined in the Site Management Plan. The survey will measure the grade covered by the demarcation layer before the placement of cover soils, pavement and sub-soils, structures, or other materials. This survey and the demarcation layer placed on this grade surface will constitute the physical and written record of the upper surface of the ‘Residuals Management Zone’ in the Site Management Plan. A map showing the survey results will be included in the Final Engineering Report and the Site Management Plan.

5.4.9 Backfill from Off-Site Sources

All materials proposed for import onto the Site will be approved by the Remedial Engineer and will follow provisions in this RAWP prior to receipt at the Site.

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

The Final Engineering Report will include the following certification by the Remedial Engineer: “I certify that all import of soils from off-Site, including source evaluation, approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Remedial Action Work Plan”.

All imported soils must meet the requirements of 6 NYCRR Part 375-6.7(d), DER-10 5.4(e), Table 5.4(e)10, and Appendix 5. Non-compliant soils will not be imported onto the Site without prior approval by NYSDEC. Nothing in the approved Remedial Action Work Plan or its approval by NYSDEC should be construed as an approval for this purpose.

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. Nothing in this Remedial Action Work Plan should be construed as an approval for this purpose.

Solid waste will not be imported onto the Site.

Trucks entering the Site with imported soils will be securely covered with tight fitting covers.

5.4.10 Storm water 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 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 RAWP 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 remedial construction area.

5.4.11 Contingency Plan

If underground tanks or other previously unidentified contaminant sources are found during on-Site remedial excavation or development related construction, sampling will be performed on product, sediment and surrounding soils, etc. Chemical analytical work will be for full scan parameters (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs). These analyses will not be limited to STARS parameters where tanks are identified without prior approval by NYSDEC. Analyses will not be otherwise limited without NYSDEC approval.

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. These findings will be also included in daily and periodic electronic media reports.

5.4.12 Community Air Monitoring Plan

The CAMP has been prepared to monitor air quality during ground intrusive activities at the Site, which include but not limited to soil excavation, lagging and installation of concrete foundations. Air quality monitoring will include monitoring the air Volatile Organic Compounds (VOCs) using a PID and the presence of elevated levels of dust using Particulate Dust Track Real-time Particle Counter. Exceedances observed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers and included in the Daily Report.

5.4.13 Odor, Dust and Nuisance Control Plan

The Final Engineering Report will include the following certification by the Remedial Engineer: "I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology defined in the Remedial Action Work Plan."

5.4.13.1 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 spraying of an

odor-suppressing agent, brand name Biosolve. If nuisance odors are identified, 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 all other complaints about the project. Implementation of all odor controls, including the halt of work, will be the responsibility of the Participant's Remedial Engineer, who is responsible for certifying the Final Engineering Report.

All necessary means will be employed to prevent on- and off-Site nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (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.

Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-Site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

5.4.13.2 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 through 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.

5.4.13.3 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 and will conform, at a minimum, to NYCDEP noise control standards.

6.0 RESIDUAL CONTAMINATION TO REMAIN ON-SITE

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 to protect human health and the environment. These ECs and ICs are described hereafter. Long-term management of EC/ICs and of residual contamination will be executed under a Site specific Site Management Plan (SMP) that will be developed and included in the FER.

ECs will be implemented to protect public health and the environment by appropriately managing residual contamination. The Controlled Property (the Site) will have four three (3) primary EC systems. These are: (1) a composite cover system consisting of concrete building slabs, (2) a soil vapor extraction system (SVE) and (3) a groundwater remedial program.

The FER will report residual contamination on the Site in tabular and map form. This will include presentation of exceedances of the RAO for soil cleanup established for the Site.

7.0 ENGINEERING CONTROLS:

7.1 COMPOSITE COVER SYSTEM

Exposure to residual contaminated soils will be prevented by an engineered, composite cover system that will be built on the Site. This composite cover system will be comprised of concrete covered sidewalks, and 12-inch reinforced concrete slab concrete building slabs

The composite cover system will be a permanent engineering control. The system will be inspected and its performance certified at specified intervals as required by the Site Management Plan in the FER. A Soil and Materials Management Plan will be included in the Site Management Plan and will outline the procedures to be followed in the event that the composite cover system and underlying residual soil/fill is disturbed after the remedial action is complete. Maintenance of this composite cover system will be described in the Site Management Plan in the Remedial Action Report.

7.2 GROUNDWATER REMEDIATION

An in-situ chemical oxidant consisting of PersulfOx and a bioremedial agent identified as 3_D Microemulsion Factory Elumlsified (3DME) have been proposed as part of the remedy at the Site. Per manufacturer guidance, PersulfOx and 3DME solutions will be introduced separately via two phases of injections into the saturated zone in the southeastern portion of the Site for a target treatment zone 16 feet below the soil and groundwater interface. PersulfOx will destroy the chlorinated contaminants in an approximately 800 square foot area and 3DME mixed with additives identified as Bio-Dechlor Innoculum Plus (BDI Plus) and CRS Chemical Reducing Solution (CRS) will be applied 3 months after the application of PersulfOx to treat residual contaminants in an area approximately 4,900 square foot.

A total of 3,361 pounds of PersulfOx mixed with 2,954 gallons of water will be applied during the first phase of injection via 8 injections points spaced evenly 10 feet apart. A total of 6,000 pounds of 3DME mixed with 6,471 gallons of water, total of 2,400 pounds of CRS mixed

with 274 gallons of water and a total of 30 liters of BDI mixed with 300 gallons of water will be applied during the second phase of injections via 30 injection points spaced evenly 12.5 feet apart.

The effectiveness of in-situ injections will be evaluated by conducting a round of groundwater sampling in all existing all thirteen on-site and off-site monitoring wells prior to injections in order to establish background levels of CVOCs. Monitoring wells located in the in the treatment area, i.e. MW-5S (Shallow), MW-8, MW-9, MW-10, MW-11, and MW-12 will also be analyzed for aquifer indicators parameters of oxidative reaction in water prior and after injection. Post-injection groundwater sampling will be conducted three (3) months after first injection and quarterly for a minimum of 24 months after the second injections.

Appendix 11 provides the Groundwater Remedial Action Work Plan.

7.3 SOIL VAPOR EXTRACTION SYSTEM

The SVE system will be installed 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. The system will consist of three extraction wells designated EW-1 to EW-3. The SVE wells will be installed using a Geoprobe and will be constructed using 4-inch diameter schedule 80 PVC pipes. The well screen will be 0.030 inch slotted with each well screened at different depths below the proposed floor of excavation, i.e. EW-1 from 20 to 25 feet bgd, EW-2 from 29 to 34 feet bgs and EW-3 from 25 to 30 feet bgs. The SVE wells will be connected to EN 707 5-HP Rotron blower. Six (6) Vacuum monitoring points will also be installed as part of the SVE system on-site and also off-site in the sidewalks in the south-adjacent vicinity of the Site. The purpose of these points is to evaluate the field of influence of the SVE system. The SVE system will be subject to

periodic inspections and its performance its radius of influence will be certified at specified intervals as required by the Site Management Plan in the FER. The SVE design and specifications is provided in Appendix 12.

The SVE system will not be discontinued without written approval by NYSDEC and NYSDOH. A proposal to discontinue the system may be submitted by the property owner after residual contamination concentrations in groundwater: (1) are cleaned up to levels below NYSDEC standards, (2) have become asymptotic over an extended period as mandated by the NYSDEC and the NYSDOH, or (3) if 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 NYSDEC and NYSDOH. These sampling/monitoring activities will adhere to stipulations outlined in the Monitoring Plan section of the SMP.

The primary EC systems will be implemented during remedial construction at the Site. All as-built drawings, diagrams, calculation and manufacturer documentation for these-systems will be presented in the FER.

8.0 INSTITUTIONAL CONTROLS

After the remedy is complete, the Site will have residual contamination remaining in place. Engineering Controls (ECs) for the residual contamination have been incorporated into the remedy to render the overall Site remedy protective of public health and the environment. Two elements have been designed to ensure continual and proper management of residual contamination in perpetuity: An Environmental Easement and a Site Management Plan. These elements are described in this Section. A Site -specific Environmental Easement will be recorded with Queens County to provide an enforceable means of ensuring the continual and proper management of residual contamination and protection of public health and the environment in perpetuity or until released in writing by NYSDEC. It requires that the grantor of the Environmental Easement and the grantor's successors and assigns adhere to all Engineering and Institutional Controls (ECs/ICs) placed on this Site by this NYSDEC-approved remedy. ICs provide restrictions on Site usage and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs. The Site Management Plan (SMP) describes appropriate methods and procedures to ensure compliance with all ECs and ICs that are required by the Environmental Easement. Once the SMP has been approved by the NYSDEC, compliance with the SMP is required by the grantor of the Environmental Easement and grantor's successors and assigns.

8.1 ENVIRONMENTAL EASEMENT

An Environmental Easement, as defined in Article 71 Title 36 of the Environmental Conservation Law, is required when residual contamination is left on-Site after the Remedial Action is complete. As part of this remedy, an Environmental Easement approved by NYSDEC will be filed and recorded with the Queens County Office of the City Register. The Environmental Easement will be submitted as part of the Final Engineering Report.

The Environmental Easement renders the Site a Controlled Property. The Environmental Easement must be recorded with the Queens County Office of the City Register before the Certificate of Completion can be issued by NYSDEC. A series of Institutional Controls are

required under this remedy to implement, maintain and monitor these Engineering Control systems, prevent future exposure to residual contamination by controlling disturbances of the subsurface soil and restricting the use of the Site to restricted residential use. These Institutional Controls are requirements or restrictions placed on the Site that are listed in, and required by, the Environmental Easement. Institutional Controls can, generally, be subdivided between controls that support Engineering Controls, and those that place general restrictions on Site usage or other requirements. Institutional Controls in both of these groups are closely integrated with the Site Management Plan, which provides all of the methods and procedures to be followed to comply with this remedy.

Adherence to these Institutional Controls for the Site is mandated by the Environmental Easement and will be implemented under the Site Management Plan (discussed in the next section). The Controlled Property (Site) will also have a series of Institutional Controls in the form of Site restrictions and requirements. The Site restrictions that apply to the Controlled Property are:

- Vegetable gardens and farming on the Controlled Property are prohibited;
- Use of groundwater underlying the Controlled Property is prohibited without treatment rendering it safe for intended purpose;
- All future activities on the Controlled Property that will disturb residual contaminated material are prohibited unless they are conducted in accordance with the soil management provisions in the Site Management Plan;
- The Controlled Property may be used for Residential and restricted commercial use only, provided the long-term Engineering and Institutional Controls included in the Site Management Plan are employed;
- Grantor agrees to submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the Controlled Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public

health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access such Controlled Property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow. This statement must be certified by an expert that the NYSDEC finds acceptable.

8.2 SITE MANAGEMENT PLAN

Site Management is the last phase of remediation and begins with the approval of the Final Engineering Report and issuance of the Certificate of Completion (COC) for the Remedial Action. The Site Management Plan is submitted as part of the FER but will be written in a manner that allows its removal and use as a complete and independent document. Site Management continues in perpetuity or until released in writing by NYSDEC. The property owner is responsible to ensure that all Site Management responsibilities defined in the Environmental Easement and the Site Management Plan are performed.

The SMP is intended to provide a detailed description of the procedures required to manage residual contamination left in place at the Site following completion of the Remedial Action in accordance with the BCA with the NYSDEC. This includes: (1) development, implementation, and management of all Engineering and Institutional Controls; (2) development and implementation of monitoring systems and a Monitoring Plan; (3) development of a plan to operate and maintain any treatment, collection, containment, or recovery systems (including, where appropriate, preparation of an Operation and Maintenance Manual); (4) submittal of Site Management Reports, performance of inspections and certification of results, and demonstration of proper communication of Site information to NYSDEC; and (5) defining criteria for termination of treatment system operation.

To address these needs, this SMP will include four plans: (1) an Engineering and Institutional Control Plan for implementation and management of EC/ICs; (2) a Monitoring Plan for implementation of Site Monitoring; (3) an Operation and Maintenance Plan for implementation of remedial collection, containment, treatment, and recovery systems; and (4) a Site Management Reporting Plan for submittal of data, information, recommendations, and

certifications to NYSDEC. The SMP will be prepared in accordance with the requirements in NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010, and the Site Management Plan (SMP) templates guidelines provided by NYSDEC.

Site management activities, reporting, and EC/IC certification will be scheduled on a certification period basis. The certification period will be annually. The Site Management Plan will be based on a calendar year and will be due for submission to NYSDEC by March 1 of the year following the reporting period.

The Site Management Plan in the Final Engineering Report will include a monitoring plan for groundwater at the down-gradient Site perimeter to evaluate Site -wide performance of the remedy.

No exclusions for handling of residual contaminated soils will be provided in the SMP. All handling of residual contaminated material will be subject to provisions contained in the SMP.

9.0 FINAL ENGINEERING REPORT

A Final Engineering Report (FER) and Certificate Of Completion (COC) will be submitted to NYSDEC following implementation of the Remedial Action defined in this RAWP. The FER provides the documentation that the remedial work required under this RAWP has been completed and has been performed in compliance with this plan. The FER will provide a comprehensive account of the locations and characteristics of all material removed from the Site including the surveyed map(s) of all sources. The Final Engineering Report will include as-built drawings for all constructed elements, certifications, manifests, bills of lading as well as the complete Site Management Plan (formerly the Operation and Maintenance Plan). The FER will provide a description of the changes in the Remedial Action from the elements provided in the RAWP and associated design documents. The FER will provide a tabular summary of all performance evaluation sampling results and all material characterization results and other sampling and chemical analysis performed as part of the Remedial Action. The FER will provide test results demonstrating that all mitigation and remedial systems are functioning properly. The FER will be prepared in conformance with DER-10. The required certifications in the FER are listed in the Checklist for Final Engineering Report (FER) approval in Appendix 13.

Where determined to be necessary by NYSDEC, a Financial Assurance Plan will be required to ensure the sufficiency of revenue to perform long-term operations, maintenance and monitoring tasks defined in the Site Management Plan and Environmental Easement. This determination will be made by NYSDEC in the context of the Final Engineering Report review.

The Final Engineering Report will include written and photographic documentation of all remedial work performed under this remedy.

The FER will include an itemized tabular description of actual costs incurred during all aspects of the Remedial Action.

The FER will provide a thorough summary of all residual contamination left on the Site after the remedy is complete. Residual contamination includes all contamination that exceeds the SCOs defined for the Site in the RAWP and must provide an explanation for why the material was not removed as part of the Remedial Action. A table that shows residual contamination in excess of Site SCOs and a map that shows residual contamination in excess of Site SCOs will be included in the FER.

The Final Engineering Report will include an accounting of the destination of all material removed from the Site, including excavated contaminated soil, historic fill, solid waste, hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. It will provide an accounting of the origin and chemical quality of all material imported onto the Site.

Before approval of a FER and issuance of a Certificate of Completion, all project reports must be submitted in digital form on electronic media (PDF).

9.1 CERTIFICATIONS

The following certification will appear in front of the Executive Summary of the Final Engineering Report. The certification will be signed by the Remedial Engineer Tarek Z. Khouri who is a Professional Engineer registered in New York State. This certification will be appropriately signed and stamped. The certification will include the following statements:

I, Tarek Z. Khouri, am currently a registered professional engineer licensed by the State of New York. I had primary direct responsibility for implementation of the remedial program for the 77-39/63 Vleigh Place Site (NYSDEC BCA Index No. C241168-03-15 Site No. C241168).

I certify that the Site description presented in this FER is identical to the Site descriptions presented in the Environmental Easement, the Site Management Plan, and the Brownfield Cleanup Agreement for 77-39/63 Vleigh Place and related amendments.

I certify that the Remedial Action Work Plan dated [month day year] and Stipulations [if any] in a letter dated [month day year] and approved by the NYSDEC were implemented and that all requirements in those documents have been substantively complied with.

I certify that the remedial activities were observed by qualified environmental professionals under my supervision and that the remediation requirements set forth in the Remedial Action Work Plan and any other relevant provisions of ECL 27-1419 have been achieved.

I certify that all use restrictions, Institutional Controls, Engineering Controls, and all operation and maintenance requirements applicable to the Site are contained in an Environmental Easement created and recorded pursuant ECL 71-3605 and that all affected local governments, as defined in ECL 71-3603, have been notified that such easement has been recorded. A Site Management Plan has been submitted by the Participant for the continual and proper operation, maintenance, and monitoring of all Engineering Controls employed at the Site, including the proper maintenance of all remaining monitoring wells, and that such plan has been approved by the NYSDEC.

I certify that the export of all contaminated soil, fill, water or other material from the property was performed in accordance with the Remedial Action Work Plan, and were taken to facilities licensed to accept this material in full compliance with all Federal, State and local laws.

I certify that all import of soils from off-Site, including source approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Remedial Action Work Plan.

I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology and soil screening methodology defined in the Remedial Action Work Plan.

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

It is a violation of Article 130 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 130, New York State Education Law.

10.0 SCHEDULE

Implementation of the Track 4 remedial activities are anticipated to take approximately 12 months. Within 8 months of completion of all remedial activities at the Site, a Final Engineering Report (FER) will be submitted to NYSDEC as detailed in Section 5.2. The FER will include a Site Management Plan (SMP), which will be implemented following the issuance of a Certificate of Completion. A chart showing a detailed project schedule is included in Appendix 14.

FIGURES

FIGURE 1 - SITE LOCATION MAP



141-04 77 AVENUE
Owner Name: KEW GARDENS HILLS APT
Zoning Type: R3-2

141-25 VLEIGH PLACE
Owner Name: QUEEN OF PEACE R C CH
Zoning Type: R3-2

77-40 VLEIGH PLACE
Owner Name: ANDRADE, JOHANNA
Zoning Type: C1-2/R3-2

138-06 78 AVENUE
Owner Name: KEW GARDENS HILLS APT
Zoning Type: R3-2

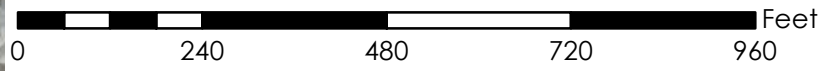
141-33 78 AVENUE
Owner Name: KEW GARDENS OWNERS CO
Zoning Type: C1-2/R3-2

141-24 78 AVENUE
Owner Name: REGENCY GARDENS APART
Zoning Type: R3-2

UNION TURNPIKE
Owner Name: PARKS AND RECREATION
Zoning Type: PARK

The Site

- Site Boundary
- SurroundingParcels
- Building Footprint



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OF SEC. 7209 OF THE N.Y.S. EDUCATION LAW

DRAWING PREPARED FOR:

REVISION	DATE	INITIAL	COMMENTS
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DRAWING INFORMATION:

Project:	Designed by:
Date:	Drawn by:
Scale:	AS SHOWN
	Approved by:

PROJECT SITE AND
ADJACENT PROPERTIES

77-39/63 VLEIGH PL
FLUSHING, NY

FIGURE NO:

1

SHEET:



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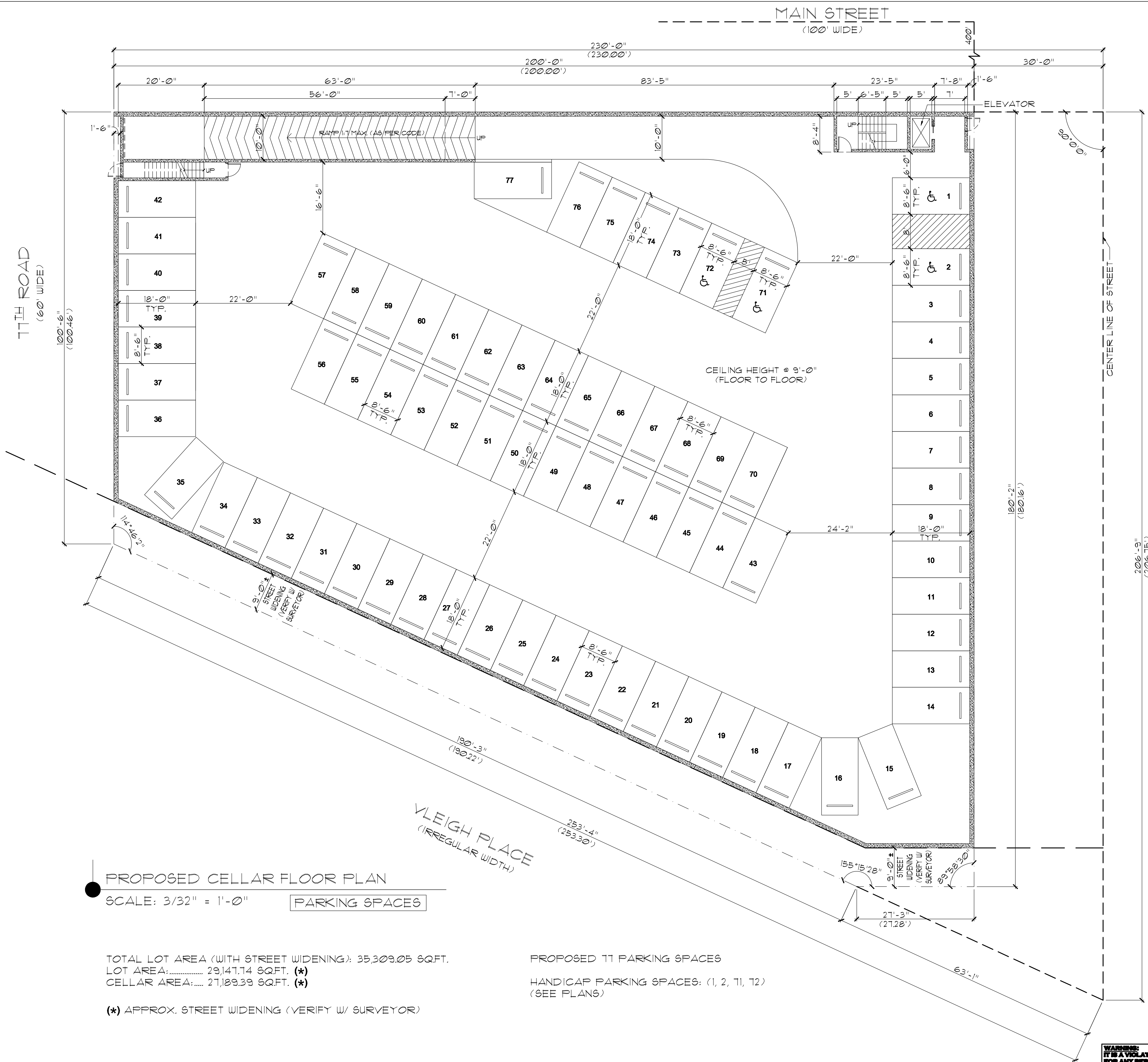
77-57 Vleigh Pl
 Flushing, NY
 HTE Job# 160113

Drawn By: C.Q.
 Reviewed By: P.M.
 Approved By: M.R.
 Date: 12/5/16
 Scale: AS NOTED

TITLE:

FIGURE 2: SITE BOUNDARY MAP

FIGURE 3 – Proposed Development



PROPOSED CELLAR FLOOR PLAN

SCALE: 3/32" = 1'-0"

PARKING SPACES

TOTAL LOT AREA (WITH STREET WIDENING): 35,309.05 SQ.FT.
LOT AREA: 29,147.74 SQ.FT. (*)
CELLAR AREA: 27,189.39 SQ.FT. (*)

(*) APPROX. STREET WIDENING (VERIFY W/ SURVEYOR)

PROPOSED 77 PARKING SPACES
HANDICAP PARKING SPACES: (1, 2, T1, T2)
(SEE PLANS)

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EMAIL: OFFICE@AMPCONSULTING.COM

NOT FOR CONSTRUCTION
SUBJECT TO BUILDING DEPARTMENT APPROVAL

(2014) CODE

REVISIONS

NB

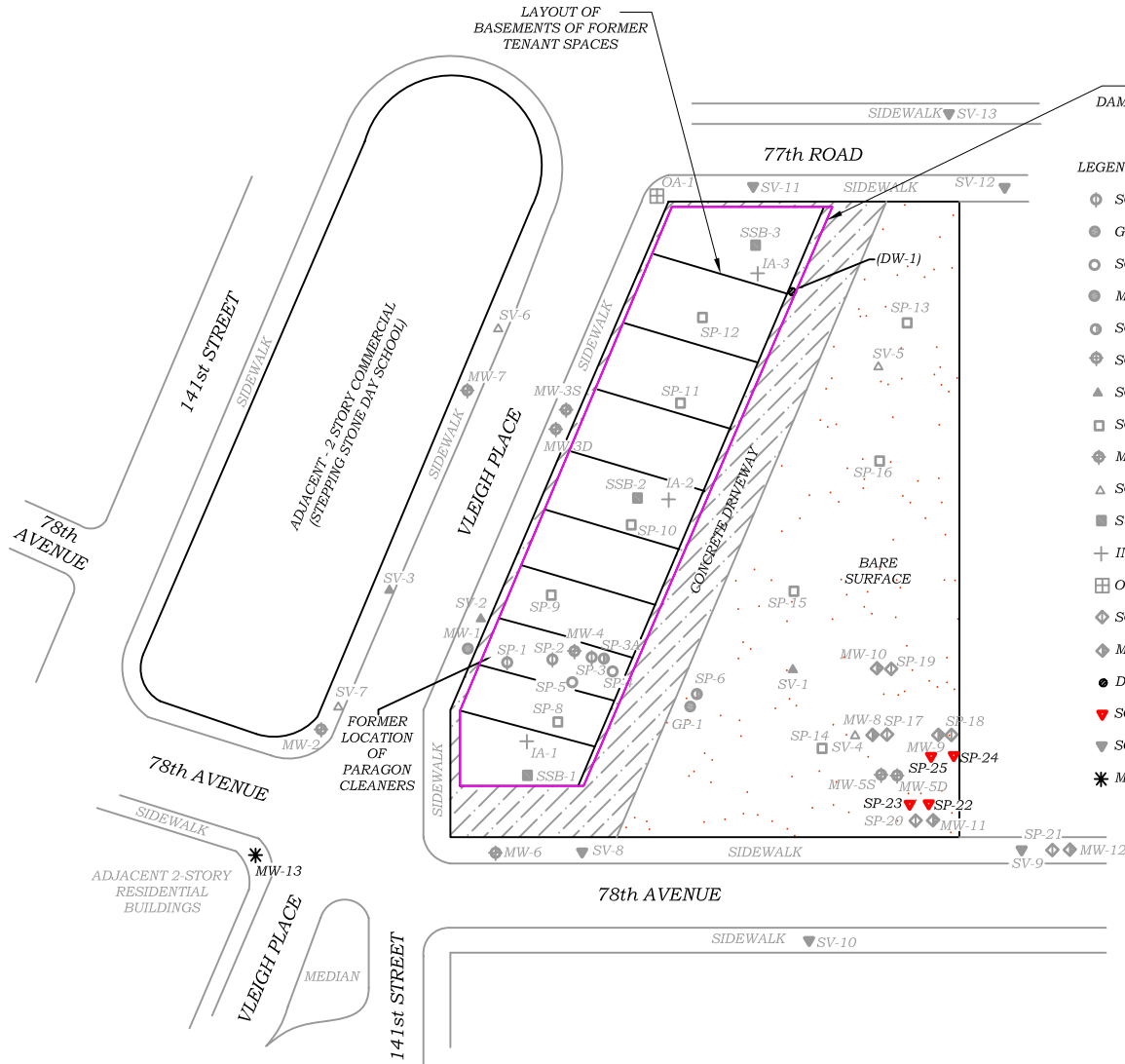
PROPOSED PARKING SPACES

PROPOSED COMMERCIAL BUILDING AT:
11-39 VLEIGH PLACE
QUEENS, NY
BLOCK: 1 LOT: 66.30

JOB#: 2017-XX
DRN BY: HR
CKD BY: ASH
DATE: 05/2017
SCALE: AS NOTED

NEW YORK CITY
DEPARTMENT OF BUILDINGS
APPLICATION NUMBER

DOB APPROVAL



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
- 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
- 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

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



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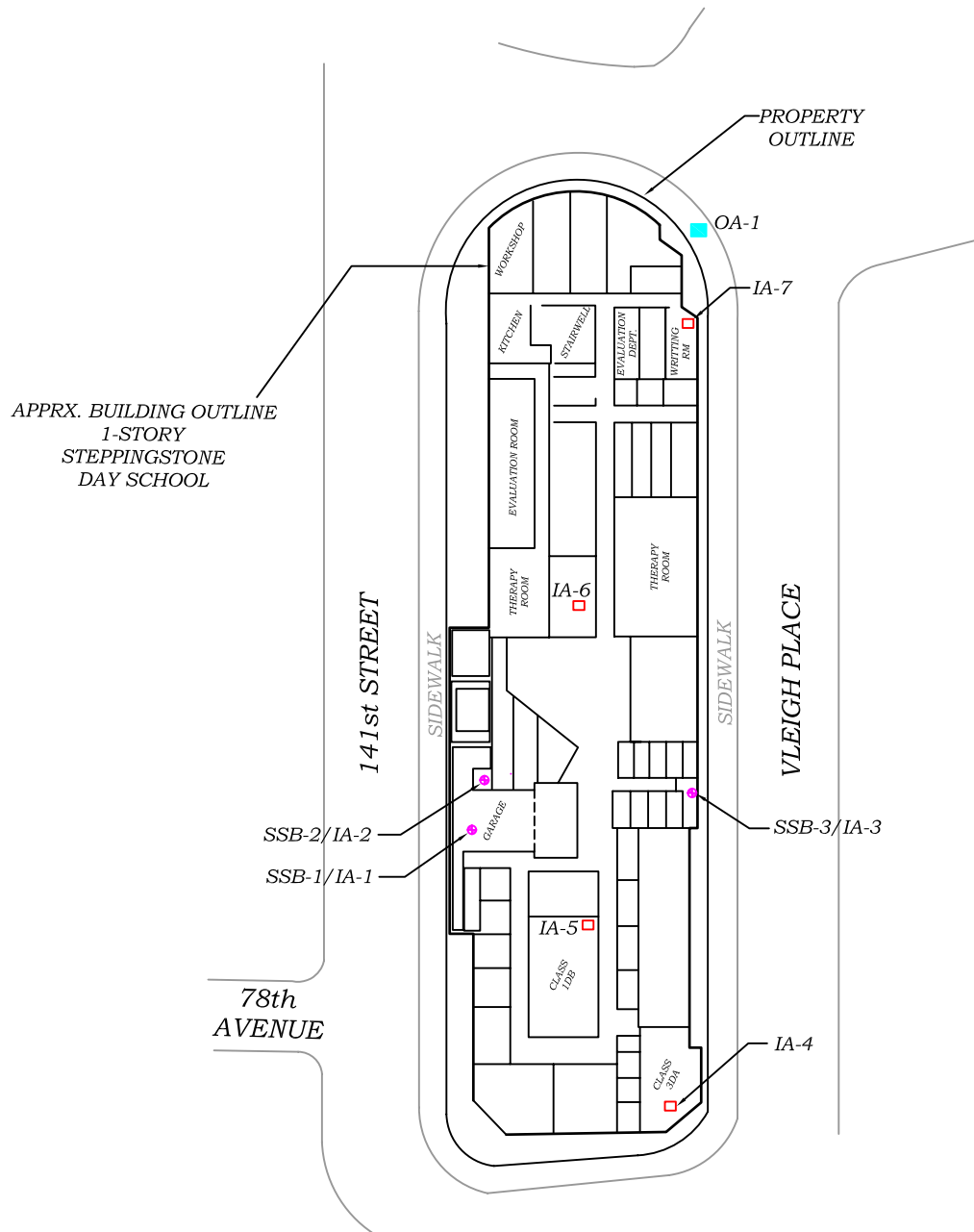
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77-57 Vleigh Pl
Flushing, NY
HTE Job# 160113

Drawn By: C.Q.
Reviewed By: P.M.
Approved By: M.R.
Date: 06/26/17
Scale: AS NOTED

TITLE:

FIGURE 4a: SAMPLING PLAN AT THE SITE AND ITS VICINITIES



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.

NOT TO SCALE



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TITLE:

FIGURE 4b: SAMPLING PLAN OFF-SITE AT STEPPING STONE DAY SCHOOL



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 Reviewed By: P.M.
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TITLE:

FIGURE 4c: SAMPLING MAP OFF-SITE AS KEW GARDENS OWNERS CORP



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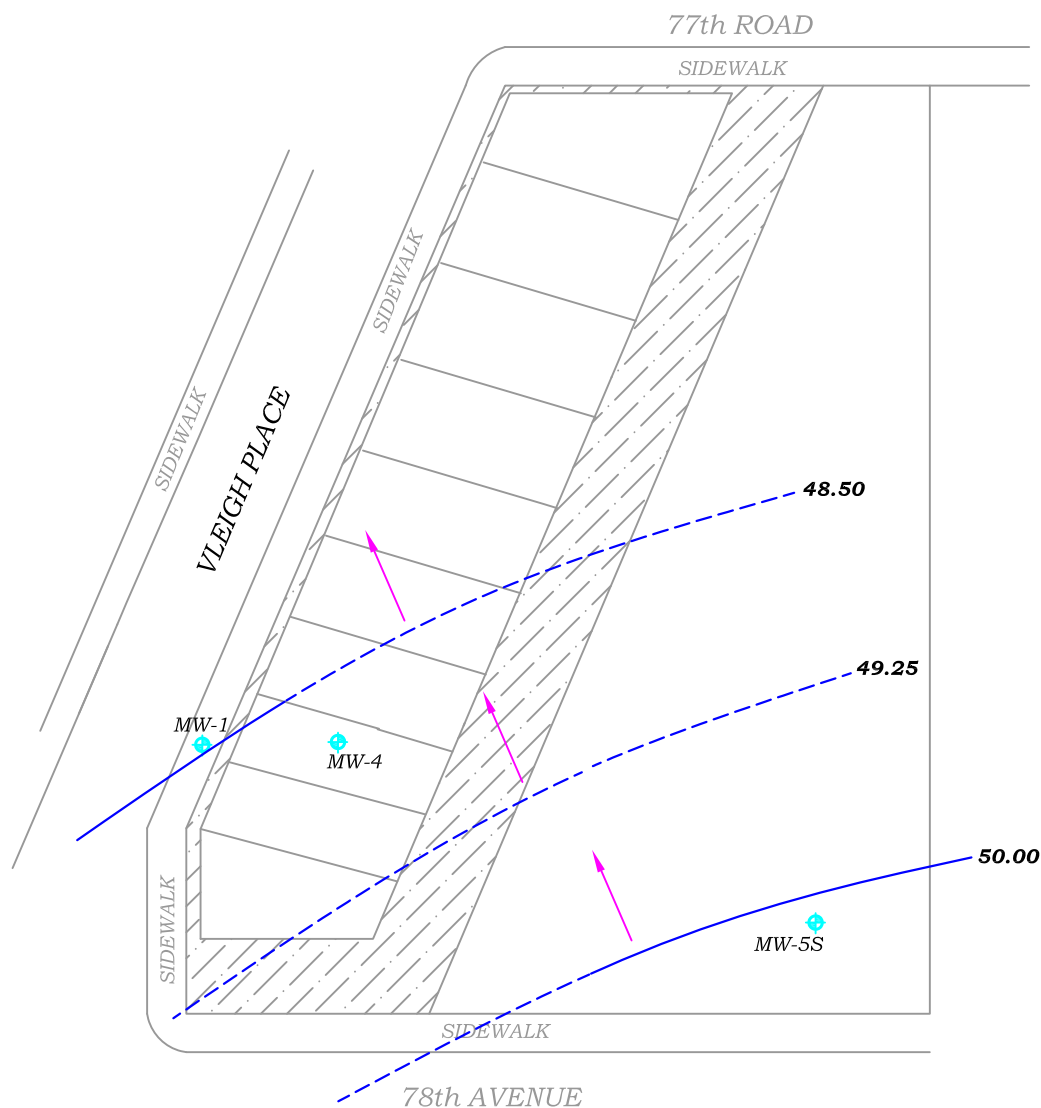
FIGURE 4d: SAMPLING MAP OFF-SITE AT REGENCY GARDENS COMPANY



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



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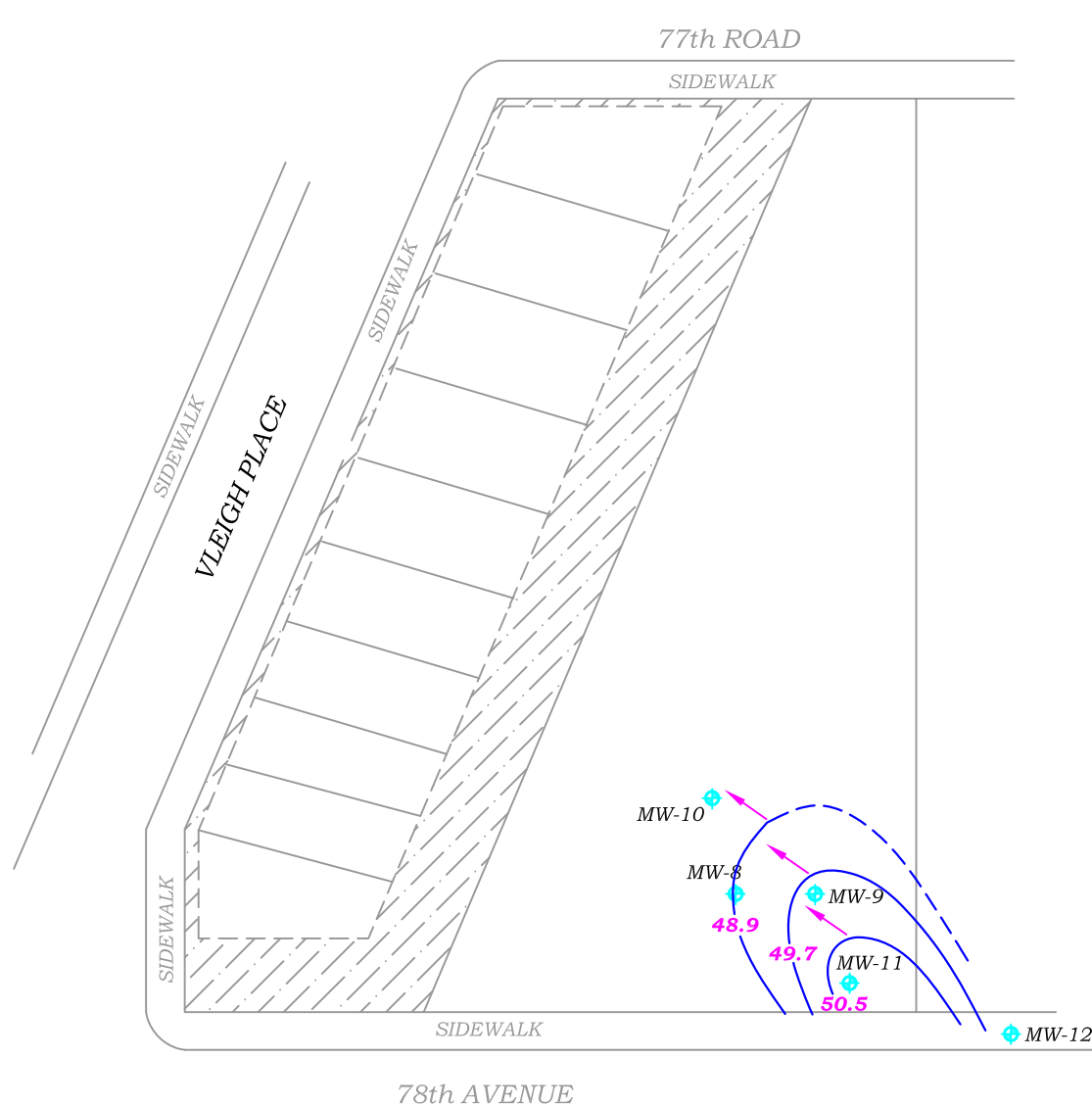
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77-57 Vleigh Pl
 Flushing, NY
 HTE Job# 160113

Drawn By: C.O.
 Reviewed By: P.M.
 Approved By: M.R.
 Date: 06/26/17
 Scale: AS NOTED

TITLE:

FIGURE 5a: GROUNDWATER FLOW CONTOUR MAP - DECEMBER 2015



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.)



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Drawn By: C.O.
Reviewed By: P.M.
Approved By: M.R.
Date: 06/26/17
Scale: AS NOTED

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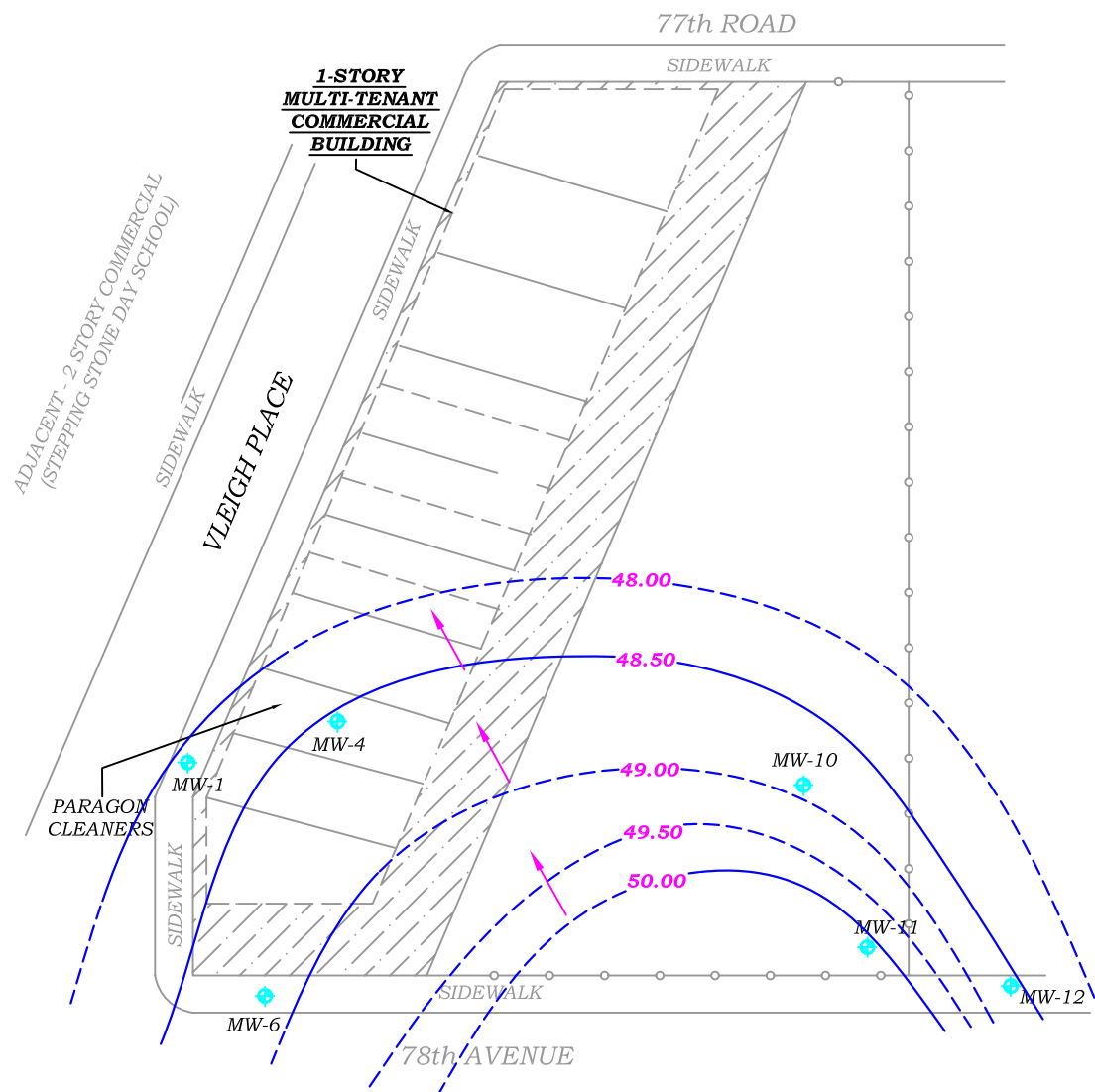
FIGURE 5b: GROUNDWATER FLOW CONTOUR MAP - MARCH 2016



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.)



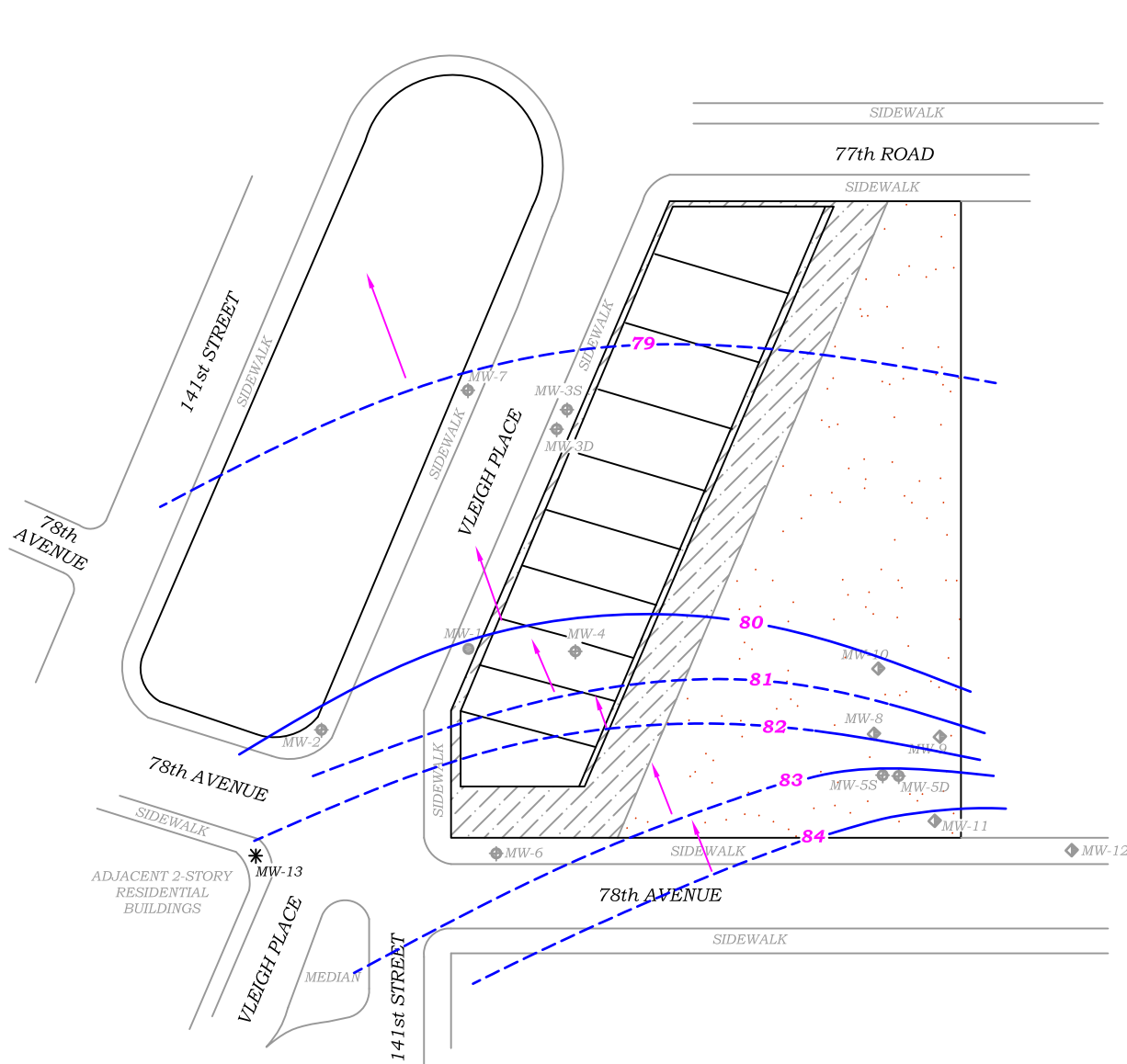
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 HTE Job# 160113

Drawn By: C.Q.
 Reviewed By: P.M.
 Approved By: M.R.
 Date: 07/05/17
 Scale: AS NOTED

TITLE:

FIGURE 5c: GROUNDWATER FLOW CONTOUR MAP - MAY 2016



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.)



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 Flushing, NY
 HTE Job# 160113

Drawn By: C.O.
 Reviewed By: P.M.
 Approved By: M.R.
 Date: 06/26/17
 Scale: AS NOTED

TITLE:

FIGURE 5d: GROUNDWATER FLOW CONTOUR MAP - OCTOBER 2016



LEGEND:

- ▼ SOIL PROBE LOCATIONS (SP)- INSTALLED OCTOBER 2016
- SOIL PROBE LOCATIONS (SP)- INSTALLED MARCH 2016
- SOIL PROBE LOCATIONS (SP)- INSTALLED JANUARY 2014
- × SOIL PROBE LOCATIONS (SP)- INSTALLED OCTOBER 2013
- BASEMENT PARTITION
- VOCs VOLATILE ORGANIC COMPOUNDS
- mg/Kg MILLIGRAMS PER KILOGRAM
- USCO UNRESTRICTED USE SOIL CLEANUP OBJECTIVES
- RRSCO RESTRICTED RESIDENTIAL USE SOIL CLEANUP OBJECTIVES
- ND NONE DETECTED
- BGS BELOW GRADE SURFACE
- BBS BELOW BASEMENT SSLAB
- BLUE SHADED VALUES EXCEED USCO
- RED SHADED VALUES EXCEED RRSCO

SP-12 (12/1/15)				
Chlorinated VOCs	Depth (BBS)	mg/Kg	USCO	RRSCO
Methylene chloride	18'-20'	0.0087	0.05	100

SP-11 (12/1/15)		
Depth (BBS)	Chlorinated VOCs	ND
18'-20'		

SP-10 (12/1/15)		
Depth (BBS)	Chlorinated VOCs	ND
18'-20'		

SP-9 (11/30/15)		
Depth (BBS)	Chlorinated VOCs	ND
18'-20'		

SP-3				
Chlorinated VOCs	Depth (BBS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	0'-2'	14.6	1.3	19

SP-3A				
Chlorinated VOCs	Depth	mg/Kg	USCO	RRSCO
Tetrachloroethylene	2'-4'	0.0030	1.3	19
	10'-12'	ND		
	16'-18'	ND		
	20'-22'	0.0095		

SP-2				
Chlorinated VOCs	Depth (BBS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	4'-6'	0.0143	1.3	19

SP-1 (6'-8')				
Chlorinated VOCs	Depth (BBS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	6'-8'	0.91	1.3	19

SP-8 (11/30/15)		
Depth (BBS)	Chlorinated VOCs	ND
14'-16'		

SP-6		
Chlorinated VOCs	Depth (BGS)	mg/Kg
Tetrachloroethylene	4'-6'	ND
	14'-16'	
	26'-28'	
	32'-34'	

SP-14 (11/24/15)				
Chlorinated VOCs	Depth (BGS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	33'-35'	0.026	1.3	19

SP-25 (10/12/16)				
Chlorinated VOCs	Depth (BGS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	22'-24'	0.37	1.3	19
	28'-30'	0.30		

SP-21 (3/21/16)				
Chlorinated VOCs	Depth (BGS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	32'-34'	0.11	1.3	19

SP-13 (12-1-15)		
Depth (BGS)	Chlorinated VOCs	ND
33'-35'		

SP-16 (12-1-15)		
Depth (BGS)	Chlorinated VOCs	ND
26'-28'		

SP-15 (11/24/15)				
Chlorinated VOCs	Depth (BGS)	mg/Kg	USCO	RRSCO
cis-1,2-Dichloroethylene	24'-26'	0.0057	0.25	500
Tetrachloroethylene	33'-35'	0.020	1.3	19

SP-19 (3/22/16)				
Chlorinated VOCs	Depth (BGS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	30'-32'	0.13	1.3	19

SP-17 (3/22/16)				
Chlorinated VOCs	Depth (BGS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	30'-32'	0.012	1.3	19

SP-18 (3/21/16)				
Chlorinated VOCs	Depth (BGS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	16'-18'	4.4	1.3	19
	30'-32'	3.2		

SP-24 (10/12/16)				
Chlorinated VOCs	Depth (BGS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	20'-22'	0.68	1.3	19
	28'-30'	1.90		

SP-23 (10/12/16)				
Chlorinated VOCs	Depth (BGS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	22'-24'	2.1	1.3	19
	28'-30'	0.53		

SP-22 (10/12/16)				
Chlorinated VOCs	Depth (BGS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	6'-8'	2.3	1.3	19
	28'-30'	0.0073		
Trichloroethylene	6'-8'	2.10	1.3	21
	28'-30'	0.0030		

SP-20 (3/21/16)				
Chlorinated VOCs	Depth (BGS)	mg/Kg	USCO	RRSCO
Tetrachloroethylene	10'-12'	2.4	1.3	19
	30'-32'	0.17		

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



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77-57 Vleigh Pl
Flushing, NY
HTE Job# 160113

Drawn By: C.O.
Reviewed By: P.M.
Approved By: M.R.
Date: 07/17/17
Scale: AS NOTED

TITLE:

FIGURE 6: SPIDER MAP OF CVOCs IN EXCEEDANCE OF TRACK 1 SCOs IN SOIL



SP-12 (12/1/15)				
PESTICIDES	Depth (BBS)	mg/Kg	USCO	RSCO
4,4'-DDT	18' - 20'	0.00171	0.0033	47

SP-11 (12/1/15)				
PESTICIDES	Depth (BBS)	mg/Kg	USCO	RSCO
4,4'-DDE	18' - 20'	0.0175	0.0033	62
4,4'-DDT	18' - 20'	0.026	0.0033	47

SP-10 (12/1/15)		
Depth (BBS)	PESTICIDES	ND
18'-20'		

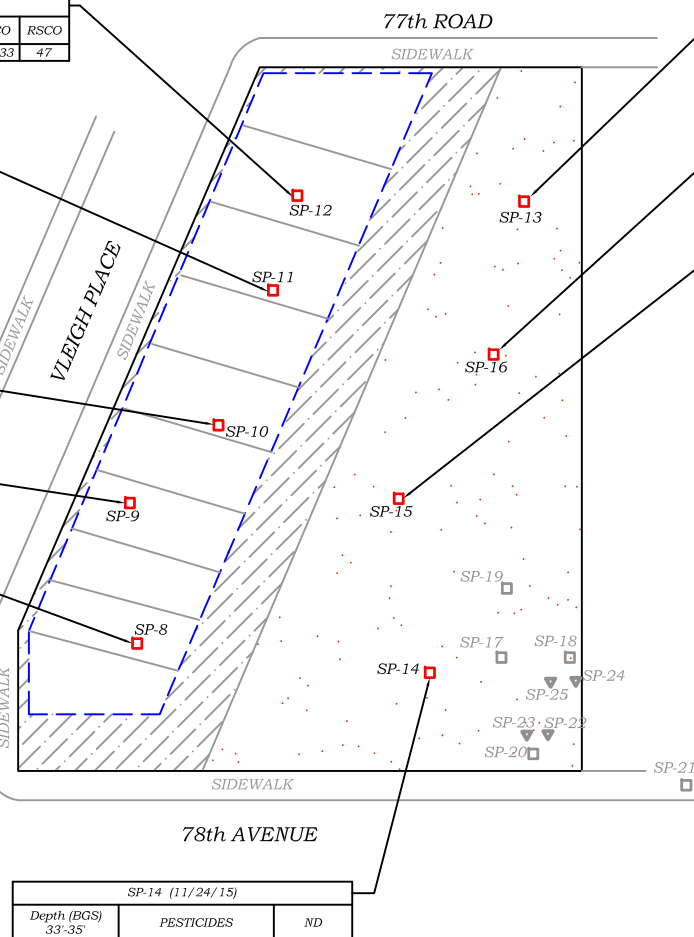
SP-9 (11/30/15)		
Depth (BBS)	PESTICIDES	ND
18'-20'		

SP-8 (11/30/15)		
Depth (BBS)	PESTICIDES	ND
14'-16'		

SP-13 (12/1/15)		
Depth (BGS)	PESTICIDES	ND
33'-35'		

SP-16 (12/1/15)		
Depth (BGS)	PESTICIDES	ND
26'-28'		

SP-15 (11/24/15)		
Depth (BGS)	PESTICIDES	ND
24'-26' & 33'-35'		



LEGEND:

- ▼ SOIL PROBE LOCATIONS (SP) - INSTALLED OCTOBER 2016
- SOIL PROBE LOCATIONS (SP) - INSTALLED MARCH 2016
- BASEMENT PARTITION
- mg/Kg MILLIGRAMS PER KILOGRAM
- USCO UNRESTRICTED USE SOIL CLEANUP OBJECTIVES
- RRSCO RESTRICTED RESIDENTIAL USE SOIL CLEANUP OBJECTIVES
- ND NONE DETECTED
- BGS BELOW GRADE SURFACE
- BBS BELOW BASEMENT SLAB
- SHADED VALUES EXCEED USCO
- ▼□ SOIL PROBE LOCATIONS NOT TARGETED FOR THIS SAMPLE ARE SHOWN IN GRAY

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



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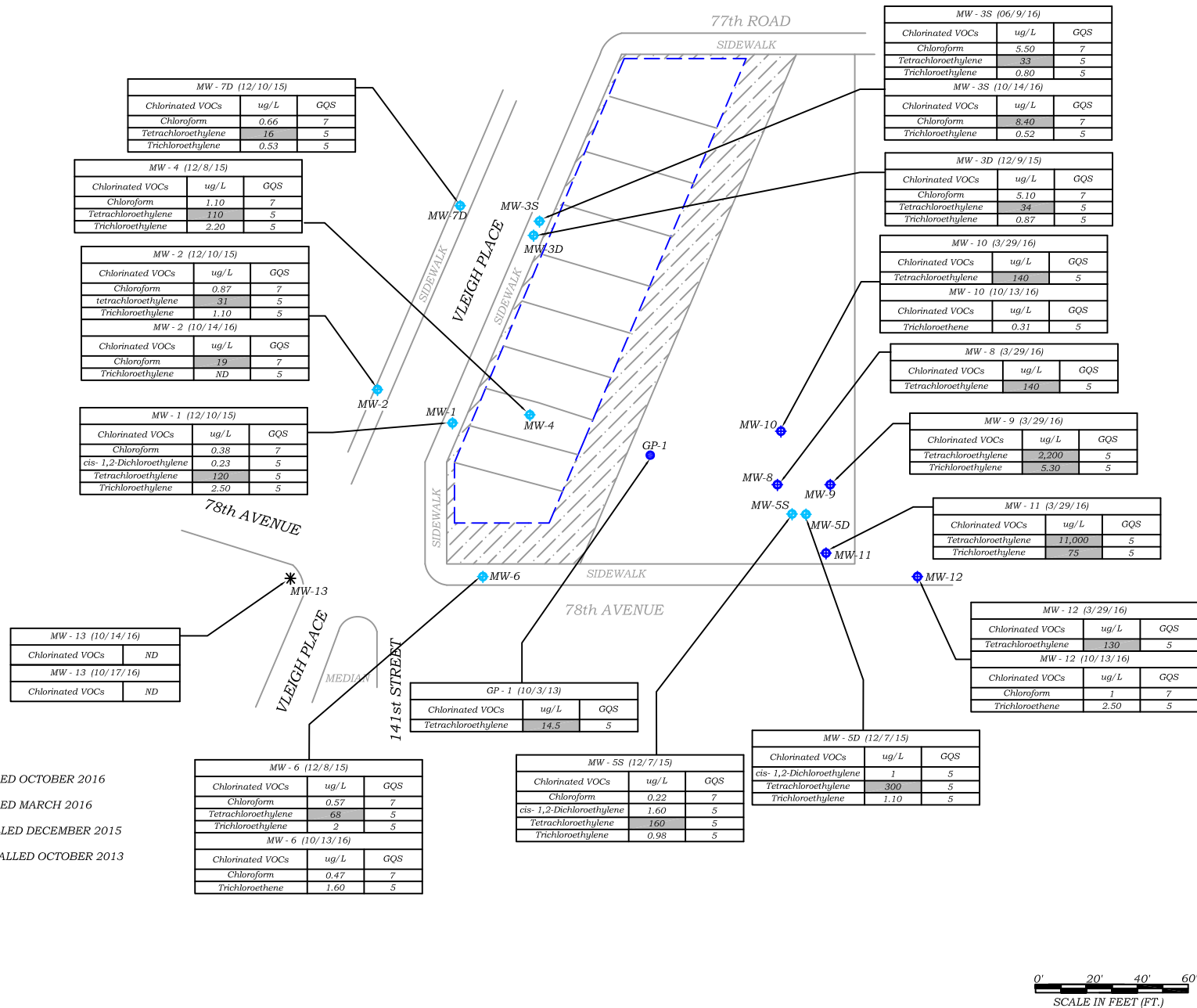
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FIGURE 7: SPIDER MAP OF PESTICIDES IN EXCEEDANCE OF TRACK 1 SCOs IN SOIL



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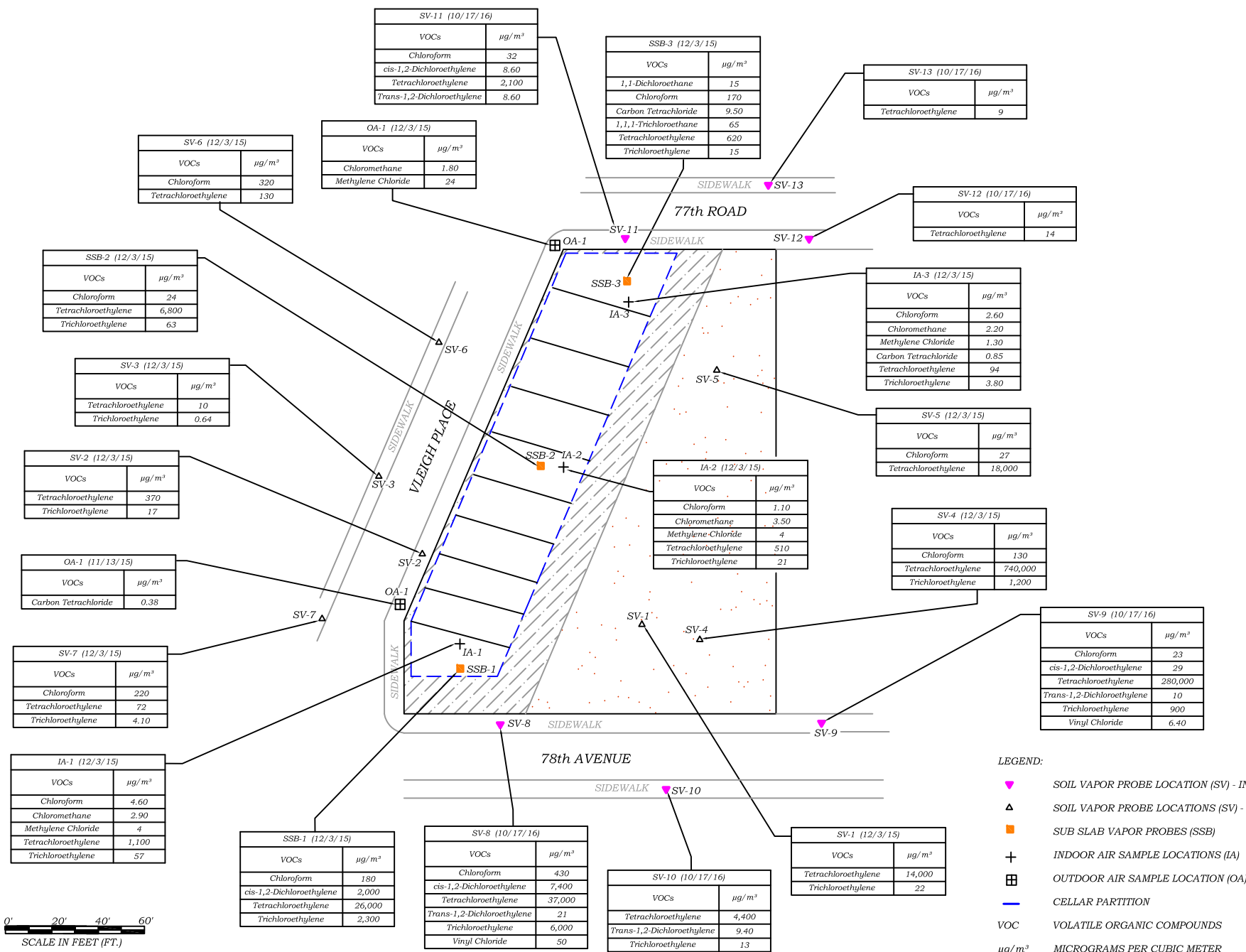
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FIGURE 8: SPIDER MAP OF CVOCs IN EXCEEDANCE OF GA STANDARD IN GROUNDWATER



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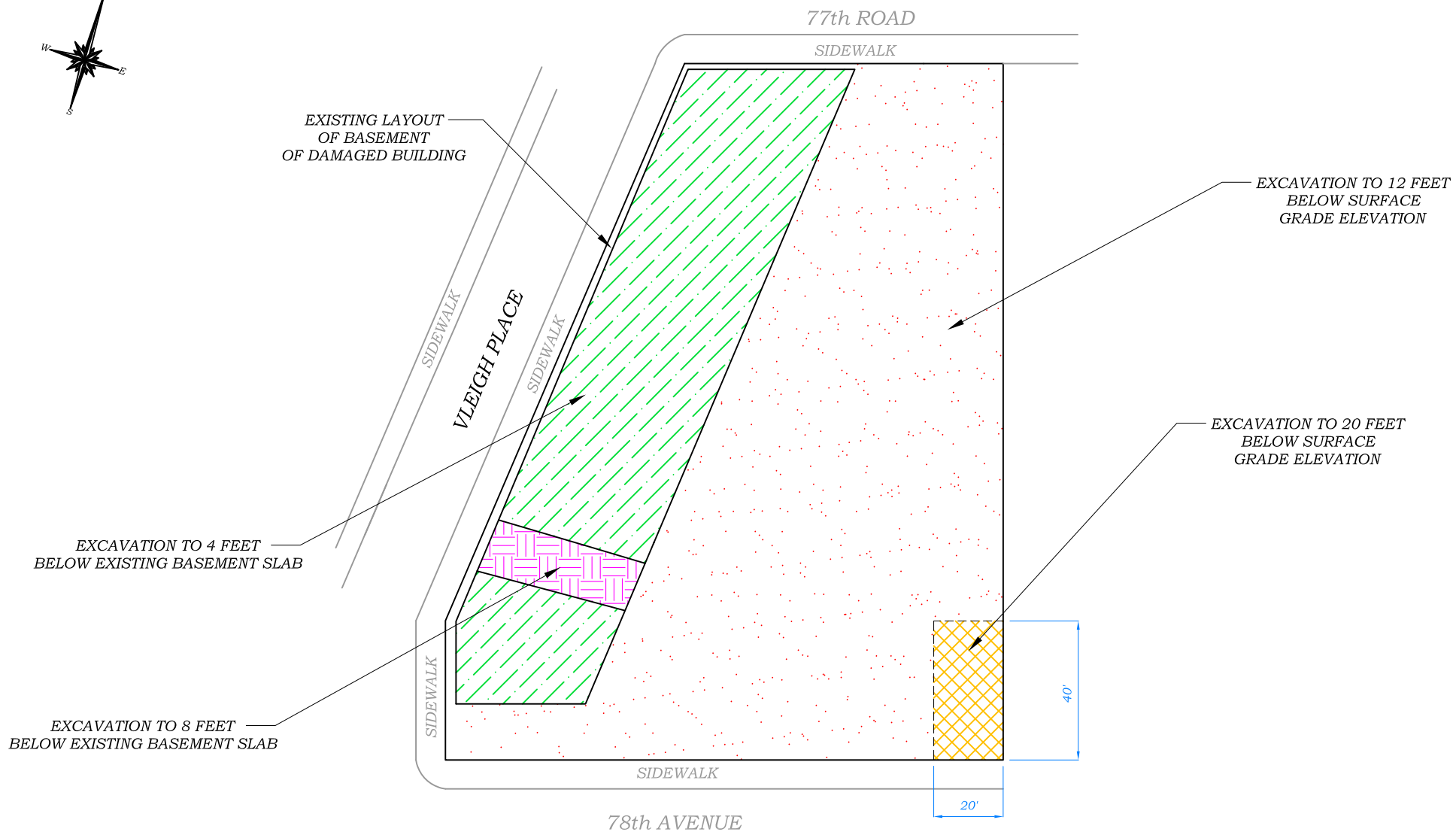
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FIGURE 9: SPIDER MAP OF SOIL VAPOR / SUB-SLAB VAPOR DATA



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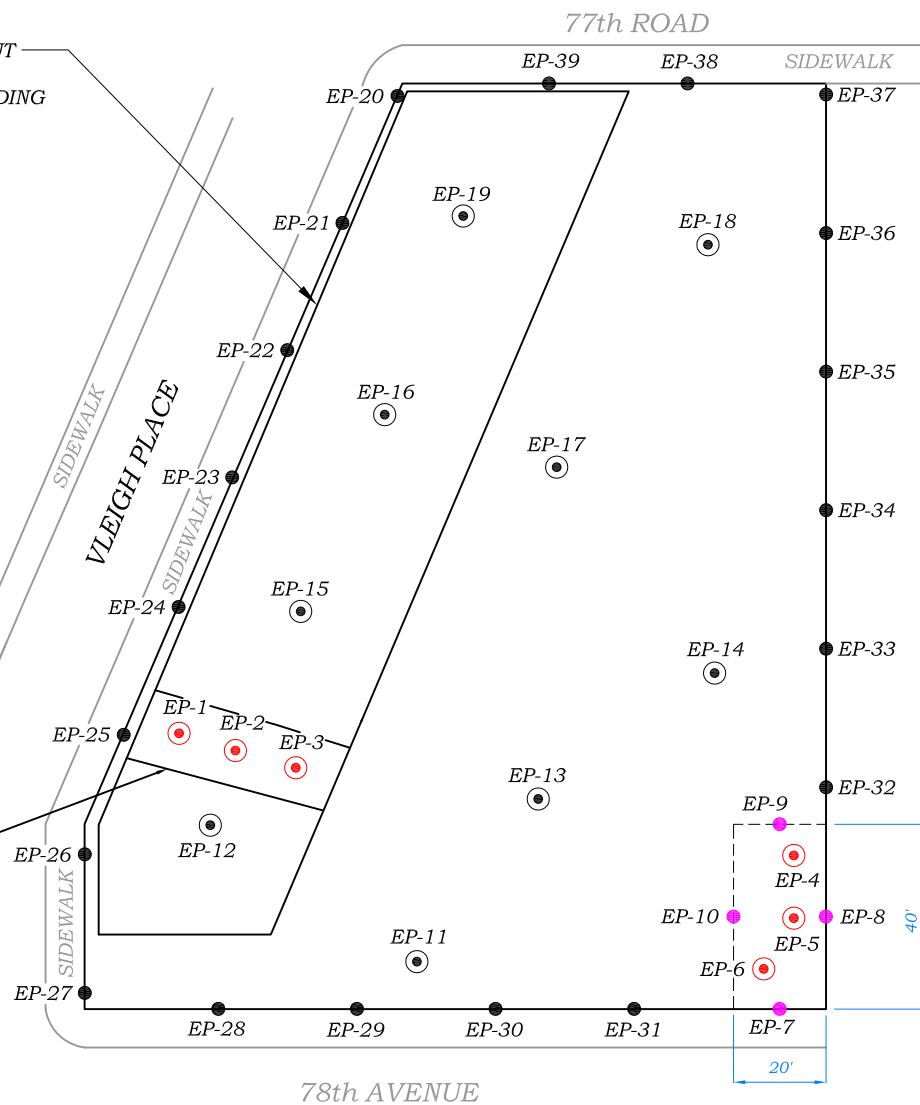
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Reviewed By: P.M.
Approved By: M.R.
Date: 10/17/17
Scale: AS NOTED

TITLE:

FIGURE 10: MAP OF SITE EXCAVATION DEPTH

EXISTING LAYOUT
OF BASEMENT
OF DAMAGED BUILDING

FORMER
LOCATION
OF
PARAGON
CLEANERS



LEGEND:

END POINT SAMPLES TARGETING CVOC CLEAN UP

● BOTTOM SAMPLES (EP)

● SIDEWALL SAMPLES (EP)

END POINT SAMPLES TARGETING SITE CLEAN UP OBJECTIVE

● BOTTOM SAMPLES (EP)

● SIDEWALL SAMPLES (EP)



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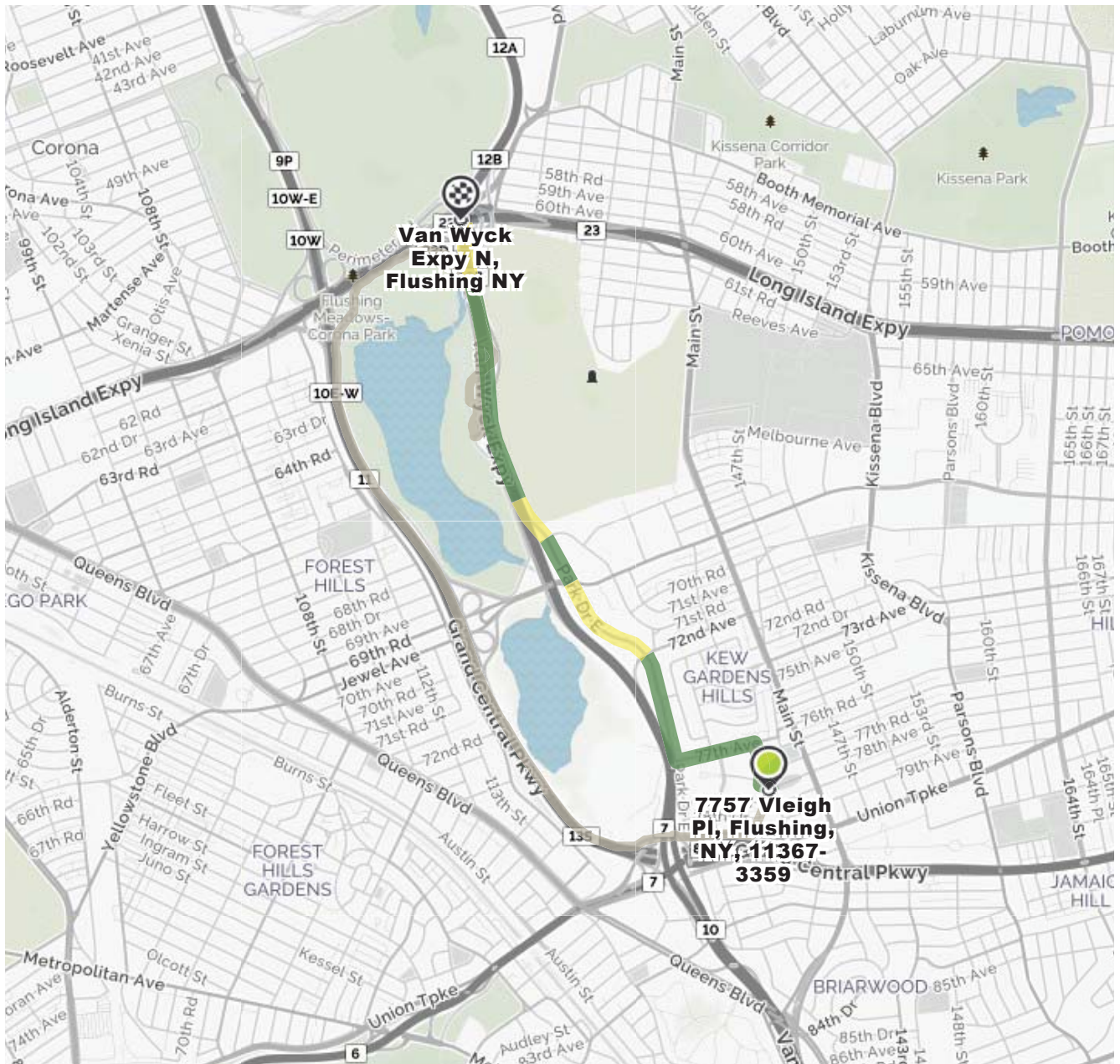
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Date: 10/13/17
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TITLE:

FIGURE 11: END POINT SAMPLING MAP

Figure 12: Trucks Transport Routes



TABLES

Table 1 - Summary of Soil and Sedeiment Sampling Locations, Depth and Analyses

Soil Probe ID	Physical Location	Specific Location	Soil Characterization Depth (Feet)	Samples Chosen For Analysis (Feet)	Sample Selection Criteria	Analytical Methods	
SP-1	On-Site - basement	Western portion of drcyleaners	0-12 (bbs)	4-6 (bbs)	Elevated PID	*TCL VOCs via EPA Method 8260	
SP-2		Central portion of drcyleaners	0-12 (bbs)	4-6 (bbs)			
SP-3		Eastern portion of drcyleaners	0-12 (bbs)	0-2 (bbs)			
SP-3a		Immediate vicinity of SP-3	0-24 (bbs)	2-4	Shallow PCE impact in prior Invsestigation		
				10-12			
				16-18			
				20-22			
SP-4		Southeast of SP-3	0-12 (bbs)	0-2			4-6
				4-6			
SP-5		Southwest of SP-3	0-12 (bbs)	0-2			4-6
	4-6						
SP-6	On-Site - parking lot	East -adjacent to dryleaner/ immediate vicinity of GP-1	0-34 (bgs)	4-6	Vertical delineation of PCE impact		
				14-16			
				26-28			
				32-34			
SP-7	Off-Site - adjacent to sensitive receptor	Sidewalk across western boundary of drycleaner	0-30 (bgs)	14-16	Corresponding depth of PCE impact beneath drycleaner		
				28-30			
SP-8	On-Site - basement	Southwestern portion of basement	8-24 (bbs)	22-24	Deepest dry sample	*TCL VOCs via EPA Method 8260 *TCL SVOCs via EPA Method 8270 * Pesticides via EPA Method 8081 * Herbicides via EPA Method 8151 * Polychlorinated biphenyls via EPA Method 8082 *TAL Metals via EPA Method 6010 & EPA Method 7471 for Mercury	
SP-9		Southwestern portion of basement	8-28 (bbs)	26-28	Deepest dry sample		
SP-10		West-central portion of basement		26-28			
SP-11		Northwestern portion		26-28			
SP-12		Northwestern portion of basement		26-28			
SP-13	On-Site - parking lot	Northeastern portion of open area	0-35 (bgs)	33-35			
SP-14		Southeastern portion of open area		33-35			
SP-15		East-central portion of open area		24-26	Elevated PID		
				33-35	Deepest dry sample		
SP-16		East-central portion of open area		26-28	Moist soil layer		
SP-17		Southeastern portion-location of SV-4	0-34 (bgs)	30-32	Deepest dry sample	*TCL VOCs via EPA Method 8260	
SP-18		Southeastern portion - north of SV-4	0-32 (bgs)	16-18	Elevated PID		
				30-32	Deepest dry sample		
SP-19		East-central portion – east of SV-4	0-34 (bgs)	30-32	Deepest dry sample		
SP-20		East-central portion - southeast of MW-5	0-32 (bgs)	10-12	Elevated PID		
	30-32			Deepest dry sample			
SP-21	Off-Site - adjacent upgradient	Sidewalk - 30 feet southeast of SP-20		32-34	Deepest dry sample		
SP-22	On-Site - parking lot	5-foot step-out northeast of SP-20		6-8	Elevated PID		
				28-30	Deepest dry sample		
		5-foot step-out northwest of SP-20		22-24	Elevated PID		
				28-30	Deepest dry sample		
		5-foot step-out southeast of SP-18		20-22	Elevated PID		
				28-30	Deepest dry sample		
		SP-24		5-foot step-out southwest of SP-18	22-24	Elevated PID	
			28-30		Deepest dry sample		

REC=Reconized Environmental Condition identified in Phase I Environmental Site Assessment

PCE=tetrachloroethylene

bbs=below basement slab elevation

bgs=below grade surface elevation

Table 2 - Summary of Groundwater Monitoring Well Sampling Locations and Analyses

Monitoring Well (MW) ID	Physical Location	Specific Location	Screen Depth Interval (Feet)	Analysis
GP-1	On-Site - parking lot	East-adjacent to drycleaners	Not Applicable	*TCL VOCs via EPA Method 8260
MW-1	Off-Site	West-adjacent to drycleaners	30-55	*TCL VOCs via EPA Method 8260 *TCL SVOCs via EPA Method 8270 * Pesticides via EPA Method 8081 * Herbicides via EPA Method 8151 * Polychlorinated biphenyls via EPA Method 8082 *TAL Metals via EPA Method 6010 & EPA Method 7471 for Mercury
MW-2	Off-Site - crossgradient & adjacent to sensitive receptor	Sidewalk across western boundary of drycleaner	32-42	
MW-3 (S &D)	On-Site - parking lot	East-adjacent sidewalk- within 93 feet north of MW-1	S = 27-37 D = 37-42	
MW-4	On-Site - basement	Eastern portion of drcyleaners	24-31	
MW-5 (S&D)	On-Site - parking lot	Southeastern portion of parking lot	S = 30-40 D = 40-46	
MW-6	Off-Site - adjacent crossgradient	East-adjacent to Site	27-42	
MW-7 (D)	Off-Site - downgradient & adjacent to sensitive receptor	Sidewalk across northwestern boundary of Site	D = 37-42	
MW-8	On-Site - parking lot	Southeastern portion - location of SV-4 at SP-17	28-43	*TCL VOCs via EPA Method 8260
MW-9		Southeastern portion - north of SV-4 at SP-18	28-43	
MW-10		Southeastern portion - east of SV-4 area at SP-19	28-43	
MW-11		Southeastern portion - southeast of MW-5 at SP-20	28-45	
MW-12	Off-Site - adjacent upgradient	Southeast-adjacent sidewalk - 30 feet southeast of MW-11	33-48	
MW-13	Off-Site - Crossgradient	Sidewalk across southwest Site boundary	27-47	

S=Shallow

D=Deep

Table 3 - Summary of Soil Vapor Sampling Locations and Analyses

Soil Vapor Point ID	Physical Location	Specific Location	Sample Collection Depth (Feet)	Analysis
SV-1	On-Site - parking lot	East of dryleaner - immediate vicinity of GP-1	6	* VOCs and via EPA Method TO-15
SV-2	Off-Site-adjacent to sensitive receptor	Sidewalk across western boundary of drycleaner		
SV-3		Sidewalk across northwern boundary of drycleaner		
SV-4	On-Site - parking lot	Southeastern portion of Site	10	
SV-5				
SV-6	Off-Site-adjacent to sensitive receptor	West-adjacent sidewalk within 132 feet north of SV-3		
SV-7		West-adjacent sidewalk within 20 feet south of SV-3		
SV-8	Off-Site	South-adjacent sidewalk in the vicinity of MW-6		
SV-9		South-adjacent sidewalk in the vicinity of MW-12		
SV-10	Off-Site-adjacent to sensitive receptor	Sidewalk across the southern Site boundary		
SV-11	Off-Site	North-adjacent sidewalk		
SV-12		North-adjacent sidewalk and within 10 feet to the northeast of Site		
SV-13	Off-Site-adjacent to sensitive receptor	Sidewalk across the northern Site boundary		
SSB-1/IA-1	On-Site - basement	Southern portion of building	Sub-slab	
SSB-2/IA-2		Central portion of buildinbg		
SSB-3/IA-3		Northern portion of building		
OA-1	Outdoor	Ambient upwind	Not Applicable	

Table 4 - Summary of Sediment Sampling Locations and Analyses

Sample ID	Physical Location	Specific Location	Analytical Methods
DW-1	On-Site - basement	Northwest of common alley	*TCL VOCs via EPA Method 8260

Table 5
Groundwater Monitoring Gauging and Surveying Results
77-57 Vleigh Place, Flushing NY

Well ID	Casing Elevation (Nov 1, 2016)	DTP	DTW (December 2015)	DTW (March 2016)	DTW (May 2016)	DTW (October 2016)	Water Table Elevation (December 2015)	Water Table Elevation (March 2016)	Water Table Elevation (May 2016)	Water Table Elevation (October 2016)
MW-1	80.71	ND	32.2	NM	32.66	32.9	48.51	NM	48.05	47.81
MW-2	80.83	ND	31.72	NM	31.83	32.45	49.11	NM	49	48.38
MW-3S	79.6	ND	30.08	NM	29.84	31.94	49.52	NM	49.76	47.66
MW-3D	79.54	ND	31.37	NM	31.87	30.9	48.17	NM	47.67	48.64
MW-4	70.73	ND	21.65	NM	22.2	22.44	49.08	NM	48.53	48.29
MW-5S	83.04	ND	32.8	NM	33.2	33.62	50.24	NM	49.84	49.42
MW-5D	83.1	ND	35.01	NM	33	33.39	48.07	NM	50.1	49.69
MW-6	83.14	ND	34.14	NM	34.55	34.83	49	NM	48.59	48.31
MW-7D	79.88	ND	30.94	NM	31.42	31.69	48.94	NM	48.46	48.19
MW-8	81.76	ND	NA	32.8	33.1	33.41	NA	48.98	48.66	48.37
MW-9	82.8	ND	NA	32.53	35.75	33.18	NA	50.27	47.05	49.64
MW-10	80.88	ND	NA	32.3	32.33	32.63	NA	48.58	48.55	48.27
MW-11	84.19	ND	NA	33.57	33.75	33.17	NA	50.62	50.44	51.02
MW-12	84.95	ND	NA	36	36.3	36.6	NA	48.95	48.65	48.37
MW-13	82.36	NA	NA	NA	NA	33.58	NA	NA	NA	48.78

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 6
Soil Samples Analytical Results for VOCs
77-57 Vleigh Place, Flushing, NY

Sample ID	SP-1 (4'-6')		SP-2 (4'-6')		SP-3 (0'-2')		SP-3a (2'-4')		SP-3a (10'-12')		SP-3a (16'-18')		SP-3a (20'-22')		SP-4 (0'-2')		SP-4 (4'-6')		SP-5 (0'-2')		SP-5 (4'-6')		SP-6 (4'-6')		SP-6 (14'-16')		SP-6 (26'-28')		SP-6 (32'-34')		SP-7 (14'-16')		SP-7 (28'-30')		NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives	Restricted Use Soil Cleanup Objectives (6 NYC RR Pt.375-6.8b) - Restricted Residential
Sampling Date	10/2/2013		10/2/2013		10/2/2013		3/27/2014		3/27/2014		3/27/2014		3/27/2014		1/30/2014		1/30/2014		1/30/2014		1/30/2014		3/27/2014		3/27/2014		3/27/2014		3/27/2014		11/22/2014		11/22/2014			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result			
Units	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/Kg	mg/Kg
1,1,1,2-Tetrachloroethane	<0.902	U	<1.05	U	<1.29	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	NS	NS
1,1,1-Trichloroethane	<0.902	U	<1.05	U	<1.29	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	0.68	100
1,1,2,2-Tetrachloroethane	<1.80	U	<2.10	U	<2.58	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	NS	NS
1,1,2-Trichloro-1,2,2-trifluoroeth	NT		NT		NT		0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	NS	NS
1,1,2-Trichloroethane	<1.80	U	<2.10	U	<2.58	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	NS	NS
1,1-Dichloroethane	<1.80	U	<2.10	U	<2.58	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	0.27	26
1,1-Dichloroethylene	<0.902	U	<1.05	U	<1.29	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	0.33	100
1,1-Dichloropropylene	<0.902	U	<1.05	U	<1.29	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	NS	NS
1,2,3-Trichlorobenzene	<1.80	U	<2.10	U	<2.58	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	NS	NS
1,2,3-Trichloropropane	<4.51	U	<5.24	U	<6.46	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	NS	NS
1,2,4-Trichlorobenzene	NT		NT		NT		0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	NS	NS
1,2,4-Trimethylbenzene	0.633	U	0.003	U	<1.29	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	3.6	52
1,2-Dibromo-3-chloropropane	<1.80	U	<2.10	U	<2.58	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	NS	NS
1,2-Dibromoethane	<1.80	U	<2.10	U	<2.58	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	NS	NS
1,2-Dichlorobenzene	<0.902	U	<1.05	U	<1.29	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	1.1	100
1,2-Dichloroethane	<0.902	U	<1.05	U	<1.29	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	0.02	3.1
1,2-Dichloroethane-d4	NT		NT		NT		0.050		0.049		0.048		0.049		NT		NT		NT		NT		0.050		0.054		0.052		0.052		NT		NT		NS	NS
1,2-Dichloropropane	<0.902	U	<1.05	U	<1.29	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	NS	NS
1,3,5-Trimethylbenzene	0.267	U	<2.10	U	<2.58	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	8.4	52
1,3-Dichlorobenzene	<1.80	U	<2.10	U	<2.58	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	2.4	49
1,3-Dichloropropane	<0.902	U	<1.05	U	<1.29	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	NS	NS
1,4-Dichlorobenzene	<0.902	U	<1.05	U	<1.29	U	0.0023	U	0.0035	U	0.0022	U	0.0021	U	<0.0025	U	<0.0024	U	<0.0027	U	<0.0028	U	0.0020	U	0.0047	U	0.0023	U	0.0024	U	0.0012	U	0.0016	U	1.8	13
1,4-Dioxane	NT		NT		NT		0.046	U	0.069	U	0.043	U	0.043	U	<0.049	U	<0.048	U	<0.054	U	<0.056	U	0.040	U	0.093	U										

Table 6 (Cont.)
Soil Samples Analytical Results for VOC's
77-57 Vleigh Place, Flushing NY

Sample ID	SP-8 (22-24)		SP-9 (26-28)		SP10 (26-28')		SP11 (26-28')		SP12 (26-28)		SP13 (33-35')		SP-14 (33-35)		SP-15 (24-26)		SP-15 (33-35)		SP16 (26-28')		SP-17 (30-32 ft)		SP-18 (16-18 ft)		SP-18 (30-32)		SP-19 (30-32 ft)		SP-20 (10-12 ft)		SP-20 (30-32 ft)		NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives	Restricted Use Soil Cleanup Objectives (6 NYC RR Pt.375-6.8b) - Restricted Residential
Sampling Date	11/30/2015		11/30/2015		12/1/2015		12/1/2015		12/2/2015		12/1/2015		11/24/2015		11/24/2015		11/24/2015		12/1/2015		3/22/2016		3/21/2016		3/21/2016		3/22/2016		3/21/2016		3/21/2016			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result			
Units	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/Kg	Q	mg/Kg	Q	mg/Kg	Q	mg/Kg	Q	mg/Kg	Q	mg/Kg	Q	mg/Kg	
1,1,1,2-Tetrachloroethane	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	NS	NS
1,1,1-Trichloroethane	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	0.68	100
1,1,2,2-Tetrachloroethane	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	NS	NS
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	NS	NS
1,1,2-Trichloroethane	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	NS	NS
1,1-Dichloroethane	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	0.27	26
1,1-Dichloroethylene	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	0.33	100
1,1-Dichloropropylene	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	NS	NS
1,2,3-Trichlorobenzene	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	NS	NS
1,2,3-Trichloropropane	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	NS	NS
1,2,4-Trichlorobenzene	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	NS	NS
1,2,4-Trimethylbenzene	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	3.6	52
1,2-Dibromo-3-chloropropane	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	NS	NS
1,2-Dibromoethane	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	NS	NS
1,2-Dichlorobenzene	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	1.1	100
1,2-Dichloroethane	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	0.02	3.1
1,2-Dichloroethane-d4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NS	NS
1,2-Dichloropropane	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	NS	NS
1,3,5-Trimethylbenzene	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	8.4	52
1,3-Dichlorobenzene	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	2.4	49
1,3-Dichloropropane	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	NS	NS
1,4-Dichlorobenzene	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U	<0.0021	U	<0.0024	U	<0.0027	U	<0.0033	U	<0.22	U	<0.23	U	<0.0041	U	<0.74	U	<0.003	U	1.8	13
1,4-Dioxane	<0.064	U	<0.057	U	<0.065	U	<0.053	U	<0.06	U	<0.075	U	<0.051	U	<0.042	U	<0.047	U	<0.053	U	<0.065	U	<4.3	U	<4.6	U	<0.082	U	<15	U	<0.061	U	0.1	13
2,2-Dichloropropane	<0.0032	U	<0.0029	U	<0.0033	U	<0.0027	U	<0.003	U	<0.0037	U	<0.0026	U																				

Table 6 (Cont.)
Soil Samples Analytical Results for VOC's
77-57 Vleigh Place, Flushing NY

Sample ID	SP-21 (32'-34')		SP-22 (6'-8')		SP-22 (28'-30')		SP-23 (22'-24')		SP-23 (28'-30')		SP-24 (20'-22')		SP-24 (28'-30')		SP-25 (22'-24')		SP-25 (28'-30')		NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives	Restricted Use Soil Cleanup Objectives (6 NYC RR Pt.375-6.8b) - Restricted Residential
Sampling Date	3/21/2016		10/12/2016		10/12/2016		10/12/2016		10/12/2016		10/12/2016		10/12/2016		10/12/2016		10/12/2016			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result		Result		Result		Result		Result		Result		Result		Result		Result			
Units	mg/Kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/Kg	mg/Kg
1,1,1,2-Tetrachloroethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
1,1,1-Trichloroethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	0.68	100
1,1,2,2-Tetrachloroethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon)	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
1,1,2-Trichloroethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
1,1-Dichloroethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	0.27	26
1,1-Dichloroethylene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	0.33	100
1,1-Dichloropropylene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
1,2,3-Trichlorobenzene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
1,2,3-Trichloropropane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
1,2,4-Trichlorobenzene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
1,2,4-Trimethylbenzene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	3.6	52
1,2-Dibromo-3-chloropropane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
1,2-Dibromoethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
1,2-Dichloroethane-d4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NS	100
1,2-Dichlorobenzene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	1.1	3.1
1,2-Dichloroethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	0.02	NS
1,2-Dichloropropane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
1,3,5-Trimethylbenzene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	8.4	52
1,3-Dichlorobenzene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	2.4	49
1,3-Dichloropropane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
1,4-Dichlorobenzene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	1.8	13
1,4-Dioxane	<0.045	U	0.13	U	0.045	U	0.051	U	0.047	U	0.049	U	0.070	U	0.051	U	0.052	U	0.1	13
2,2-Dichloropropane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
2-Butanone	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	0.12	100
2-Chlorotoluene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
4-Chlorotoluene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Acetone	<0.0045	U	0.013	U	0.010		0.0051	U	0.012		0.0049	U	0.0070	U	0.0051	U	0.0052	U	0.05	100
Benzene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	0.06	4.8
Bromobenzene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Bromochloromethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Bromodichloromethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Bromoform	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Bromomethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Carbon tetrachloride	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	0.76	2.4
Chlorobenzene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	1.1	100
Chloroethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Chloroform	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	0.37	49
Chloromethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
cis-1,2-Dichloroethylene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	0.25	100
cis-1,3-Dichloropropylene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Dibromochloromethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Dibromomethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Dichlorodifluoromethane	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Ethyl Benzene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	1	41
Hexachlorobutadiene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Isopropylbenzene	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U	NS	NS
Methyl tert-butyl ether (MTBE)	<0.0023	U	0.0063	U	0.0022	U	0.0025	U	0.0024	U	0.0024	U	0.0035	U	0.0025	U	0.0026	U		

Table 6 (cont.) Soil Samples Analytical Results for SVOC's 77-57 Vleigh Place, Flushing NY																				NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives	Restricted Use Soil Cleanup Objectives (6 NYC RR Pt.375-6.8b) - Restricted Residential	
Sample ID	SP-8 (22'-24')		SP-9 (26'-28')		SP10 (26'-28')		SP11 (26'-28')		SP12 (26'-28')		SP13 (33'-35')		SP-14 (33'-35')		SP-15 (24'-26')		SP-15 (33'-35')		SP16 (26'-28')			
Sampling Date	11/30/2015		11/30/2015		12/1/2015		12/1/2015		12/2/2015		12/1/2015		11/24/2015		11/24/2015		11/24/2015		12/1/2015			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		mg/Kg	mg/Kg
Units	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q		
1,2,4-Trichlorobenzene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0426	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
1,2-Dichlorobenzene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
1,3-Dichlorobenzene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
1,4-Dichlorobenzene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
2,4,5-Trichlorophenol	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
2,4,6-Trichlorophenol	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
2,4-Dichlorophenol	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
2,4-Dimethylphenol	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
2,4-Dinitrophenol	<0.0456	U	<0.0422	U	<0.0843	U	<0.0911	U	<0.0848	U	<0.0848	U	<0.049	U	<0.0462	U	<0.0487	U	<0.0851	U	NS	NS
2,4-Dinitrotoluene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
2,6-Dinitrotoluene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
2-Chloronaphthalene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
2-Chlorophenol	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
2-Methylnaphthalene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
2-Methylphenol	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
2-Nitroaniline	<0.0456	U	<0.0422	U	<0.0843	U	<0.0911	U	<0.0848	U	<0.0848	U	<0.049	U	<0.0462	U	<0.0487	U	<0.0851	U	NS	NS
2-Nitrophenol	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
3- & 4-Methylphenols	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
3,3'-Dichlorobenzidine	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
3-Nitroaniline	<0.0456	U	<0.0422	U	<0.0843	U	<0.0911	U	<0.0848	U	<0.0849	U	<0.049	U	<0.0462	U	<0.0487	U	<0.0851	U	NS	NS
4,6-Dinitro-2-methylphenol	<0.0456	U	<0.0422	U	<0.0843	U	<0.0911	U	<0.0848	U	<0.0849	U	<0.049	U	<0.0462	U	<0.0487	U	<0.0851	U	NS	NS
4-Bromophenyl phenyl ether	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
4-Chloro-3-methylphenol	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
4-Chloroaniline	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
4-Chlorophenyl phenyl ether	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
4-Nitroaniline	<0.0456	U	<0.0422	U	<0.0843	U	<0.0911	U	<0.0848	U	<0.0849	U	<0.049	U	<0.0462	U	<0.0487	U	<0.0851	U	NS	NS
4-Nitrophenol	<0.0456	U	<0.0422	U	<0.0843	U	<0.0911	U	<0.0848	U	<0.0849	U	<0.049	U	<0.0462	U	<0.0487	U	<0.0851	U	NS	NS
Acenaphthene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	20	100
Acenaphthylene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	100	100
Aniline	<0.0913	U	<0.0844	U	<0.169	U	<0.182	U	<0.17	U	<0.17	U	<0.0981	U	<0.0924	U	<0.0974	U	<0.17	U	NS	NS
Anthracene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	100	100
Benzo(a)anthracene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	1	1
Benzo(a)pyrene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	1	1
Benzo(b)fluoranthene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	1	1
Benzo(g,h,i)perylene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	100	100
Benzo(k)fluoranthene	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	0.8	3.9
Benzyl alcohol	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
Benzyl butyl phthalate	<0.0229	U	<0.0211	U	<0.0423	U	0.1	D	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
Bis(2-chloroethoxy)methane	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
Bis(2-chloroethyl)ether	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
Bis(2-chloroisopropyl)ether	<0.0229	U	<0.0211	U	<0.0423	U	<0.0456	U	<0.0425	U	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
Bis(2-ethylhexyl)phthalate	<0.0229	U	<0.0211	U	<0.0423	U	0.191	D	0.0556	BD	<0.0425	U	<0.0246	U	<0.0231	U	<0.0244	U	<0.0426	U	NS	NS
Chrysene	<0.0229	U	<0.0211	U	<0.																	

Table 6 (cont.)																						
Soil Samples Analytical Results for Herbicides, Pesticides & PCBs																						
77-57 Vleigh Place, Flushing NY																						
Sample ID	SP-8 (22'-24')		SP-9 (26'-28')		SP10 (26'-28')		SP11 (26'-28')		SP12 (26'-28')		SP13 (33'-35')		SP-14 (33'-35')		SP-15 (24'-26')		SP-15 (33'-35')		SP16 (26'-28')		NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives	Restricted Use Soil Cleanup Objectives (6 NYC RR Pt.375-6.8b) - Restricted Residential
Sampling Date	11/30/2015		11/30/2015		12/1/2015		12/1/2015		12/2/2015		12/1/2015		11/24/2015		11/24/2015		11/24/2015		12/1/2015			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result		Result		Result		Result		Result		Result		Result		Result		Result		Result			
Units	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/Kg	mg/Kg
Herbicide																						
2,4,5-T	<0.0219	U	<0.0202	U	<0.0202	U	<0.0218	U	<0.0203	U	<0.0204	U	<0.0235	U	<0.0221	U	<0.0233	U	<0.0204	U	NS	NS
2,4,5-TP (Silvex)	<0.0219	U	<0.0202	U	<0.0202	U	<0.0218	U	<0.0203	U	<0.0204	U	<0.0235	U	<0.0221	U	<0.0233	U	<0.0204	U	3.8	100
2,4-D	<0.0219	U	<0.0202	U	<0.0202	U	<0.0218	U	<0.0203	U	<0.0204	U	<0.0235	U	<0.0221	U	<0.0233	U	<0.0204	U	NS	NS
Pesticides																						
4,4'-DDD	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	0.0033	13
4,4'-DDE	<0.0018	U	<0.00167	U	<0.00167	U	0.0175	D	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	0.0033	8.9
4,4'-DDT	<0.0018	U	<0.00167	U	<0.00167	U	0.026	D	0.00171	D	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	0.0033	7.9
Aldrin	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	0.005	0.097
alpha-BHC	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	0.02	0.48
alpha-Chlordane	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	0.094	4.2
beta-BHC	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	0.036	0.36
Chlordane, total	<0.0722	U	<0.0667	U	<0.0667	U	<0.0721	U	<0.0671	U	<0.0672	U	<0.0775	U	<0.0731	U	<0.077	U	<0.0673	U	NS	NS
delta-BHC	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	0.04	100
Dieldrin	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	0.005	0.2
Endosulfan I	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	2.4	24
Endosulfan II	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	2.4	24
Endosulfan sulfate	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	2.4	24
Endrin	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	0.014	11
Endrin aldehyde	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	NS	NS
Endrin ketone	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	NS	NS
gamma-BHC (Lindane)	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	0.1	1.3
gamma-Chlordane	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	NS	NS
Heptachlor	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	0.042	2.1
Heptachlor epoxide	<0.0018	U	<0.00167	U	<0.00167	U	<0.0018	U	<0.00168	U	<0.00168	U	<0.00194	U	<0.00183	U	<0.00193	U	<0.00168	U	NS	NS
Methoxychlor	<0.00902	U	<0.00834	U	<0.00834	U	<0.00901	U	<0.00839	U	<0.0084	U	<0.00969	U	<0.00913	U	<0.00963	U	<0.00842	U	NS	NS
Toxaphene	<0.0913	U	<0.0844	U	<0.0844	U	<0.0912	U	<0.0849	U	<0.085	U	<0.0981	U	<0.0924	U	<0.0974	U	<0.0852	U	NS	NS
PCB's																						
Aroclor 1016	<0.0182	U	<0.0168	U	<0.0168	U	<0.0182	U	<0.0169	U	<0.017	U	<0.0196	U	<0.0184	U	<0.0194	U	<0.017	U	NS	NS
Aroclor 1221	<0.0182	U	<0.0168	U	<0.0168	U	<0.0182	U	<0.0169	U	<0.017	U	<0.0196	U	<0.0184	U	<0.0194	U	<0.017	U	NS	NS
Aroclor 1232	<0.0182	U	<0.0168	U	<0.0168	U	<0.0182	U	<0.0169	U	<0.017	U	<0.0196	U	<0.0184	U	<0.0194	U	<0.017	U	NS	NS
Aroclor 1242	<0.0182	U	<0.0168	U	<0.0168	U	<0.0182	U	<0.0169	U	<0.017	U	<0.0196	U	<0.0184	U	<0.0194	U	<0.017	U	NS	NS
Aroclor 1248	<0.0182	U	<0.0168	U	<0.0168	U	<0.0182	U	<0.0169	U	<0.017	U	<0.0196	U	<0.0184	U	<0.0194	U	<0.017	U	NS	NS
Aroclor 1254	<0.0182	U	<0.0168	U	<0.0168	U	<0.0182	U	<0.0169	U	<0.017	U	<0.0196	U	<0.0184	U	<0.0194	U	<0.017	U	NS	NS
Aroclor 1260	<0.0182	U	<0.0168	U	<0.0168	U	<0.0182	U	<0.0169	U	<0.017	U	<0.0196	U	<0.0184	U	<0.0194	U	<0.017	U	NS	NS
Total PCBs	<0.0182	U	<0.0168	U	<0.0168	U	<0.0182	U	<0.0169	U	<0.017	U	<0.0196	U	<0.0184	U	<0.0194	U	<0.017	U	0.1	1

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

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

ND=analyte not detected at or above the level indicated

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

sample exceeds NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives

Table 6 (cont.) Soil Samples Analytical Results for Metals 77-57 Vleigh Place, Flushing NY																						
Sample ID	SP-8 (22'-24')		SP-9 (26'-28')		SP10 (26'-28')		SP11 (26'-28')		SP12 (26'-28')		SP13 (33'-35')		SP-14 (33'-35')		SP-15 (24'-26')		SP-15 (33'-35')		SP16 (26'-28')		NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives	Restricted Use Soil Cleanup Objectives (6 NYC RR Pt.375-6.8b) - Restricted Residential
Sampling Date	11/30/2015		11/30/2015		12/1/2015		12/1/2015		12/2/2015		12/1/2015		11/24/2015		11/24/2015		11/24/2015		12/1/2015			
Client Matrix	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil			
Compound	Result		Result		Result		Result		Result		Result		Result		Result		Result		Result			
Units	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/Kg	mg/Kg
Aluminum	5,490		3,000		2,420		5,450		2600		4,250		3,910		4,750		4,260		3,500		NS	NS
Antimony	<0.547	U	<0.506	U	<0.506	U	<0.546	U	<0.508	U	<0.509	U	<0.587	U	<0.553	U	<0.583	U	<0.51	U	NS	NS
Arsenic	1.54		<1.01	U	<1.01	U	<1.09	U	<1.02	U	<1.02	U	<1.17	U	<1.11	U	<1.17	U	<1.02	U	13	16
Barium	39		23.90		19.20		38.60		18.8		53		30.20		34.70		29.70		31.10		350	400
Beryllium	<0.109	U	<0.101	U	<0.101	U	<0.109	U	<0.102	U	<0.102	U	<0.117	U	<0.111	U	<0.117	U	<0.102	U	7.2	72
Cadmium	<0.328	U	<0.303	U	<0.303	U	<0.328	U	<0.305	U	<0.305	U	<0.352	U	<0.332	U	<0.35	U	<0.306	U	2.5	4.3
Calcium	6,150		796		818		1,050		1320		390		1,210		592		1,130		349		NS	NS
Chromium, Hexavalent	<0.547	U	<0.506	U	0.51	U	0.55	U	<0.508	U	0.51	U	0.59	U	0.55	U	0.58	U	0.51	U	1	110
Chromium, Trivalent	15.20		10.70		5.69		15.20		7.04		14.80		9.91		11.50		9.65		14.20		30	180
Cobalt	5.91		5.09		2.84		6.14		3.55		5.58		5.08		5.67		5.17		4.07		NS	NS
Copper	15.20		12.20		12.30		20.10		7.27		9.13		12.80		11.80		9.61		7.33		50	270
Iron	13,500		11,700		8,450		15,800		7360		11,900		9,620		12,700		10,000		18,400		NS	NS
Lead	6.69		2.22		2.14		3.69		1.99		2.47		5.34		3.26		2.33		4.28		63	400
Magnesium	1,920		1,770		1,250		1,620		1290		1,560		1,850		1,280		1,860		1,310		NS	NS
Manganese	182		271		142		283		188		341		255		91		302		122		1600	2,000
Mercury	<0.0361	U	<0.0334	U	<0.0334	U	<0.036	U	<0.0336	U	<0.0336	U	<0.0388	U	<0.0365	U	<0.0385	U	<0.0337	U	0.18	0.81
Nickel	11.40		13.60		6.07		12.10		7.29		8.84		9.19		10		10.50		7.41		30	310
Potassium	1,080		385		285		1,040		509		1,280		779		921		796		1,180		NS	NS
Selenium	2.67		1.66		1.70		2.32		<1.02	U	2.20		1.83		1.51		1.28		3.74		3.9	180
Silver	<0.547	U	<0.506	U	<0.506	U	<0.546	U	<0.508	U	<0.509	U	<0.587	U	<0.553	U	<0.583	U	<0.51	U	2	180
Sodium	169		89.20		107		132		106		86.20		377		103		139		61.40		NS	NS
Thallium	<1.09	U	<1.01	U	<1.01	U	<1.09	U	<1.02	U	<1.02	U	<1.17	U	<1.11	U	<1.17	U	<1.02	U	NS	NS
Vanadium	23.50		11.90		8.68		22.30		11.4		15.40		13.20		19.10		16.20		13.50		NS	NS
Zinc	26.50		14.70		12		26		12.8		20		21.50		23.20		18.80		15.90		109	10,000

NOTES:

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U=analyte not detected at or above the level indicated
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Table 7 Groundwater Samples Analytical Results for VOC's 77-57 Vleigh Place, Flushing NY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
Sample ID	GP-1			MW-1			MW-1			MW-2			MW-2			MW - 2			MW-3S			MW - 3S			MW-3D			MW-4			MW-5S			MW-5D			MW-6			MW - 6			MW-7D			MW-8			MW-9			MW-10			MW - 10			MW-11			MW-12			MW - 12			MW - 13			NYSDEC TOGS Standards and Guidance Values - GA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
Sampling Date	10/3/2013			2/4/2014			12/10/2015			11/23/2014			12/10/2015			10/14/2016			12/9/2015			10/14/2016			12/9/2015			12/8/2015			12/7/2015			10/13/2016			12/10/2015			3/29/2016			3/29/2016			3/29/2016			10/13/2016			3/29/2016			3/29/2016			10/13/2016			10/14/2016																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
Client Matrix	Water			Water			Water			Water			Water			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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		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		Result	Q		Result	Q		Result	Q		Result	Q		Result	Q		Result	Q		Result	Q</

Table 7 (Cont.)
Groundwater Samples Analytical Results for SVOC's
77-57 Vleigh Place, Flushing NY

Sample ID	MW-1		MW-2		MW-3S		MW-3D		MW-4		MW-5S		MW-5D		MW-6		MW-7D		MW-8		MW-9		MW-10		MW-11		MW-12		NYSDEC TOGS Standards and Guidance Values	
Sampling Date	12/10/2015		12/10/2015		12/9/2015		12/9/2015		12/8/2015		12/7/2015		12/7/2015		12/8/2015		12/10/2015		3/29/2016		3/29/2016		3/29/2016		3/29/2016		3/29/2016			
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			GA
Units	ug/L		ug/L	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
1,2,4-Trichlorobenzene	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		5	
1,2-Dichlorobenzene	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		3	
1,3-Dichlorobenzene	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		3	
1,4-Dichlorobenzene	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		3	
2,4,5-Trichlorophenol	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		1	
2,4,6-Trichlorophenol	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		1	
2,4-Dichlorophenol	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		5	
2,4-Dimethylphenol	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		50	
2,4-Dinitrophenol	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		10	
2,4-Dinitrotoluene	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		5	
2,6-Dinitrotoluene	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		5	
2-Chloronaphthalene	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		10	
2-Chlorophenol	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		1	
2-Methylnaphthalene	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		NS	
2-Methylphenol	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		1	
2-Nitroaniline	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		5	
2-Nitrophenol	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		1	
3- & 4-Methylphenols	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		NS	
3,3'-Dichlorobenzidine	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		5	
3-Nitroaniline	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		5	
4,6-Dinitro-2-methylphenol	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		NS	
4-Bromophenyl phenyl ether	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		NS	
4-Chloro-3-methylphenol	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		1	
4-Chloroaniline	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		5	
4-Chlorophenyl phenyl ether	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		NS	
4-Nitroaniline	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		5	
4-Nitrophenol	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		1	
Acenaphthene	<0.0526	U	<0.0606	U	<0.0526	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0541	U	<0.0541	U	<0.0541	U	NT		NT		NT		NT		NT		20	
Acenaphthylene	<0.0526	U	<0.0606	U	<0.0526	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0541	U	<0.0541	U	<0.0541	U	NT		NT		NT		NT		NT		NS	
Aniline	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		5	
Anthracene	<0.0526	U	<0.0606	U	<0.0526	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0541	U	<0.0541	U	<0.0541	U	NT		NT		NT		NT		NT		50	
Benzo(a)anthracene	<0.0526	U	<0.0606	U	<0.0526	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0541	U	<0.0541	U	<0.0541	U	NT		NT		NT		NT		NT		0.002	
Benzo(a)pyrene	<0.0526	U	<0.0606	U	<0.0526	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0541	U	<0.0541	U	<0.0541	U	NT		NT		NT		NT		NT		0.002	
Benzo(b)fluoranthene	<0.0526	U	<0.0606	U	<0.0526	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0541	U	<0.0541	U	<0.0541	U	NT		NT		NT		NT		NT		0.002	
Benzo(g,h,i)perylene	<0.0526	U	<0.0606	U	<0.0526	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0541	U	<0.0541	U	<0.0541	U	NT		NT		NT		NT		NT		NS	
Benzo(k)fluoranthene	<0.0526	U	<0.0606	U	<0.0526	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0541	U	<0.0541	U	<0.0541	U	NT		NT		NT		NT		NT		0.002	
Benzyl alcohol	<2.63	U	<3.03	U	<2.63	U	<2.56	U	<2.56	U	<2.56	U	<2.7	U	<2.7	U	<2.7	U	NT		NT		NT		NT		NT		NS	
Benzyl butyl phthalate	<2.63	U	<3.03	U	<2.63	U																								

Table 7 (Cont.)
Groundwater Samples Analytical Results for Herbicides, Pesticides & PCBs
77-57 Vleight Place, Flushing NY

Sample ID	MW-1		MW-2		MW-3S		MW-3D		MW-4		MW-5S		MW-5D		MW-6		MW-7D		NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	12/10/2015		12/10/2015		12/9/2015		12/9/2015		12/8/2015		12/7/2015		12/7/2015		12/8/2015		12/10/2015		
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	Q	ug/L	Q	ug/L	Q	ug/L		ug/L		ug/L		ug/L		ug/L	Q	
Herbicides																			
2,4,5-T	<5	U	NT		<5	U	<5	U	<5	U	<5	U	<5	U	<5	U	NT		35
2,4,5-TP (Silvex)	<5	U	NT		<5	U	<5	U	<5	U	<5	U	<5	U	<5	U	NT		0.26
2,4-D	<5	U	NT		<5	U	<5	U	<5	U	<5	U	<5	U	<5	U	NT		50
Pesticides																			
4,4'-DDD	<0.0041	U	<0.00421	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0041	U	0.3
4,4'-DDE	<0.0041	U	<0.00421	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0041	U	0.2
4,4'-DDT	<0.0041	U	<0.00421	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0041	U	0.2
Aldrin	<0.0041	U	<0.00421	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0041	U	NS
alpha-BHC	<0.0041	U	<0.00421	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0041	U	0.01
alpha-Chlordane	<0.0041	U	<0.00421	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0041	U	NS
beta-BHC	<0.0041	U	<0.00421	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0041	U	0.04
Chlordane, total	<0.041	U	<0.0105	U	<0.041	U	<0.041	U	<0.041	U	<0.0421	U	<0.0471	U	<0.041	U	<0.0103	U	0.05
delta-BHC	<0.0041	U	<0.0105	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0103	U	0.04
Dieldrin	<0.00205	U	<0.00421	U	<0.0041	U	<0.0041	U	<0.00205	U	<0.00211	U	<0.00235	U	<0.00205	U	<0.0041	U	0.004
Endosulfan I	<0.0041	U	<0.0105	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0103	U	NS
Endosulfan II	<0.0041	U	<0.00421	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0041	U	NS
Endosulfan sulfate	<0.0041	U	<0.00421	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0041	U	NS
Endrin	<0.0041	U	<0.00421	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0041	U	NS
Endrin aldehyde	<0.0103	U	<0.105	U	<0.0103	U	<0.0103	U	<0.0103	U	<0.0105	U	<0.0118	U	<0.0103	U	<0.103	U	5
Endrin ketone	<0.0103	U	<0.0526	U	<0.0103	U	<0.0103	U	<0.0103	U	<0.0105	U	<0.0118	U	<0.0103	U	<0.0513	U	5
gamma-BHC (Lindane)	<0.0041	U	<0.0526	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0513	U	0.05
gamma-Chlordane	<0.0103	U	<0.0526	U	0.010	U	0.010	U	0.0103	U	0.0105	U	0.0118	U	0.0103	U	<0.0513	U	NS
Heptachlor	<0.0041	U	<0.0526	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0513	U	0.04
Heptachlor epoxide	<0.0041	U	<0.0526	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0513	U	0.03
Methoxychlor	<0.0041	U	<0.0526	U	<0.0041	U	<0.0041	U	<0.0041	U	<0.00421	U	<0.00471	U	<0.0041	U	<0.0513	U	35
Toxaphene	<0.103	U	<0.0526	U	<0.103	U	<0.103	U	<0.103	U	<0.105	U	<0.118	U	<0.103	U	<0.0513	U	0.06
PCBs																			
Aroclor 1016	<0.0513	U	<0.00421	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0526	U	<0.0588	U	<0.0513	U	<0.0041	U	NS
Aroclor 1221	<0.0513	U	<0.0421	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0526	U	<0.0588	U	<0.0513	U	<0.041	U	NS
Aroclor 1232	<0.0513	U	<0.00421	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0526	U	<0.0588	U	<0.0513	U	<0.0041	U	NS
Aroclor 1242	<0.0513	U	<0.00211	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0526	U	<0.0588	U	<0.0513	U	<0.00205	U	NS
Aroclor 1248	<0.0513	U	<0.00421	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0526	U	<0.0588	U	<0.0513	U	<0.0041	U	NS
Aroclor 1254	<0.0513	U	<0.00421	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0526	U	<0.0588	U	<0.0513	U	<0.0041	U	NS
Aroclor 1260	<0.0513	U	<0.00421	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0526	U	<0.0588	U	<0.0513	U	<0.0041	U	NS
Total PCBs	<0.0513	U	<0.0526	U	<0.0513	U	<0.0513	U	<0.0513	U	<0.0526	U	<0.0588	U	<0.0513	U	<0.0513	U	0.09

NOTES:

Q is the Qualifier Column with definitions as follows:

U=analyte not detected at or above the level indicated

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

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

Table 7 (Cont.)
Groundwater Samples Analytical Results for Metals
77-57 Vleigh Place, Flushing NY

Sample ID	MW-1		MW-2		MW-3S		MW-3D		MW-4		MW-5S		MW-5D		MW-6		MW-7D		NYSDEC TOGS Standards and Guidance Values - GA
Sampling Date	12/10/2015		12/10/2015		12/9/2015		12/9/2015		12/8/2015		12/7/2015		12/7/2015		12/8/2015		12/10/2015		
Client Matrix	Water		Water		Water		Water		Water		Water		Water		Water		Water		
Compound	Result	Q	Result		Result		Result		Result	Q	Result	Q	Result	Q	Result	Q	Result		
Units	ug/L		ug/L		Q	ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q
Metals, Dissolved - Target Analyte (TAL)																			
Aluminum	139		<56	U	<56	U	<56	U	<56	U	<56	U	<56	U	<56	U	<56	U	NS
Antimony	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	3
Arsenic	<4	U	<4	U	<4	U	<4	U	<4	U	5		5		<4	U	6		25
Barium	82		173		58		58		85		517		469		181		231		1000
Beryllium	<1	U	<1	U	<1	U	<1	U	<1	U	<1	U	<1	U	<1	U	<1	U	3
Cadmium	<3	U	<3	U	<3	U	<3	U	<3	U	<3	U	<3	U	<3	U	<3	U	5
Calcium	150,000		89,300		36,700		37,000		73,800		277,000		272,000		102,000		161,000		NS
Chromium	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	50
Chromium, Hexavalent	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	50
Chromium, Trivalent	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	NS
Cobalt	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	NS
Copper	10		11		12	B	8	B	7		23		22		9		12		200
Iron	28		40		30		33		52		171		<22	U	80		44		NS
Lead	<3	U	<3	U	<3	U	<3	U	<3	U	<3	U	<3	U	<3	U	<3	U	25
Magnesium	76,100		46,000		16,200		16,400		39,000		48,100		49,400		42,200		84,300		35000
Manganese	37		30		11		11		244		266		568		286		2,630		300
Mercury	<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	0.7
Nickel	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<7		<6	U	10		100
Potassium	3,100		2,520		1,550		1,600		2,470		5,570		7,390		3,220		5,570		NS
Selenium	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	10
Silver	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	50
Sodium	249,000		224,000		236,000		232,000		113,000		713,000	E	722,000	E	425,000		545,000		20000
Thallium	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	NS
Vanadium	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	NS
Zinc	33		23		46		27		18		49		38		30		29		2000
Metals, Target Analyte																			
Aluminum	7,030		106		1,350		906		96		114		4,610		1,520		56	U	NS
Antimony	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	3
Arsenic	5		<4	U	<4	U	<4	U	<4	U	<4	U	<4	U	<4	U	<4	U	25
Barium	126		177		66		62		88		515		505		190		225		1000
Beryllium	<1	U	<1	U	<1	U	<1	U	<1	U	<1	U	<1	U	<1	U	<1	U	3
Cadmium	<3	U	<3	U	<3	U	<3	U	<3	U	<3	U	<3	U	<3	U	<3	U	5
Calcium	153,000		89,200		35,700		37,500		73,500		279,000		274,000		103,000		159,000		NS
Chromium	16		6	U	<6	U	6		<6	U	<6	U	13		<6	U	6	U	50
Chromium, Hexavalent	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	50
Chromium, Trivalent	16		<10	U	<10	U	<10	U	<10	U	<10	U	13		<10	U	<10	U	NS
Cobalt	<6	U	6	U	<6	U	<6	U	<6	U	<6	U	7		<6	U	6	U	NS
Copper	22		8		4		<3	U	25		18		30		34		10		200
Iron	10,200		294		1,630		1,120		178		178		6,680		1,940		75		NS
Lead	6		<3	U	<3	U	<3	U	<3	U	<3	U	6		<3	U	<3	U	25
Magnesium	78,700		45,900		17,700		18,400		42,300		49,600		52,000		43,900		82,700		35000
Manganese	231		45		60		32		243		263		801		346		2,570		300
Mercury	<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	0.7
Nickel	7		<6	U	7		7		<6	U	<6	U	13		<6	U	9		100
Potassium	4,930		2,700	B	1,820		1,840		2,700		5,870		8,750		3,750		5,710	B	NS
Selenium	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	10
Silver	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	50
Sodium	246,000		223,000	B	251,000		262,000		115,000		743,000	E	736,000	E	413,000		537,000	B	20000
Thallium	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	<6	U	NS
Vanadium	18		<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	<11	U	NS
Zinc	48		14		20		18		32		42		54		31		25		2000

NOTES:

Q is the Qualifier Column with definitions as follows:

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

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

sample exceeds NYSDEC TOGS Standards and Guidance Values - GA

Table 8
Soil/Sub-Slab Vapor Samples Analytical Results for VOCs
77-57 Vleigh Place, Flushing NY

Sample ID	SSB-1		SSB-2		SSB-3		SV-1		SV-2		SV-3		SV-4		SV-5		SV-6		SV-7		SV-8		SV-9		SV-10		SV-11		SV-12		SV-13		IA-1		IA-2		IA-3		OA-1		OA-1	
Sampling Date	12/3/2015		12/3/2015		12/3/2015		11/23/2014		11/23/2014		11/23/2014		12/3/2015		12/3/2015		12/3/2015		12/3/2015		10/17/2016		10/17/2016		10/17/2016		10/17/2016		10/17/2016		10/17/2016		12/3/2015		12/3/2015		12/3/2015		11/23/2014		12/3/2015	
Client Matrix Compound	Soil Vapor Result		Soil Vapor Result		Soil Vapor Result		Soil Vapor Result		Soil Vapor Result		Soil Vapor Result		Soil Vapor Result		Soil Vapor Result		Soil Vapor Result		Soil Vapor Result		Soil Vapor ug/m3		Soil Vapor ug/m3		Soil Vapor ug/m3		Soil Vapor ug/m3		Soil Vapor ug/m3		Soil Vapor ug/m3		Indoor Air Result		Indoor Air Result		Indoor Air Result		Outdoor Air Result		Outdoor Air Result	
Units	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q	ug/m³	Q
1,1,1,2-Tetrachloroethane	<18	U	<14	U	<1.9	U	NT		NT		NT		<16	U	<18	U	<7.9	U	<2	U	16	U	17	U	16	U	15	U	16	U	18	U	<0.97	U	<1	U	<0.92	U	NT		<0.69	U
1,1,1-Trichloroethane	<14	U	<11	U	65	D	9.80	U	1.10	U	1.10	U	<13	U	<14	U	<6.2	U	<1.6	U	13	U	14	U	13	U	12	U	13	U	14	U	<0.77	U	<0.79	U	<0.73	U	0.55	U	<0.55	U
1,1,2,2-Tetrachloroethane	<18	U	<14	U	<1.9	U	12	U	1.40	U	1.40	U	<16	U	<18	U	<7.9	U	<2	U	16	U	17	U	16	U	15	U	16	U	18	U	<0.97	U	<1	U	<0.92	U	0.69	U	<0.69	U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	<20	U	<16	U	<2.1	U	14	U	1.60	U	1.50	U	<18	U	<20	U	<8.8	U	<2.3	U	18	U	19	U	18	U	17	U	18	U	20	U	<1.1	U	<1.1	U	<1	U	0.77	U	<0.77	U
1,1,2-Trichloroethane	<14	U	<11	U	<1.5	U	9.80	U	1.10	U	1.10	U	<13	U	<14	U	<6.2	U	<1.6	U	13	U	14	U	13	U	12	U	13	U	14	U	<0.77	U	<0.79	U	<0.73	U	0.55	U	<0.55	U
1,1-Dichloroethane	<10	U	<8.3	U	15	D	7.30	U	0.83	U	0.80	U	<9.5	U	<10	U	<4.6	U	<1.2	U	9.70	U	10	U	9.60	U	8.80	U	9.40	U	11	U	<0.57	U	<0.59	U	<0.54	U	0.40	U	<0.4	U
1,1-Dichloroethylene	<10	U	<8.2	U	<1.1	U	7.10	U	0.82	U	0.78	U	<9.3	U	<10	U	<4.5	U	<1.2	U	9.50	U	10	U	9.40	U	8.60	U	9.20	U	11	U	<0.56	U	<0.58	U	<0.53	U	0.40	U	<0.4	U
1,2,4-Trichlorobenzene	<19	U	<15	U	<2.1	U	13	U	1.50	U	1.50	U	<17	U	<19	U	<8.5	U	<2.2	U	20	D	19	U	18	U	16	U	17	U	20	U	<1.1	U	<1.1	U	<1	U	0.74	U	<0.74	U
1,2,4-Trimethylbenzene	<13	U	<10	U	<1.4	U	8.80	U	6.50	D	9.60	D	<12	U	<13	U	<5.6	U	2.80	D	12	U	12	U	12	U	11	U	11	U	13	U	0.77	D	<0.71	U	1.20	D	3.20		<0.49	U
1,2-Dibromoethane	<20	U	<16	U	<2.2	U	14	U	1.60	U	1.50	U	<18	U	<20	U	<8.8	U	<2.3	U	18	U	19	U	18	U	17	U	18	U	20	U	<1.1	U	<1.1	U	<1	U	0.77	U	<0.77	U
1,2-Dichlorobenzene	<16	U	<12	U	<1.7	U	11	U	1.20	U	1.20	U	23	D	<16	U	<6.9	U	<1.8	U	14	U	15	U	14	U	13	U	14	U	16	U	<0.85	U	<0.87	U	<0.81	U	0.60	U	<0.6	U
1,2-Dichloroethane	<10	U	<8.3	U	<1.1	U	7.30	U	0.83	U	0.80	U	<9.5	U	<10	U	<4.6	U	<1.2	U	9.70	U	10	U	9.60	U	8.80	U	9.40	U	11	U	<0.57	U	<0.59	U	<0.54	U	0.40	U	<0.4	U
1,2-Dichloropropane	<12	U	<9.5	U	<1.3	U	8.30	U	0.95	U	0.91	U	<11	U	<12	U	<5.3	U	<1.4	U	11	U	12	U	11	U	10	U	11	U	12	U	<0.65	U	<0.67	U	<0.62	U	0.46	U	<0.46	U
1,2-Dichlorotetrafluoroethane	<18	U	<14	U	<2	U	13	U	1.40	U	1.40	U	<16	U	<18	U	<8	U	<2.1	U	17	U	18	U	17	U	15	U	16	U	19	U	<0.99	U	<1	U	<0.94	U	0.70	U	<0.7	U
1,3,5-Trimethylbenzene	<13	U	<10	U	<1.4	U	8.80	U	2.10	D	2.70	D	<12	U	<13	U	<5.6	U	<1.5	U	12	U	12	U	12	U	11	U	11	U	13	U	<0.7	U	<0.71	U	<0.66	U	0.93		<0.49	U
1,3-Butadiene	<34	U	<27	U	<3.6	U	7.80	U	0.89	U	0.86	U	<30	U	<34	U	<15	U	<3.8	U	16	U	17	U	16	U	14	U	15	U	18	U	<1.8	U	<1.9	U	<1.7	U	0.43	U	<1.3	U
1,3-Dichlorobenzene	<16	U	<12	U	<1.7	U	11	U	1.20	U	1.20	U	<14	U	<16	U	<6.9	U	<1.8	U	14	U	15	U	14	U	13	U	14	U	16	U	<0.85	U	<0.87	U	<0.81	U	0.60	U	<0.6	U
1,3-Dichloropropane	<12	U	<9.5	U	<1.3	U	NT		NT		NT		<11	U	<12	U	<5.3	U	<1.4	U	11	U	12	U	11	U	10	U	11	U	12	U	<0.65	U	<0.67	U	<0.62	U	NT		<0.46	U
1,4-Dichlorobenzene	<16	U	<12	U	<1.7	U	11	U	1.20	U	1.20	U	<14	U	<16	U	<6.9	U	<1.8	U	14	U	15	U	14	U	13	U	14	U	16	U	<0.85	U	<0.87	U	<0.81	U	0.60	U	<0.6	U
1,4-Dioxane	<19	U	<15	U	<2	U	6.50	U	0.74	U	0.71	U	<17	U	<19	U	<8.3	U	<2.1	U	17	U	18	U	17	U	16	U	17	U	19	U	<1	U	<1	U	<0.97	U	0.36	U	<0.72	U
2-Butanone	<7.6	U	<6.1	U	1.50	D	5.30	U	1.70	D	5.20	D	<6.9	U	<7.6	U	<3.4	U	1.30	D	7.80	D	7.40	U	7	U	6.40	U	6.90	U	7.80	U	1.40	D	1.50	D	8.60	D	3.10		2.10	
2-Hexanone	<21	U	<17	U	<2.3	U	15	U	1.70	U	1.60	U	<19	U	<21	U	<9.4	U	<2.4	U	20	U	21	U	19	U	18	U	19	U	22	U	<1.2	U	<1.2	U	<1.1	U	0.82	U	<0.82	U
3-Chloropropene	<40	U	<32	U	<4.4	U	NT		NT		NT		<37	U	<40	U	<18	U	<4.6	U	38	U	39	U	37	U	34	U	37	U	42	U	<2.2	U	<2.3	U	<2.1	U	NT		<1.6	U
4-Methyl-2-pentanone	<11	U	<8.4	U	<1.1	U	7.40	U	0.84	U	0.81	U	<9.6	U	<11	U	<4.7	U	<1.2	U	9.80																					

Table 8 (Cont.)																						
Sub-Slab Vapor Samples Analytical Results for VOCs																						
77-40 Vleigh Place, Flushing, NY (Steppingstone Day School)																						
Sample ID	SSB-1		IA-1		SSB-2		IA-2		SSB-3		IA-3		IA-4		IA-5		IA-6		IA-7		OA-1	
Sampling Date	4/2/2016		4/2/2016		4/2/2016		4/2/2016		4/2/2016		4/2/2016		4/2/2016		4/2/2016		4/2/2016		4/2/2016		4/2/2016	
Client Matrix	Air		Air		Air		Air		Air		Air		Air		Air		Air		Air		Air	
Compound	Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result	
Volatile Organics, EPA TO15 Full List	ug/m3	Q	ug/m3	Q	ug/m3	Q	ug/m3	Q	ug/m3	Q	ug/m3	Q	ug/m3	Q	ug/m3	Q	ug/m3	Q	ug/m3	Q	ug/m3	Q
1,1,1,2-Tetrachloroethane	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,1,1-Trichloroethane	1.83		<1.00	U	4.19		<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,1,2,2-Tetrachloroethane	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,1,2-Trichloroethane	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,1-Dichloroethane	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,1-Dichloroethene	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,2,4-Trichlorobenzene	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,2,4-Trimethylbenzene	13.7		9.33		24.5		5.6		33.9		7.91		9.63		6.14		4.51		4.51		<1.00	U
1,2-Dibromoethane(EDB)	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,2-Dichlorobenzene	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,2-Dichloroethane	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,2-dichloropropane	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,2-Dichlorotetrafluoroethane	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,3,5-Trimethylbenzene	2.76		3.91		4.28		1.55		5.65		2.05		2.69		2.03		1.21		1.23		<1.00	U
1,3-Butadiene	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,3-Dichlorobenzene	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,4-Dichlorobenzene	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
1,4-Dioxane	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
2-Hexanone(MBK)	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
4-Ethyltoluene	5.65		1.54		7.66		1.34		12		1.82		1.79		1.36		1.11		1.02		<1.00	U
4-Isopropyltoluene	<1.00	U	<1.00	U	1.21		<1.00	U	1.36		<1.00	U	1.33		<1.00	U	<1.00	U	<1.00	U	<1.00	U
4-Methyl-2-pentanone(MIBK)	<1.00	U	<1.00	U	<1.00	U	<1.00	U	1.02		<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Acetone	23.2		16.2		52.5		34.7		38.7		42.5		51.5		35.8		21.8		27.1		5.75	S
Acrylonitrile	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Benzene	1.57		1.16		1.08		2.79		2.85		4.21		5.01		2.31		2.27		2.61		<1.00	U
Benzyl chloride	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Bromodichloromethane	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Bromoform	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Bromomethane	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Carbon Disulfide	21.9		<1.00	U	1.1		<1.00	U	11		<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Carbon Tetrachloride	0.38		0.52		0.48		1.09		0.32		0.49		0.55		0.55		0.41		0.58		0.5	
Chlorobenzene	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Chloroethane	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Chloroform	3.7		<1.00	U	1.86		1.28		<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Chloromethane	<1.00	U	1.16		<1.00	U	1.42		<1.00	U	1.45		1.24		1.26		<1.00	U	1.28		1.14	
Cis-1,2-Dichloroethene	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
cis-1,3-Dichloropropene	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Cyclohexane	7.74		<1.00	U	2.79		1.87		28.9		2.43		3.42		1.51		1.69		1.55		<1.00	U
Dibromochloromethane	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Dichlorodifluoromethane	3.16		1.86		2.12		1.67		2.8		2.08		2.05		2.38		1.55		2.04		2.05	
Ethanol	11		277	E	43.1		721	E	27.9		727	E	868	E	491	E	444	E	537	E	7.53	S
Ethyl acetate	<1.00	U	<1.00	U	<1.00	U	1.27		<1.00	U	1.67		1.95		<1.00	U	<1.00	U	1.04		<1.00	U
Ethylbenzene	7.68		<1.00	U	5.08		3.21		10.1		4.14		4.95		2.5		2.37		2.27		<1.00	U
Heptane	2.59		1		1.33		3.58		2.88		4.1		5.77		2.79		2.72		2.92		<1.00	U
Hexachlorobutadiene	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U	<1.00	U
Hexane	4.37	S																				

Table 8 (Cont.)																		
Soil/Crawl Space Vapor Samples Analytical Results for VOCs																		
77-57 Vleigh Place, Flushing, New York (Kew Gardens Owners. Corp.)																		
Sample ID	SV-KG-1		SV-KG-2		CS-KG-1		IA-KG-1		CS-KG-2		IA-KG-2		CS-KG-3		IA-KG-3		OA-KG-1	
Sampling Date	4/4/2017		4/4/2017		4/4/2017		4/4/2017		4/4/2017		4/4/2017		4/4/2017		4/4/2017		4/4/2017	
Client Matrix	Soil Vapor		Soil Vapor		Crawl Space Vapor		Air		Crawl Space Vapor		Indoor Air		Crawl Space Vapor		Indoor Air		Outdoor Air	
Compound	Result		Result		Result		Indoor Air		Result		Result		Result		Result		Result	
Units	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q
1,1,1,2-Tetrachloroethane	17.0	U	4.9	U	1.2	U	0.7	U	1.3	U	0.69	U	1.3	U	0.69	U	0.69	U
1,1,1-Trichloroethane	13.00	U	3.9	U	0.97	U	0.55	U	1	U	0.55	U	1	U	0.55	U	0.55	U
1,1,2,2-Tetrachloroethane	17	U	4.9	U	1.2	U	0.69	U	1.3	U	0.69	U	1.3	U	0.69	U	0.69	U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	19	U	5.5	U	1.4	U	0.77	U	1.5	U	0.77	U	1.5	U	0.77	U	0.77	U
1,1,2-Trichloroethane	13	U	3.9	U	0.97	U	0.55	U	1	U	0.55	U	1	U	0.55	U	0.55	U
1,1-Dichloroethane	10	U	2.9	U	0.72	U	0.4	U	0.78	U	0.4	U	0.77	U	0.4	U	0.4	U
1,1-Dichloroethylene	9.7	U	2.8	U	0.7	U	0.4	U	0.76	U	0.4	U	0.75	U	0.4	U	0.4	U
1,2,4-Trichlorobenzene	18	U	5.3	U	1.3	U	0.74	U	1.4	U	0.74	U	1.4	U	0.74	U	0.74	U
1,2,4-Trimethylbenzene	12	U	8.5	D	0.87	U	9.6	D	0.94	U	10		5	D	0.49	U	63	D
1,2-Dibromoethane	19	U	5.5	U	1.4	U	0.77	U	1.5	U	0.77	U	1.5	U	0.77	U	0.77	U
1,2-Dichlorobenzene	15	U	4.3	U	1.1	U	0.6	U	1.2	U	0.6	U	1.1	U	0.6	U	0.6	U
1,2-Dichloroethane	10	U	2.9	U	0.72	U	0.4	U	0.78	U	0.4	U	0.77	U	0.4	U	0.4	U
1,2-Dichloropropane	11	U	3.3	U	0.82	U	0.46	U	0.89	U	0.46	U	0.88	U	0.46	U	0.46	U
1,2-Dichlorotetrafluoroethane	17	U	5	U	1.2	U	0.7	U	1.3	U	0.7	U	1.3	U	0.7	U	0.7	U
1,3,5-Trimethylbenzene	12	U	3.5	U	0.87	U	2.2	D	0.94	U	2.4		1.1	D	0.49	U	18	D
1,3-Butadiene	16	U	17	D	1.2	U	0.66	U	1.3	U	0.66	U	1.3	U	0.66	U	0.66	U
1,3-Dichlorobenzene	15	U	4.3	U	1.1	U	0.6	U	1.2	U	0.6	U	1.1	U	0.6	U	0.6	U
1,3-Dichloropropane	11	U	3.3	U	0.82	U	0.46	U	0.89	U	0.46	U	0.88	U	0.46	U	0.46	U
1,4-Dichlorobenzene	15	U	4.3	U	1.1	U	0.6	U	1.2	D	0.6	U	1.1	U	0.6	U	0.6	U
1,4-Dioxane	18	U	5.2	U	1.3	U	0.72	U	1.4	U	0.72	U	1.4	U	0.72	U	0.72	U
2-Butanone	7.3	U	3	D	0.58	D	0.83	D	0.57	U	2.4		1.3	D	0.38	D	3.3	D
2-Hexanone	20	U	5.9	U	1.5	U	0.82	U	1.6	U	1.2		1.6	U	0.82	U	0.82	U
3-Chloropropene	38	U	11	U	2.8	U	1.6	U	3	U	1.6	U	3	U	1.6	U	1.6	U
4-Methyl-2-pentanone	10	U	2.9	U	0.73	U	0.41	U	0.78	U	0.41	U	0.78	U	0.41	U	0.41	U
Acetone	29	D	14	D	8.1	D	7.7	D	6.1	D	16		5.2	D	9	D	21	D
Acrylonitrile	5.3	U	1.6	U	0.39	U	0.22	U	0.42	U	0.22	U	0.41	U	0.22	U	0.22	U
Benzene	13	D	8.2	D	0.57	D	1.6	D	0.73	D	5.6		1.2	D	0.54	D	18	D
Benzyl chloride	13	U	3.7	U	0.92	U	0.52	U	0.99	U	0.52	U	0.98	U	0.52	U	0.52	U
Bromodichloromethane	16	U	4.8	U	1.2	U	0.67	U	1.3	U	0.67	U	1.3	U	0.67	U	0.67	U
Bromoform	25	U	7.4	U	1.8	U	1	U	2	U	1	U	2	U	1	U	1	U
Bromomethane	9.5	U	2.8	U	0.69	U	0.39	U	0.74	U	0.39	U	0.74	U	0.39	U	0.39	U
Carbon disulfide	7.7	U	2.5	D	0.55	U	0.31	U	0.6	U	0.31	U	0.59	U	0.31	U	2.3	D
Carbon tetrachloride	3.9	U	1.1	U	0.45	D	0.44	D	0.48	D	0.38		0.36	D	0.44	D	0.44	D
Chlorobenzene	11	U	3.3	U	0.82	U	0.46	U	0.88	U	0.46	U	0.87	U	0.46	U	0.46	U
Chloroethane	6.5	U	1.9	U	0.47	U	0.26	U	0.51	U	0.26	U	0.5	U	0.26	U	0.26	U
Chloroform	12	U	3.5	U	0.87	U	0.54	D	1.4	D	0.49	U	0.93	U	0.49	U	0.88	D
Chloromethane	5.1	U	1.5	U	1.9	D	1.7	D	1.6	D	1.4		1.8	D	1.3	D	1.7	D
cis-1,2-Dichloroethylene	9.7	U	2.8	U	0.7	U	0.4	U	0.76	U	0.4	U	0.75	U	0.4	U	0.4	U
cis-1,3-Dichloropropylene	11	U	3.3	U	0.81	U	0.45	U	0.87	U	0.45	U	0.86	U	0.45	U	0.45	U
Cyclohexane	8.5	U	2.5	U	0.61	U	0.34	D	0.66	U	4.1		0.65	U	0.34	U	12	D
Dibromochloromethane	21	U	6.1	U	1.5	U	0.85	U	1.6	U	0.85	U	1.6	U	0.85	U	0.85	U
Dichlorodifluoromethane	12	U	3.5	U	2.4	D	2	D	2.4	D	1.9		2.4	D	2	D	2.3	D
Ethyl acetate	18	U	5.2	U	1.3	U	0.72	U	1.4	U	1.5		1.4	U	0.72	U	5.9	D
Ethyl Benzene	11	U	5.9	D	0.77	U	4.2	D	0.83	U	6.3		2.6	D	0.43	U	42	D
Hexachlorobutadiene	26	U	7.6	U	1.9	U	1.1	U	2	U	1.1	U	2	U	1.1	U	1.1	U
Isopropanol	12	U	14	D	0.87	U	3.5	D	1.4	D	39		0.93	U	3.2	D	7.6	D
Methyl Methacrylate	10	U	2.9	U	0.73	U	0.41	U	0.78	U	4.7		0.78	U	0.41	U	0.41	U
Methyl tert-butyl ether (MTBE)	8.9	U	2.6	U	0.64	U	0.36	U	0.69	U	0.36	U	0.68	U	0.36	U	0.36	U
Methylene chloride	17	U	9	D	1.2	U	0.69	U	1.3	U	10		1.3	U	0.69	U	1.8	D
n-Heptane	10	U	6.8	D	0.73	U	1.9	D	0.79	U	7.7		0.93	D	0.41	U	24	D
n-Hexane	13	D	13	D	0.63	U	1.8	D	0.68	U	18		1	D	0.35	U	30	D
o-Xylene	11	U	6.8	D	0.77	U	5.9	D	0.83	U	8.3		3.3	D	0.43	U	54	D
p- & m- Xylenes	30	D	25	D	2.1	D	20	D	1.7	U	27		12	D	0.87	U	140	D
p-Ethyltoluene	12	U	7.8	D	0.87	U	8.2	D	0.94	U	9.1		4.6	D	0.49	U	62	D
Propylene	61	D	94	D	0.64	D	0.77	D	0.86	D	1.4		0.52	D	0.62	D	2.6	D
Styrene	10	U	3.1	U	0.76	U	0.43	U	0.82	U	0.43	U	0.81	U	0.43	U	0.43	U
Tetrachloroethylene	13,000	D	39	D	10	D	3.6	D	12	D	0.95		1.3	D	8.1	D	2.5	D
Tetrahydrofuran	15	U	4.2	U	1	U	0.59	U	1.1	U	7.4		1.1	U	0.59	U	0.59	U
Toluene	35	D	27	D	1.1	D	14	D	1.1	D	29		9.1	D	1.3	D	120	D
trans-1,2-Dichloroethylene	9.7	U	2.8	U	0.7	U	0.4	U	0.76	U	0.4	U	0.75	U	0.4	U	0.4	U
trans-1,3-Dichloropropylene	11	U	3.3	U	0.81	U	0.45	U	0.87	U	0.45	U	0.86	U	0.45	U	0.45	U
Trichloroethylene	13	D	0.96	U	0.24	U	0.13	U	0.26	U	0.13	U	0.25	U	0.13	U	0.16	D
Trichlorofluoromethane (Freon 11)	14	U	4	U	1.4	D	1.3	D	1.6	D	2.9		1.3	D	1.3	D	2	D
Vinyl acetate	8.7	U	2.5	U	0.62	U	0.35	U	0.67	U	0.35	U	0.67	U	0.35	U	0.35	U
Vinyl bromide	11	U	3.1	U	0.78	U	0.44	U	0.84	U	0.44	U	0.83	U	0.44	U	0.44	U
Vinyl Chloride	6.3	U	1.8	U	0.45	U	0.26	U	0.49	U	0.26	U	0.48	U	0.26	U	0.26	U

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

Table 8 (Cont.)
Soil/Sub-Slab Vapor Samples Analytical Results for VOCs
77-57 Vleigh Place, Flushing, New York (Rengency Garden Company)

Sample ID	SSB-RG-1		IA-RG-1		SSB-RG-2		IA-RG-2		SSB-RG-3		IA-RG-3		SSB-RG-4		IA-RG-4		OA-RG-1	
Sampling Date	4/4/2017		4/4/2017		4/4/2017		4/4/2017		4/4/2017		4/4/2017		4/4/2017		4/4/2017		4/4/2017	
Client Matrix	Sub-Slab vapor		Indoor Air		Sub-Slab vapor		Indoor Air		Sub-Slab vapor		Indoor Air		Sub-Slab vapor		Indoor Air		Outdoor Air	
Compound	Result		Result		Result		Result		Result		Result		Result		Result		Result	
Units	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q	ug/m ³	Q
1,1,1,2-Tetrachloroethane	2.2	U	0.69	U	1.5	U	0.69	U	16	U	0.88	U	17	U	0.86	U	0.9	U
1,1,1-Trichloroethane	1.7	U	0.55	U	1.2	U	0.55	U	13	U	0.7	U	14	U	0.68	U	0.71	U
1,1,2,2-Tetrachloroethane	2.2	U	0.69	U	1.5	U	0.69	U	16	U	0.88	U	17	U	0.86	U	0.9	U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	2.4	U	0.77	U	1.7	U	0.77	U	18	U	0.99	U	19	U	0.96	U	1	U
1,1,2-Trichloroethane	1.7	U	0.55	U	1.2	U	0.55	U	13	U	0.7	U	14	U	0.68	U	0.71	U
1,1-Dichloroethane	1.3	U	0.4	U	0.88	U	0.4	U	9.7	U	0.52	U	10	U	0.51	U	0.53	U
1,1-Dichloroethylene	1.3	U	0.4	U	0.86	U	0.4	U	9.5	U	0.51	U	10	U	0.5	U	0.52	U
1,2,4-Trichlorobenzene	2.4	U	0.82	D	1.6	U	0.74	U	18	U	0.95	U	19	U	0.93	U	0.97	U
1,2,4-Trimethylbenzene	15	D	12	D	24	D	20	D	12	U	11	D	12	U	0.68	D	12	D
1,2-Dibromoethane	2.4	U	0.77	U	1.7	U	0.77	U	18	U	0.99	U	19	U	0.96	U	1	U
1,2-Dichlorobenzene	1.9	U	0.6	U	1.3	U	0.6	U	14	U	0.77	U	15	U	0.75	U	0.78	U
1,2-Dichloroethane	1.3	U	0.4	D	0.88	U	0.4	U	9.7	U	0.52	U	10	U	0.51	U	0.53	U
1,2-Dichloropropane	1.5	U	0.46	U	1	U	0.46	U	11	U	0.59	U	12	U	0.58	U	0.6	U
1,2-Dichlorotetrafluoroethane	2.2	U	0.7	U	1.5	U	0.7	U	17	U	0.9	U	18	U	0.87	U	0.91	U
1,3,5-Trimethylbenzene	3.8	D	3.1	D	9.1	D	5.1	D	12	U	2.9	D	12	U	0.61	U	2.8	D
1,3-Butadiene	2.1	U	0.66	U	7.2	D	0.66	U	16	U	0.85	U	17	U	0.83	U	0.87	U
1,3-Dichlorobenzene	1.9	U	0.6	U	1.3	U	0.6	U	14	U	0.77	U	15	U	0.75	U	0.78	U
1,3-Dichloropropane	1.5	U	0.46	U	1	U	0.46	U	11	U	0.59	U	12	U	0.58	U	0.6	U
1,4-Dichlorobenzene	1.9	U	0.6	U	1.3	U	0.6	U	14	U	0.77	U	15	U	0.75	U	0.78	U
1,4-Dioxane	2.3	U	0.72	U	1.6	U	0.72	U	17	U	0.93	U	18	U	0.9	U	0.94	U
2-Butanone	2.7	D	4.3	D	5.4	D	5.1	D	7.1	U	1.6	D	7.4	U	0.63	D	1.7	D
2-Hexanone	2.6	U	4.1	D	1.8	U	0.82	U	20	U	1.1	U	21	U	1	U	7.1	D
3-Chloropropene	5	U	1.6	U	3.4	U	1.6	U	38	U	2	U	39	U	2	U	2	U
4-Methyl-2-pentanone	1.3	U	0.41	U	0.89	U	0.41	U	9.8	U	0.53	U	10	U	0.51	U	0.53	U
Acetone	74	D	18	D	100	D	27	D	12	D	7.4	D	12	U	6.8	D	12	D
Acrylonitrile	0.69	U	0.22	U	0.47	U	0.22	U	5.2	U	0.28	U	5.5	U	0.27	U	0.28	U
Benzene	8.4	D	4.2	D	8.2	D	12	D	7.7	U	4	D	8.1	U	0.84	D	3.5	D
Benzyl chloride	1.6	U	0.52	U	1.1	U	0.52	U	12	U	0.67	U	13	U	0.65	U	0.68	U
Bromodichloromethane	2.1	U	0.67	U	1.4	U	0.87	D	16	U	0.86	U	17	U	0.84	U	0.87	U
Bromoform	3.3	U	1	U	2.2	U	1	U	25	U	1.3	U	26	U	1.3	U	1.3	U
Bromomethane	1.2	U	0.39	U	0.84	U	0.39	U	9.3	U	0.5	U	9.8	U	0.49	U	0.51	U
Carbon disulfide	7.2	D	0.31	U	4.8	D	2.6	D	7.5	U	0.4	U	7.8	U	0.39	U	0.41	U
Carbon tetrachloride	0.5	U	0.38	D	0.41	D	0.5	D	3.8	U	0.4	D	4	U	0.39	D	0.41	D
Chlorobenzene	1.5	U	0.46	U	1	U	0.46	U	11	U	0.59	U	12	U	0.58	U	0.6	U
Chloroethane	0.84	U	0.26	U	0.57	U	0.26	U	6.3	U	0.34	U	6.6	U	0.33	U	0.34	U
Chloroform	4.8	D	0.49	U	12	D	9.4	D	12	U	0.63	U	12	U	0.61	U	0.64	U
Chloromethane	0.66	U	1.2	D	0.49	D	1.8	D	5	U	1.8	D	5.2	U	1.5	D	1.8	D
cis-1,2-Dichloroethylene	1.3	U	0.4	U	0.86	U	0.79	D	9.5	U	0.51	U	10	U	0.5	U	0.52	U
cis-1,3-Dichloropropylene	1.4	U	0.45	U	0.98	U	0.45	U	11	U	0.58	U	11	U	0.57	U	0.59	U
Cyclohexane	16	D	1.5	D	13	D	7.6	D	8.3	U	1.2	D	8.7	U	0.43	U	1.5	D
Dibromochloromethane	2.7	U	0.85	U	1.8	U	0.85	U	20	U	1.1	U	21	U	1.1	U	1.1	U
Dichlorodifluoromethane	2.4	D	1.6	D	2.4	D	2.3	D	12	U	1.9	D	12	U	2	D	1.9	D
Ethyl acetate	2.3	U	0.72	U	1.6	D	2.9	D	17	U	0.93	U	18	U	0.9	U	0.94	U
Ethyl Benzene	11	D	11	D	19	D	17	D	10	U	9.3	D	11	D	0.54	U	7.6	D
Hexachlorobutadiene	3.4	U	1.1	U	2.3	U	1.1	U	26	U	1.4	U	27	U	1.3	U	1.4	U
Isopropanol	6.8	D	27	D	6.6	D	94	D	12	U	9.1	D	12	U	2.9	D	7.4	D
Methyl Methacrylate	1.3	U	0.41	U	0.89	U	0.41	U	9.8	U	0.53	U	10	U	0.51	U	0.53	U
Methyl tert-butyl ether (MTBE)	1.1	U	0.36	U	0.78	U	0.36	U	8.7	U	0.46	U	9.1	U	0.45	U	0.47	U
Methylene chloride	2.2	U	1.5	D	4	D	0.9	D	17	U	3.4	D	18	U	0.87	U	1.9	D
n-Heptane	7	D	6.6	D	14	D	18	D	9.8	U	5.4	D	10	U	0.51	U	4.7	D
n-Hexane	8.4	D	7.3	D	16	D	34	D	8.5	U	6.5	D	8.9	U	0.66	D	6.2	D
o-Xylene	14	D	13	D	30	D	20	D	10	D	12	D	11	D	0.54	U	9.9	D
p- & m- Xylenes	49	D	43	D	76	D	67	D	42	D	40	D	48	D	1.5	D	33	D
p-Ethyltoluene	15	D	12	D	31	D	19	D	12	U	12	D	12	U	0.61	U	11	D
Propylene	3.8	D	1.1	D	68	D	2.4	D	4.1	U	1.7	D	4.3	U	1	D	0.76	D
Styrene	1.4	U	0.43	U	0.92	U	0.43	U	10	U	0.55	U	11	U	0.53	U	0.56	U
Tetrachloroethylene	260	D	1.4	D	350	D	8.3	D	1200	D	1.6	D	1300	D	13	D	0.89	D
Tetrahydrofuran	1.9	U	6.8	D	1.3	U	15	D	14	U	0.76	U	15	U	0.74	U	0.77	U
Toluene	41	D	42	D	51	D	75	D	38	D	37	D	44	D	1.9	D	30	D
trans-1,2-Dichloroethylene	1.3	U	0.4	U	0.86	U	0.4	U	9.5	U	0.51	U	10	U	0.5	U	0.52	U
trans-1,3-Dichloropropylene	1.4	U	0.45	U	0.98	U	0.45	U	11	U	0.58	U	11	U	0.57	U	0.59	U
Trichloroethylene	1.9	D	0.16	D	0.7	D	0.97	D	3.2	U	0.17	U	3.4	U	0.17	U	0.18	U
Trichlorofluoromethane (Freon 11)	1.8	U	1.3	D	1.6	D	4.2	D	13	U	1.5	D	14	U	1.3	D	1.5	D
Vinyl acetate	1.1	U	0.35	U	0.76	U	0.35	U	8.5	U	0.45	U	8.9	U	0.44	U	0.46	U
Vinyl bromide	1.4	U	0.44	U	0.95	U	0.44	U	10	U	0.56	U	11	U	0.55	U	0.57	U
Vinyl Chloride	0.81	U	0.26	U	0.55	U	0.26	U	6.1	U	0.33	U	6.4	U	0.32	U	0.33	U

NOTES:
Q is the Qualifier Column with definitions as follw Q is the Qualifier Column with definitions as follows:
D=result is from an analysis that required a diluti D=result is from an analysis that required a dilution
U=analyte not detected at or above the level indic U=analyte not detected at or above the level indicated

Table 9
Dry Well Sediment Sample Analytical Results for VOC's
77-57 Vleigh Place, Flushing NY

Sample ID	DW-1		NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives	Restricted Use Soil Cleanup Objectives (6 NYC RR Pt.375-6.8b) - Restricted Residential
Sampling Date	3/22/2016			
Client Matrix	Soil			
Compound	Result			
Units	mg/Kg	Q	mg/Kg	mg/Kg
1,1,1,2-Tetrachloroethane	<0.0052	U	NS	NS
1,1,1-Trichloroethane	<0.0052	U	0.68	100
1,1,2,2-Tetrachloroethane	<0.0052	U	NS	NS
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	<0.0052	U	NS	NS
1,1,2-Trichloroethane	<0.0052	U	NS	NS
1,1-Dichloroethane	<0.0052	U	0.27	26
1,1-Dichloroethylene	<0.0052	U	0.33	100
1,1-Dichloropropylene	<0.0052	U	NS	NS
1,2,3-Trichlorobenzene	<0.0052	U	NS	NS
1,2,3-Trichloropropane	<0.0052	U	NS	NS
1,2,4-Trichlorobenzene	<0.0052	U	NS	NS
1,2,4-Trimethylbenzene	<0.0052	U	3.6	52
1,2-Dibromo-3-chloropropane	<0.0052	U	NS	NS
1,2-Dibromoethane	<0.0052	U	NS	NS
1,2-Dichlorobenzene	<0.0052	U	1.1	100
1,2-Dichloroethane	<0.0052	U	0.02	3.1
1,2-Dichloroethane-d4	NT		NS	NS
1,2-Dichloropropane	<0.0052	U	NS	NS
1,3,5-Trimethylbenzene	<0.0052	U	8.4	52
1,3-Dichlorobenzene	<0.0052	U	2.4	49
1,3-Dichloropropane	<0.0052	U	NS	NS
1,4-Dichlorobenzene	<0.0052	U	1.8	13
1,4-Dioxane	<0.1	U	0.1	13
2,2-Dichloropropane	<0.0052	U	NS	NS
2-Butanone	<0.0052	U	0.12	100
2-Chlorotoluene	<0.0052	U	NS	NS
4-Chlorotoluene	<0.0052	U	NS	NS
Acetone	<0.01	U	0.05	100
Benzene	<0.0052	U	0.06	4.8
Bromobenzene	<0.0052	U	NS	NS
Bromochloromethane	<0.0052	U	NS	NS
Bromodichloromethane	<0.0052	U	NS	NS
Bromoform	<0.0052	U	NS	NS
Bromomethane	<0.0052	U	NS	NS
Carbon tetrachloride	<0.0052	U	0.76	2.4
Chlorobenzene	<0.0052	U	1.1	100
Chloroethane	<0.0052	U	NS	NS
Chloroform	<0.0052	U	0.37	49
Chloromethane	<0.0052	U	NS	NS
cis-1,2-Dichloroethylene	<0.0052	U	0.25	100
cis-1,3-Dichloropropylene	<0.0052	U	NS	NS
Dibromochloromethane	<0.0052	U	NS	NS
Dibromomethane	<0.0052	U	NS	NS
Dichlorodifluoromethane	<0.0052	U	NS	NS
Ethyl Benzene	<0.0052	U	1	41
Hexachlorobutadiene	<0.0052	U	NS	NS
Isopropylbenzene	<0.0052	U	NS	NS
Methyl tert-butyl ether (MTBE)	<0.0052	U	0.93	100
Methylene chloride	<0.01	U	0.05	100
Naphthalene	<0.0052	U	12	NS
n-Butylbenzene	<0.0052	U	12	NS
n-Propylbenzene	<0.0052	U	3.9	100
o-Xylene	<0.0052	U	0.26	100
p- & m- Xylenes	<0.01	U	0.26	100
p-Bromofluorobenzene	NT		NS	NS
p-Isopropyltoluene	<0.0052	U	NS	NS
sec-Butylbenzene	<0.0052	U	11	100
Styrene	<0.0052	U	NS	NS
tert-Butylbenzene	<0.0052	U	5.9	100
Tetrachloroethylene	<0.0052	U	1.3	19
Toluene	<0.0052	U	0.7	100
Toluene-d8	NT		NS	NS
trans-1,2-Dichloroethylene	<0.0052	U	0.19	100
trans-1,3-Dichloropropylene	<0.0052	U	NS	NS
Trichloroethylene	<0.0052	U	0.47	21
Trichlorofluoromethane	<0.0052	U	NS	NS
Vinyl acetate	<0.0052	U	NS	NS
Vinyl Chloride	<0.0052	U	0.02	0.9

NOTES:

Q is the Qualifier Column with definitions as follows:

U=analyte not detected at or above the level indicated

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

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

Table 10
Protection of Groundwater Soil Cleanup Objectives

Analytes	PGWSCO's
	mg/kg
Volatile Organic Compounds (mg/kg)	
1,1,1,2-Tetrachloroethane	NS
1,1,1-Trichloroethane	0.68
1,1,2,2-Tetrachloroethane	NS
1,1,2,2-Tetrachloroethylene	NS
1,1,2-Trichloroethane	NS
1,1-Dichloroethane	0.27
1,1-Dichloroethene	0.33
1,1-Dichloropropene	NS
1,2,3,4-Tetrachlorobenzene	NS
1,2,3-Trichlorobenzene	NS
1,2,3-Trichloropropane	NS
1,2,4-Trichlorobenzene	NS
1,2,4-Trimethylbenzene	3.6
1,2-Dibromo-3-chloropropane	NS
1,2-Dibromoethane	NS
1,2-Dichlorobenzene	1.1
1,2-Dichloroethane	0.02
1,2-Dichloropropane	NS
1,3,5-Trimethylbenzene	8.4
1,3-Dichlorobenzene	2.4
1,3-Dichloropropane	NS
1,4-Dichlorobenzene	1.8
1,4-Dioxane	0.1
113 Freon	NS
2,2-Dichloropropane	NS
2,4-Dichloro aniline	NS
2,6-Dinitrotoluene	NS
2-Chlorotoluene	NS
3,4-Dichloroaniline	NS
4-Chlorotoluene	NS
4-Isopropyltoluene	NS
4-mythyl-2-pentanone	NS
Acetone	0.05
Benzene	0.06
Bromobenzene	NS
Bromochloromethane	NS
Bromodichloromethane	NS
Bromoform	NS
Bromomethane	NS
Carbon Disulfide	NS
Carbon tetrachloride	0.76
Chloroacetamide	NS
Chlorobenzene	1.1
Chloroethane	NS
Chloroform	0.37
Chloromethane	NS
cis-1,2-Dichloroethene	0.25
cis-1,3-Dichloropropene	NS
Dibromochloromethane	NS
Dibromomethane	NS
Dichlorodifluoromethane	NS
Ethylacetate	NS
Ethylbenzene	1
Hexachlorobenzene	3.2
Hexachlorobutadiene	NS
Hexachlorocyclopentadiene	NS
Isopropylbenzene	NS
m + p-Xylene	1.6
o-Xylene	1.6
Xylene (Total)	1.6
Methanol	NS
Methyl ethyl ketone (2-Butanone)	0.12
Methylene chloride	0.05
Methyl-Tert-Butyl-Ether	0.93
Naphthalene	NS
n-Butylbenzene	NS
N-Nitrosodiphenylamine	NS
n-Propylbenzene	3.9
Pentachlorobenzene	NS
Pentachloronitrobenzene	NS
sec-Butylbenzene	11
Styrene	NS
tert-Butylbenzene	5.9
Tetrachloroethene	1.3
Toluene	0.7
trans-1,2-Dichloroethene	0.19
trans-1,3-Dichloropropene	NS
Trichloroethene (Trichloroethylen)	0.47
Trichlorofluoromethane	NS
Vinyl chloride	0.02

Analytes	PGWSCO's
	mg/kg
Semi-Volatile Organic Compounds (mg/kg)	
1,2,3,6,7,8-HCDF	NS
1,2,4-Trichlorobenzene	NS
1,2-Dichlorobenzene	NS
1,3-Dichlorobenzene	NS
1,4-Dichlorobenzene	NS
2,3,4,5-Tetrachlorophenol	NS
2,3,5,6-Tetrachloroaniline	NS
2,4,5-Trichloroaniline	NS
2,4,5-Trichlorophenol	NS
2,4,6-Trichlorophenol	NS
2,4-Dichlorophenol	NS
2,4-Dinitrophenol	NS
2,4-Dinitrotoluene	NS
2,6-Dinitrotoluene	NS
2-Chloronaphthalene	NS
2-Chlorophenol	NS
2-Methylnaphthalene	NS
2-Nitroaniline	NS
2-Nitrophenol	NS
3,3'-Dichlorobenzidine	NS
3,4-Dichlorophenol	NS
3-Chlorophenol	NS
3-Nitroaniline	NS
4-Bromophenyl Phenyl Ether	NS
4-Chloroaniline	NS
4-Chlorophenyl Phenyl Ether	NS
4-methyl-2-pentanone	NS
4-Nitroaniline	NS
4-Nitrophenol	NS
Acenaphthene	98
Acenaphthylene	107
Aniline	NS
Anthracene	1000
Benzo (a) Anthracene	1
Benzo (a) Pyrene	22
Benzo (b) Fluoranthene	1.7
Benzo (g,h,l) Perylene	1000
Benzo (k) Fluoranthene	1.7
Benzoic Acid	NS
Benzyl Butyl Phthalate	NS
bis (2-Chloroethoxy) Methane	NS
bis (2-Chloroethyl) Ether	NS
bis (2-Chloroisopropyl) Ether	NS
bis (2-Ethyl Hexyl) Phthalate	NS
Carbazole	NS
Chloroethane	NS
Chrysene	1
Dibenzo (a,h) Anthracene	1000
Dibenzofuran	NS
Diethyl Phthalate	NS
Dimethyl Phthalate	NS
Di-n-Butyl Phthalate	NS
Di-n-hexyl-phthalate	NS
D-n-n-octyl Phthalate	NS
Fluoranthene	1000
Fluorene	386
Hexachlorobenzene	NS
Hexachlorobudadiene	NS
Hexachlorocyclopentadiene	NS
Hexachloroethane	NS
Indeno (1,2,3-cd) Pyrene	8.2
Isophorone	NS
m-Cresol	0.33
Naphthalene	12
Nitrobenzene	NS
n-Nitrosodi-n-propylamine	NS
N-Nitrosodiphenylamine	NS
o-Cresol	0.33
p-Cresol	0.33
Pentachloroaniline	NS
Pentachlorophenol	0.8
Phenanthrene	1000
Phenol	0.33
Pyrene	1000

Analytes	PGWSCO's
	mg/kg
Pesticides	
2,3,7,8-TCDD	NS
2,3,7,8-TCDF	NS
2,4,5-TP Acid (Silvex)	3.8
2,4-D(2,4-Dichloro-Phenoxyacetic acid)	NS
a BHC	0.02
Aldrin	0.19
b BHC	0.09
Biphenyl	NS
Chlordane (alpha)	2.9
Chlordecone (Kepone)	NS
d BHC g	0.25
Dibenzofuran	210
Dieldrin	0.1
Endosulfan I	102
Endosulfan II	102
Endosulfan Sulfate	1000
Endrin	0.06
Endrin Aldehyde	NS
Furan	NS
Gama Chlordane	NS
Heptachlor	0.38
Heptachlor Epoxide	NS
Lindane	0.1
Methoxychlor	NS
p,p-DDD	14
p,p-DDE	17
p,p-DDT	136
Parathion	NS
Polychlorinated biphenyls	3.2
Toxaphene	NS
PCBs	
Aroclor 1016	NS
Aroclor 1221	NS
Aroclor 1232	NS
Aroclor 1242	NS
Aroclor 1248	NS
Aroclor 1254	NS
Aroclor 1260	NS
Tal Metals	
Aluminum	NS
Antimony	NS
Arsenic	16
Boron	NS
Barium	820
Beryllium	47
Cadmium	7.5
Calcium	NS
Chromium Hexavalent	19
Chromium Trivalent	NS
Cobalt	NS
Copper	1,720
Cyanide	40
Iron	NS
Lithium	NS
Lead	450
Molybdenum	NS
Magnesium	NS
Manganese	2,000
Mercury	0.73
Nickel	130
Potassium	NS
Selenium	4.0
Silver	8.3
Sodium	NS
Technetium	NS
Thallium	NS
Tin	NS
Vanadium	NS
Uranium	NS
Zinc	2,480

APPENDICES

APPENDIX 1

PROPERTY METES AND BOUNDS

Exhibit A

77-39/63 Vleigh Place, Flushing, New York 11367

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

BEGINNING at a point in the center line of 78th Avenue, distant 400 feet Westerly from the corner formed by the intersection of the Westerly side of Main Street with the center line of 78th Avenue, as said Main Street and 78th Avenue are laid out and shown on the Final Topographical Map of The City of New York;

THENCE Westerly along the said 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;

THENCE Northerly along the said Easterly side of Vleigh Place, 253.30 feet to its point or intersection with the Southerly side of 77th Road, 60 feet wide, as ceded to The City of New York;

THENCE Easterly along the said Southerly side of 77th Road, 100.46 feet to a point in said Southerly side of 77th Road distant 400 feet Westerly from the said Westerly side of Main Street;

THENCE Southerly and parallel with the said Westerly side of Main Street, 230 feet to the point or place of BEGINNING.

BEING and intended to be the same premises described on a certain deed dated March 21, 2003 and recorded in the Office of the City Register of the City of New York on July 10, 2003 in City Register File Number 2003000223081.

APPENDIX 2

NYSDEC AND NYSDOH CORRESPONDENCES



FACT SHEET

Brownfield Cleanup Program

Receive Site Fact Sheets by *Email*. See "For More Information" to Learn How.

Site Name: 77-57 Vleigh Place
DEC Site #: C241168
Address: 77-39/63 Vleigh Place
Flushing, NY 11367

Have questions?
See
"Who to Contact"
Below

Report Recommends Cleanup of Brownfield Site Contamination

The New York State Department of Environmental Conservation (NYSDEC) is reviewing the Remedial Investigation Report for the 77-57 Vleigh Place site ("site") located at 77-39/63 Vleigh Place, Flushing, NY. Please see the map for the site location. Documents related to the cleanup of this site can be found at the location(s) identified below under "Where to Find Information."

Additional site details, including environmental and health assessment summaries, are available on NYSDEC's website at:

<http://www.dec.ny.gov/cfm/external/haz/details.cfm?pageid=3&progn=C241168>

Remedial Investigation Report

NYSDEC is reviewing the "Remedial Investigation Report" that was submitted by Aldrich Management Co., LLC ("applicant(s)"). The report describes the results of the site investigation and recommends development of a remedy to address the contamination that was found.

Based on the findings of the investigation, NYSDEC, in consultation with the New York State Department of Health (NYSDOH), has determined that the site poses a significant threat to public health or the environment due to elevated concentrations of contaminants in groundwater, soil, and soil vapor. The activities in the report have been designed to address the identified contamination and the threat posed.

Highlights of the Remedial Investigation Report

Soil and groundwater were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, polychlorinated biphenyls (PCBs), and pesticides. Soil vapor, sub slab vapor, indoor air and outdoor ambient air were analyzed for VOCs. The primary contaminants of concern detected in all media were tetrachloroethylene (PCE) and trichloroethylene (TCE).

Soil – PCE was detected at 15 of the 24 soil probe locations at the various depths, with the highest concentration of 94 parts per million (ppm) at 10 to 12 feet below ground surface in the southeast corner of the site. This concentration is above the Unrestricted Use Soil Cleanup Objective (UUSCO) of 1.3 parts per million (ppm) and the Restricted Residential Use SCO (RRUSCO) of 19 ppm. A former on-site dry-cleaning establishment was the most likely source of the PCE.

Groundwater - Chlorinated VOCs, primarily PCE and TCE were found in 14 of the 15 monitoring wells installed, with most on-site and off-site groundwater samples exceeding the groundwater quality standard (GQS) of 5 parts per billion (ppb). The maximum concentration of 11,000 ppb was found in the southeastern corner of the site, likely due to the overlying PCE contaminated soil.

Soil Vapor, Sub slab vapor, and Indoor Air & Outdoor Air – Samples collected during the RI from soil vapor points installed on and off-site identified chlorinated VOCs. These included PCE and TCE, which were detected in all on-site and most off-site soil vapor samples. PCE was the most abundant compound detected in on-site soil vapor. The contaminated soil and groundwater are the source of the PCE and TCE in the soil vapor. Sub slab vapor samples, indoor air samples, and outdoor air samples were also collected from the pre-school building at 77-40 Vleigh Place to the west and from the apartment buildings to the south and southeastern side of the site as part of supplemental RI work. Based on the results, no further action is necessary at the pre-school to the west of the site. The levels identified in the apartment buildings will require additional sampling during the upcoming heating season to confirm the original results.

Next Steps

NYSDEC will complete its review, make any necessary revisions and, if appropriate, approve the investigation report. The approved report will be made available to the public (see “Where to Find Information” below). The applicant(s) may then develop a cleanup plan, called a "Remedial Work Plan." This plan describes how contamination will be addressed, with NYSDEC and NYSDOH overseeing the work. NYSDEC will present the draft cleanup plan to the public for its review and comment during a 45-day comment period. Based on the findings of the supplemental soil vapor work discussed above, interim remedial measures may also be contemplated. Such actions could include installation of sub slab depressurization systems in any structure(s) where mitigation is shown to be warranted.

NYSDEC will keep the public informed throughout the investigation and cleanup of the site.

Background

Location: The 77 57 Vleigh Place site is located in an urban area in Flushing, NY. The site is bordered by Vleigh Place to the west, 77th Road to the north, 78th Ave to the south, and an apartment building to the east.

Site Features: The site is relatively flat and formerly contained a one story flat roofed building used as a retail/commercial strip mall with thirteen tenant spaces, including a dry cleaner operation. The building had a basement and occupied the western portion of the site along Vleigh Place, while the rear of the building to the east consists of a partially paved parking lot and an unpaved area. In late 2016 the on-site building was completely destroyed due to a fire and has been demolished. Only the foundation slab and walls remain.

Current Zoning and Land Use: The site is currently zoned for commercial and office use and sits within an R3 2 zoning district with a C1 2 commercial overlay. The site is currently vacant. Surrounding parcels include residential apartment buildings to the east and south and a pre-school to the west.

Past Use of the Site: The on-site building was constructed in 1939 and has been used as a strip retail and commercial office building since it was first constructed. Past tenants included multiple retail establishments including restaurants and a dry cleaner, which is the presumed source of the on-site contamination.

Site Geology and Hydrogeology: The soil in the vicinity of the site is characterized as part of the urban land complex, which indicates that the predominant soil type has been disturbed and covered with an impervious layer consisting of buildings, sidewalks, streets, and other structures. Based on soil borings, the soils beneath the site were identified as medium to fine grained sand with pebbles to a depth of approximately 34 feet below grade. The depth to ground water is approximately 36 feet below the ground surface. Groundwater flows from the southeast to the northwest across the site based on well data, which is consistent with regional groundwater flow. The nearest body of surface water is Willow Lake, approximately 0.5 miles to the west of the site, which ultimately drains into Flushing Bay.

Brownfield Cleanup Program: New York's Brownfield Cleanup Program (BCP) encourages the voluntary cleanup of contaminated properties known as "brownfields" so that they can be reused and redeveloped. These uses may include recreation, housing, business or other uses.

A **brownfield** site is any real property where a contaminant is present at levels exceeding the soil cleanup objectives or other health-based or environmental standards, criteria or guidance adopted by DEC that are applicable based on the reasonably anticipated use of the property, in accordance with applicable regulations.

For more information about the BCP, visit: <http://www.dec.ny.gov/chemical/8450.html>

FOR MORE INFORMATION

Where to Find Information

Project documents are available at the following location(s) to help the public stay informed.

Queens Library - Kew Gardens Hills
Attn: Susan Wetjen
72-33 Vleight Place
Flushing, NY 11367
phone: (718) 261-6654

Queens Community Board 8
Attn: Matha Taylor, Chairwoman
197-15 Hillside Avenue
Hollis, NY 11423
phone: (718) 264-7895

Who to Contact

Comments and questions are always welcome and should be directed as follows:

Project Related Questions

MD Hoque
NYS Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7016
Tel: 518-402-9767
Email: md.hoque@dec.ny.gov

Site-Related Health Questions

Dawn Hettrick
New York State Department of Health
Empire State Plaza, Corning Tower Rm. 1787
Albany, NY 12233
Tel: 518 402 7850
Email: BEEI@health.ny.gov

We encourage you to share this fact sheet with neighbors and tenants, and/or post this fact sheet in a prominent area of your building for others to see.

Receive Site Fact Sheets by Email

Have site information such as this fact sheet sent right to your email inbox. NYSDEC invites you to sign up with one or more contaminated sites county email listservs available at the following web page:
<http://www.dec.ny.gov/chemical/61092.html>. It's quick, it's free, and it will help keep you *better informed*.



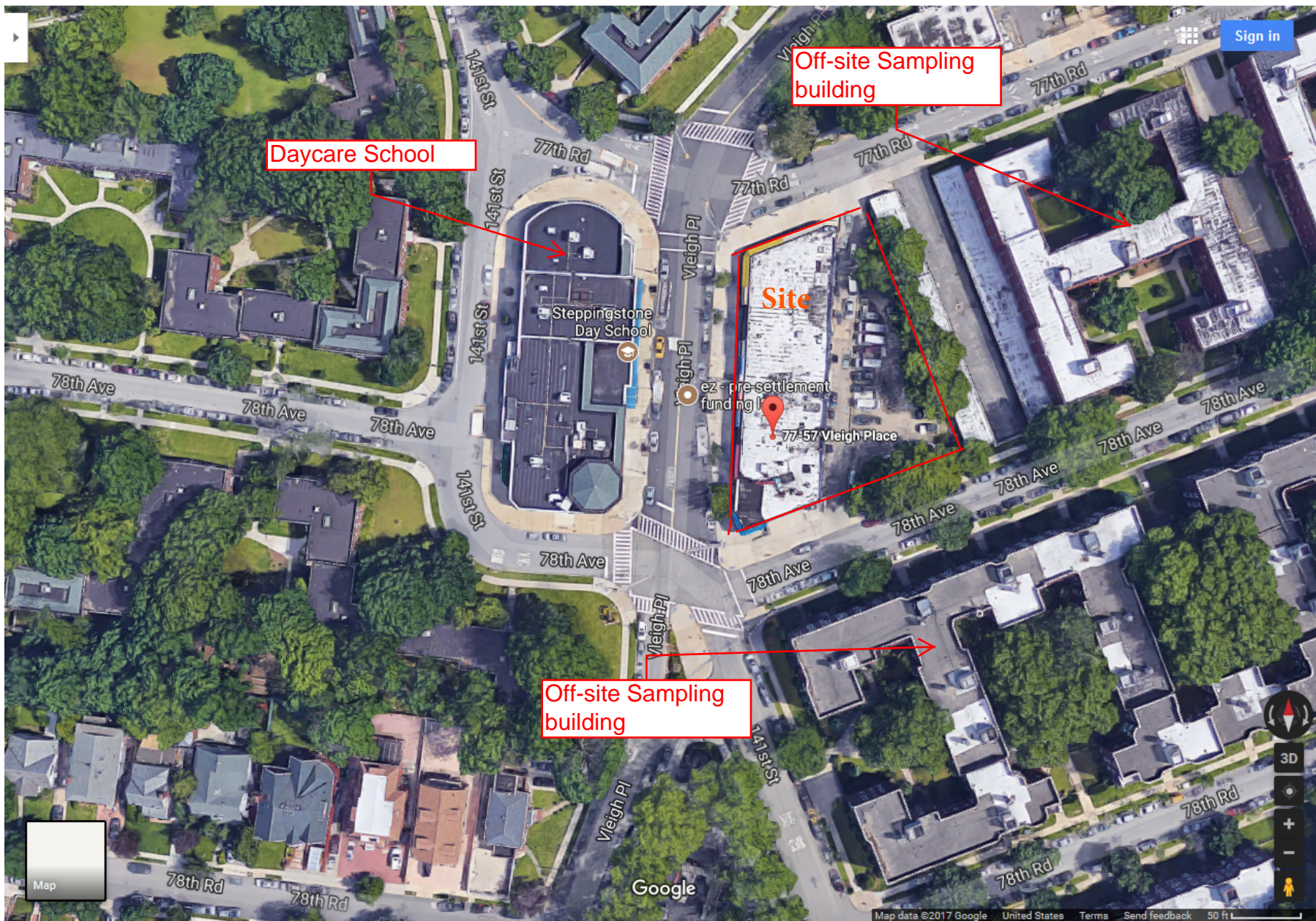
As a listserv member, you will periodically receive site-related information/announcements for all contaminated sites in the county(ies) you select.

Site Location Map



Site Address:

77-57 Vleigh Place, Flushing, NY 11367



NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Remediation, Remedial Bureau B
625 Broadway, 12th Floor, Albany, NY 12233-7016
P: (518) 402-9768 | F: (518) 402-9773
www.dec.ny.gov

VIA EMAIL

February 12, 2016

Aldrich Management Co, LLC
Attn: Denis Rodger
1975 Hempstead Tpke, Suite 309
East Meadow, NY 11554

DenisRodger@upcli.com

Re: 77-57 Vleigh Place- Site C241168
Immediate Action Required
February 2016 Remedial Investigation Report

The New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) have reviewed the subject document. Formal comments will be submitted under separate cover.

On February 4, 2016, the NYSDEC provided your consultant via email with some preliminary comments and requests concerning the reported elevated concentrations of perchloroethene (PCE) and trichloroethene (TCE) in on-site soil vapor, sub-slab vapor and indoor air. The reported indoor air concentrations in the tenant spaces sampled ranged from 94 to 1,100 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) for PCE and 3.8 $\mu\text{g}/\text{m}^3$ to 57 $\mu\text{g}/\text{m}^3$ for TCE. Attached is the NYSDOH letter documenting the need for immediate actions be taken to reduce exposure to site-related contaminants in indoor air and the significant threat to public health determination for the Site.

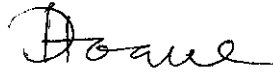
Additional actions at the Site to address the current indoor PCE and TCE levels are necessary. We would like to schedule a conference call to discuss these actions, preferably today. Please be prepared to discuss actions to taken to date and planned to address indoor air levels of PCE and TCE.

If you have any questions concerning this matter, or would like to discuss the comments, you may contact me by telephone (518) 402-9475 or by email (md.hoque@dec.ny.gov) or the NYSDOH Project Manager, Dawn Hettrick at (518) 402-7860 or dawn.hettrick@health.ny.gov.



Department of
Environmental
Conservation

Sincerely,



MD Hoque, Environmental Engineer
Remedial Bureau B, Section A
Division of Environmental Remediation

enclosure

cc:

Rachel Ataman/Paul I. MATLI - Hydro Tech Environmental Corp.
George C.D. Duke, Esq., P.G.
Tarek Khouri, HAKS
K. Mintzer – NYSDEC/OGC
R.Cozy/M. Komoroske – NYSDEC/DER
J. Deming/ D. Hettrick - NYSDOH



**Department of
Environmental
Conservation**



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 11, 2016

Mr. Robert Cozzy, Director
Remedial Bureau B
NYS Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, NY 12233

Re: Significant Threat Determination
77-57 Vleigh Place
Site #C241168
Flushing, Queens County

Dear Mr. Cozzy:

At your department's request, we have reviewed the January 29, 2016 *Remedial Investigation Report* for the referenced site. Based on that review, I understand that on-site groundwater, soil, and soil vapor are contaminated with chlorinated solvents, specifically tetrachloroethene (PCE) and trichloroethene (TCE). I also understand that elevated levels of PCE and TCE were detected in the indoor air of currently occupied tenant spaces on-site.

Based on our review of the available information, I recommend that immediate actions be taken to reduce exposure to site-related contaminants in indoor air. PCE was detected in the indoor air from 94 to 1,100 micrograms per cubic meter (mcg/m³) and TCE was detected from 3.9 to 57 mcg/m³. Furthermore, environmental sampling indicates that soil vapor intrusion is a potential exposure pathway for people in off-site structures and that additional investigation is warranted. Direct contact with contaminants in subsurface soil is unlikely because the site is covered with a building; however, people who dig below the surface may contact site-related contaminants in soil or groundwater. People are not drinking contaminated groundwater because the area is served by a public water supply that is not affected by this contamination.

I believe that this site represents a significant threat to public health and that immediate actions are needed to reduce exposure to site related contaminants. In addition, further investigation is warranted to characterize potential exposure pathways and to evaluate remedial alternatives. If you have any questions, or if you would like to discuss this site further, please contact me at (518) 402-7860.

Sincerely,

A handwritten signature in black ink, appearing to read "Justin H. Deming".

Justin H. Deming, Chief
Regions 2, 4 and 8
Bureau of Environmental Exposure Investigation

ec: K. Anders / D. Hettrick / e-file
C. Westerman – NYSDOH MARO
C. D'Andrea – NYCDHOH
M. Komoroske / M. Hoque – NYSDEC Central Office
J. O'Connell – NYSDEC Region 2

APPENDIX 3

FISH AND WILDLIFE RESOURCES IMPACT

ANALYSIS

Appendix 3C Fish and Wildlife Resources Impact Analysis Decision Key		If YES Go to:	If NO Go to:
1.	Is the site or area of concern a discharge or spill event?	13 ✓	2
2.	Is the site or area of concern a point source of contamination to the groundwater which will be prevented from discharging to surface water? Soil contamination is not widespread, or if widespread, is confined under buildings and paved areas.	13	3
3.	Is the site and all adjacent property a developed area with buildings, paved surfaces and little or no vegetation?	4	9
4.	Does the site contain habitat of an endangered, threatened or special concern species?	Section 3.10.1	5
5.	Has the contamination gone off-site?	6	14
6.	Is there any discharge or erosion of contamination to surface water or the potential for discharge or erosion of contamination?	7	14
7.	Are the site contaminants PCBs, pesticides or other persistent, bioaccumulable substances?	Section 3.10.1	8
8.	Does contamination exist at concentrations that could exceed ecological impact SCGs or be toxic to aquatic life if discharged to surface water?	Section 3.10.1	14
9.	Does the site or any adjacent or downgradient property contain any of the following resources? i. Any endangered, threatened or special concern species or rare plants or their habitat ii. Any DEC designated significant habitats or rare NYS Ecological Communities iii. Tidal or freshwater wetlands iv. Stream, creek or river v. Pond, lake, lagoon vi. Drainage ditch or channel vii. Other surface water feature viii. Other marine or freshwater habitat ix. Forest x. Grassland or grassy field xi. Parkland or woodland xii. Shrubby area xiii. Urban wildlife habitat xiv. Other terrestrial habitat	11	10
10.	Is the lack of resources due to the contamination?	3.10.1	14
11.	Is the contamination a localized source which has not migrated and will not migrate from the source to impact any on-site or off-site resources?	14	12
12.	Does the site have widespread surface soil contamination that is not confined under and around buildings or paved areas?	Section 3.10.1	12
13.	Does the contamination at the site or area of concern have the potential to migrate to, erode into or otherwise impact any on-site or off-site habitat of endangered, threatened or special concern species or other fish and wildlife resource? (See #9 for list of potential resources. Contact DEC for information regarding endangered species.)	Section 3.10.1	14 ✓
14.	No Fish and Wildlife Resources Impact Analysis needed.		✓

APPENDIX 4

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

77-57 Vleigh Place
Block 6630; Lot 1
Queens, New York

NYSDEC Site Number: C241168

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6.0 General QA/QC Considerations.....	3

Tables

1. Sampling and Analytical Method Requirements for Post-Excavation End Point Soil
2. Sampling and Analytical Method Requirements for Groundwater

Attachments

- A. Low Flow Sampling Protocol And Monitoring Well Purge/Sampling Form
- B. Sample Chain of Custody Form
- C. Conventional Laboratory QA/QC
- D. NYSDOH ELAP-Certification for York Analytical Laboratories
- E. Resume of Key Personnel Involved With This Project

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) 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 (Site #241168). 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.

2.0 Project Objective and Scope of Work

2.1 End Point Soil Sampling

A total of thirty nine (39) post-excavation confirmation end point samples designated EP-1 to EP-39 will be collected at the Site. The end point soil samples will be obtained directly from undisturbed soil from the bottom of excavation and also within the interim unsaturated zones. Excavation will be paused and the end point sample will be collected at the frequency specified in DER-10 with one bottom sample representing 900 square feet and a sidewall sample collected every 30 linear feet. In all cases, post-remediation samples should be biased toward locations and depths of the highest expected contamination utilizing field indicators such as field instrument measurements or visual contamination identified during the soil screening. It should be noted that grab VOC samples will be collected from 0 to 6 inches below final bottom grade within 24 hours of completing the excavation and 6 to 12 inches below final bottom grade past the 24 hours of completing the excavation. Each end point soil sample will be collected per EPA Method 5035 and will be placed directly into Terra Core soil samplers provided by the laboratory.

This end point investigation will be performed in accordance to the New York State Department of Environmental Conservation (NYSDEC) requirements under the NYS Brownfield Cleanup Program (BCP) and in compliance with the NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (May 2010) and other acceptable industry standards.

2.2 Groundwater Sampling

Groundwater samples will be obtained from all existing thirteen (13) on-site and off-site monitoring wells. The sampling may exclude on-site monitoring wells that will be abandoned during site excavation in consultation with NYSDEC. The groundwater sampling will be performed utilizing a low flow pump fitted with dedicated polyethylene tubing. Initially, each monitoring well will be purged prior to sampling. Purging and sampling of the monitoring wells will be conducted according to USEPA's Low Stress/Flow Groundwater Sampling Protocol (SOP #GW0001, Rev. 1996) utilizing a portable Horiba U-50 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 A**). 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.

3.0 Sampling Procedures

Each groundwater sample and select end point soil sample and will be placed directly into pre-cleaned containers provided by the laboratory. Sample containers will be labeled and placed in a cooler filled with ice and maintained at 4 degrees Celsius. Each sample will be transmitted under proper chain of custody procedures to a NYSDOH ELAP-certified laboratory for analysis. **Table 1** and **Table 2** provide the sample containers, volumes, test methods, preservation techniques, reporting limits and holding times for soil and groundwater samples.

4.0 Decontamination Procedures

During the field sampling, Paul Matli, who is a Project Manager (PM) at Hydro Tech 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 removed from the Site.

5.0 Quality Assurance and Quality Control (QA/QC)

The following Quality Assurance and Quality Control (QA/QC) samples will also be collected and analyzed.

- One trip blank per each shipment of samples will be analyzed for TCL VOCs via EPA Method 8260.
- Since the endpoint soil sampling involves the use dedicated disposal equipment, cross contamination is unlikely to occur and as such, equipment blanks (field blank) will be not required during each day of sampling end point soil samples.
- Equipment blank (field blank) for groundwater samples will be collected during each day of sampling and duplicate samples will be collected as per ASP.
- A Matrix Spike and a Matrix Spike duplicate will be collected per each sampling matrix at a frequency of 1 per 20 samples per each sampling matrix and will be analyzed for full set of analytical parameters as the soil or groundwater samples.

A summary of anticipated QA/QC for soil samples is included in **Table 1**. A summary of anticipated QA/QC for groundwater samples is included in **Table 2**.

6.0 General QA/QC Considerations

The end point soil samples and groundwater will be managed and analyzed as per the following protocols:

- Hydro Tech PM (Paul Matli) shall perform field audits to verify compliance with the RAWP and identify corrective measures where problems are identified.
- Samples will be labeled and logged in a monitor notebook and Chain of Custody upon collection including sampler name, sampling identification, date and time of sample collection and sampling depth, sampling methods and devices.
- In the field, samples will be the responsibility of, and will stay with, the Hydro Tech field geologist (Paul I. Matli).
- Once samples have been collected they are returned to Hydro Tech office and logged in for temporary storage under a proper Chain of Custody. **Attachment B** provides a sample chain of custody form.
- All samples will be refrigerated to maintain a temperature at a maximum 4 degrees Celsius.
- Hydro Tech staff will be then responsible for transporting samples to State-certified (ELAP) laboratory for analysis under a proper Chain of Custody.
- 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 QA officer who checks each data sheet for precision, missing or illegible information, errors in calculation and values outside of the expected range. A minimum of five percent of the total of a given type of sample shall be devoted to internal QC checks. These checks are designed to insure accuracy in the sampling procedure and the analytical methods and include blanks, duplicates, matrix spikes reference standards and performance evaluation samples. **Attachment C** provides a conventional lab QA/QC procedures associated with samples analysis. **Attachment D** provides NYSDOH ELAP-Certification for York Analytical Laboratories.
- The Laboratory data packages will conform to the Analytical Services Protocols (ASP) Category B Deliverables in accordance to NYSDEC DER-10 Appendix 2B.
- To ensure that data quality objectives are met, Hydro Tech QAO will assess data precision, accuracy, degree of representation, comparability and completeness of samples and data. This is primarily accomplished in the evaluation of data together with field notes and sampling logs.
- All deficiencies identified by Hydro Tech PM during the performance of field audits or evaluation of the data will be immediately reported to the field Geologist, and the NYSDEC. In addition to identifying deficiencies, the Hydro Tech PM is responsible for recommending corrective actions.
- The analytical data generated from this project will be provided in an electronic format in accordance with NYSDECs DER-10 Section 1.15. Specifically, the final reports shall be in an electronic format that complies with the NYSDEC's Electronic Document Standards (EDS).
- A Category B deliverable is required and a Data Usability Summary Report (DUSR) will be prepared. The DUSR will include all data and answer the following questions:
 3. Is the data package complete as defined under the requirements for the most current DEC ASP Category B or USEPA CLP data deliverables?
 4. Have all holding times been met?
 5. Do all the QC data; blanks, instrument tunings, calibration standards, calibration verifications, surrogate recoveries, spike recoveries, replicate analyses, laboratory controls and sample data fall within the protocol required limits and specifications?
 6. Have all of the data been generated using established and agreed upon analytical protocols?
 7. Does an evaluation of the raw data confirm the results provided in the data summary sheets and quality control verification forms?
 8. Have the correct data qualifiers been used and are they consistent with the most current DEC ASP?

9. Have any quality control (QC) exceedances been specifically noted in the DUSR and have the corresponding QC summary sheets from the data package been attached to the DUSR?
- All validated data will be reviewed by Donald C. Anné, an independent QAO of the laboratory who is responsible of generating a data usability analysis. This analysis shall consist of (1) an assessment to determine if the data quality objectives were met; (2) evaluation of field duplicate results to indicate the samples are representative; (3) comparison of the results of trip blanks and methods blanks with full data sets to provide information concerning contaminants that may have been introduced during sampling, shipping or analyzing; (4) evaluation of matrix effects to assess the performance of the analytical method with respect to sample matrix, and determine whether the data have been biased high or low due to matrix effects. A Data Usability Summary Report (DUSR) will be prepared and provided in an electronic format in accordance to NYSDEC DER-10 Appendix 2B and in compliance with the NYSDEC's Electronic Document Standards (EDS).
 - Field investigation will be performed under the full oversight of Tarek Z. Khouri, a NYS registered professional engineer. Attachment E provide Resume of Key Personnel Involved With This Project.

Table 1: Sampling & Analytical Method Requirements – Post-Excavation End Point Soil Samples

Soil Matrix (1)	Parameter	Minimum Sample Volume	Sample Container	Sample Preservation	Analytical Method	Lab Reporting Limit	Technical Holding Time
Sample ID							
EP-1 to EP-39 & Matrix Spike /Matrix Spike Duplicate	TCL VOCs	120 ml + 2 OZ	2 oz. clear wide-mouth glass with Teflon lined septum + 40 ml methanol vial with Teflon lined cap + 40 ml DI water vial with Teflon lined cap + 40 ml unpreserved vial with Teflon lined cap	Cool to 4 °C ⁽²⁾	EPA Method 8260	Compound Specific (0.001-0.05 mg/Kg)	14 days
	TCL SVOCs	8 OZ	8 oz. clear wide-mouth glass with Teflon lined septum	Cool to 4 °C	EPA Method 8270	Compound Specific (0.065-0.250 mg/Kg)	14 days
	TAL Metals	8 OZ	8 oz. clear wide-mouth glass with Teflon lined septum	Cool to 4 °C	EPA Method 6010/EPA 7470 for Mercury	Compound Specific (0.05-10 mg/Kg)	6 months/ Chromium Hexavalent 24 hours/ Mercury 28 days
	Pesticides	8 OZ	8 oz. clear wide-mouth glass with Teflon lined septum	Cool to 4 °C	EPA Method 8082	Compound Specific (0.005-0.02 mg/Kg)	14 days
	PCBs	8 OZ	8 oz. clear wide-mouth glass with Teflon lined septum	Cool to 4 °C	EPA Method 8081	Compound Specific (0.025 mg/Kg)	14 days
Trip Blank	TCL VOCs	80 ml	40 ml VOC vial with Teflon lined cap	1:1 HCL to pH<2 Cool to 4 °C	EPA Method 8260	Compound Specific (0.2-10 µg/L)	14 days

(1).....Analytical Services Protocols (ASP) Deliverables Package Category B.

(2)...If samples are not delivered to the lab with 48 hours after collection, the 40 ml DI Water vials should be preserved in a frozen condition following sampling

Table 2: Sampling & Analytical Method Requirements – Groundwater Samples

Water Matrix (1)	Parameters	Minimum Sample Volume (2)	Sample Container	Sample Preservation	Analytical Method	Lab Reporting Limit	Technical Holding Time
Sample ID							
MW-1 to MW-13	TCL VOCs	120 ml	40 ml VOC vial with Teflon lined cap	1:1 HCL to pH<2 Cool 2-6 °C	EPA Method 8260B	Compound Specific (0.5-20 µg/L)	14 days
Field Blank	TCL VOCs	120 ml	40 ml VOC vial with Teflon lined cap	1:1 HCL to pH<2 Cool 2-6 °C	EPA Method 8260B	Compound Specific (0.5-20 µg/L)	14 days
Matrix Spike /Matrix Spike Duplicate	TCL VOCs	120 ml	40 ml VOC vial with Teflon lined cap	1:1 HCL to pH<2 Cool 2-6 °C	EPA Method 8260B	Compound Specific (0.5-20 µg/L)	14 days
Trip Blank	TCL VOCs	120 ml	40 ml VOC vial with Teflon lined cap	1:1 HCL to pH<2 Cool 2-6 °C	EPA Method 8260B	Compound Specific (0.5-20 µg/L)	14 days

(1).....Analytical Services Protocols (ASP) Deliverables Package Category

ATTACHMENT A
LOW FLOW SAMPLING PROTOCOL AND MONITORING WELL
PURGE/SAMPLING FORM



Ground Water Issue

LOW-FLOW (MINIMAL DRAWDOWN) GROUND-WATER SAMPLING PROCEDURES

by Robert W. Puls¹ and Michael J. Barcelona²

Background

The Regional Superfund Ground Water Forum is a group of ground-water scientists, representing EPA's Regional Superfund Offices, organized to exchange information related to ground-water remediation at Superfund sites. One of the major concerns of the Forum is the sampling of ground water to support site assessment and remedial performance monitoring objectives. This paper is intended to provide background information on the development of low-flow sampling procedures and its application under a variety of hydrogeologic settings. It is hoped that the paper will support the production of standard operating procedures for use by EPA Regional personnel and other environmental professionals engaged in ground-water sampling.

For further information contact: Robert Puls, 405-436-8543, Subsurface Remediation and Protection Division, NRMRL, Ada, Oklahoma.

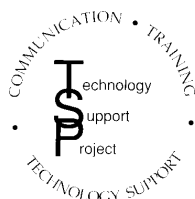
I. Introduction

The methods and objectives of ground-water sampling to assess water quality have evolved over time. Initially the emphasis was on the assessment of water quality of aquifers as sources of drinking water. Large water-bearing

units were identified and sampled in keeping with that objective. These were highly productive aquifers that supplied drinking water via private wells or through public water supply systems. Gradually, with the increasing awareness of subsurface pollution of these water resources, the understanding of complex hydrogeochemical processes which govern the fate and transport of contaminants in the subsurface increased. This increase in understanding was also due to advances in a number of scientific disciplines and improvements in tools used for site characterization and ground-water sampling. Ground-water quality investigations where pollution was detected initially borrowed ideas, methods, and materials for site characterization from the water supply field and water analysis from public health practices. This included the materials and manner in which monitoring wells were installed and the way in which water was brought to the surface, treated, preserved and analyzed. The prevailing conceptual ideas included convenient generalizations of ground-water resources in terms of large and relatively homogeneous hydrologic *units*. With time it became apparent that conventional water supply generalizations of *homogeneity* did not adequately represent field data regarding pollution of these subsurface resources. The important role of *heterogeneity* became increasingly clear not only in geologic terms, but also in terms of complex physical,

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Walter W. Kovalick, Jr., Ph.D.
Director

chemical and biological subsurface processes. With greater appreciation of the role of heterogeneity, it became evident that subsurface pollution was ubiquitous and encompassed the unsaturated zone to the deep subsurface and included unconsolidated sediments, fractured rock, and *aquifers* or low-yielding or impermeable formations. Small-scale processes and heterogeneities were shown to be important in identifying contaminant distributions and in controlling water and contaminant flow paths.

It is beyond the scope of this paper to summarize all the advances in the field of ground-water quality investigations and remediation, but two particular issues have bearing on ground-water sampling today: aquifer heterogeneity and colloidal transport. Aquifer heterogeneities affect contaminant flow paths and include variations in geology, geochemistry, hydrology and microbiology. As methods and the tools available for subsurface investigations have become increasingly sophisticated and understanding of the subsurface environment has advanced, there is an awareness that in most cases a primary concern for site investigations is characterization of contaminant flow paths rather than entire aquifers. In fact, in many cases, plume thickness can be less than well screen lengths (e.g., 3-6 m) typically installed at hazardous waste sites to detect and monitor plume movement over time. Small-scale differences have increasingly been shown to be important and there is a general trend toward smaller diameter wells and shorter screens.

The hydrogeochemical significance of colloidal-size particles in subsurface systems has been realized during the past several years (Gschwend and Reynolds, 1987; McCarthy and Zachara, 1989; Puls, 1990; Ryan and Gschwend, 1990). This realization resulted from both field and laboratory studies that showed faster contaminant migration over greater distances and at higher concentrations than flow and transport model predictions would suggest (Buddemeier and Hunt, 1988; Enfield and Bengtsson, 1988; Penrose et al., 1990). Such models typically account for interaction between the mobile aqueous and immobile solid phases, but do not allow for a mobile, reactive solid phase. It is recognition of this third *phase* as a possible means of contaminant transport that has brought increasing attention to the manner in which samples are collected and processed for analysis (Puls et al., 1990; McCarthy and Degueldre, 1993; Backhus et al., 1993; U. S. EPA, 1995). If such a phase is present in sufficient mass, possesses high sorption reactivity, large surface area, and remains stable in suspension, it can serve as an important mechanism to facilitate contaminant transport in many types of subsurface systems.

Colloids are particles that are sufficiently small so that the surface free energy of the particle dominates the bulk free energy. Typically, in ground water, this includes particles with diameters between 1 and 1000 nm. The most commonly observed mobile particles include: secondary clay minerals; hydrous iron, aluminum, and manganese oxides; dissolved and particulate organic materials, and viruses and bacteria.

These reactive particles have been shown to be mobile under a variety of conditions in both field studies and laboratory column experiments, and as such need to be included in monitoring programs where identification of the *total* mobile contaminant loading (dissolved + naturally suspended particles) at a site is an objective. To that end, sampling methodologies must be used which do not artificially bias *naturally* suspended particle concentrations.

Currently the most common ground-water purging and sampling methodology is to purge a well using bailers or high speed pumps to remove 3 to 5 casing volumes followed by sample collection. This method can cause adverse impacts on sample quality through collection of samples with high levels of turbidity. This results in the inclusion of otherwise immobile artifactual particles which produce an overestimation of certain analytes of interest (e.g., metals or hydrophobic organic compounds). Numerous documented problems associated with filtration (Danielsson, 1982; Laxen and Chandler, 1982; Horowitz et al., 1992) make this an undesirable method of rectifying the turbidity problem, and include the removal of potentially mobile (contaminant-associated) particles during filtration, thus artificially biasing contaminant concentrations low. Sampling-induced turbidity problems can often be mitigated by using low-flow purging and sampling techniques.

Current subsurface conceptual models have undergone considerable refinement due to the recent development and increased use of field screening tools. So-called hydraulic *push* technologies (e.g., cone penetrometer, Geoprobe®, QED HydroPunch®) enable relatively fast screening site characterization which can then be used to design and install a monitoring well network. Indeed, alternatives to conventional monitoring wells are now being considered for some hydrogeologic settings. The ultimate design of any monitoring system should however be based upon adequate site characterization and be consistent with established monitoring objectives.

If the sampling program objectives include accurate assessment of the magnitude and extent of subsurface contamination over time and/or accurate assessment of subsequent remedial performance, then some information regarding plume delineation in three-dimensional space is necessary prior to monitoring well network design and installation. This can be accomplished with a variety of different tools and equipment ranging from hand-operated augers to screening tools mentioned above and large drilling rigs. Detailed information on ground-water flow velocity, direction, and horizontal and vertical variability are essential baseline data requirements. Detailed soil and geologic data are required prior to and during the installation of sampling points. This includes historical as well as detailed soil and geologic logs which accumulate during the site investigation. The use of borehole geophysical techniques is also recommended. With this information (together with other site characterization data) and a clear understanding of sampling

objectives, then appropriate location, screen length, well diameter, slot size, etc. for the monitoring well network can be decided. This is especially critical for new in situ remedial approaches or natural attenuation assessments at hazardous waste sites.

In general, the overall goal of any ground-water sampling program is to collect water samples with no alteration in water chemistry; analytical data thus obtained may be used for a variety of specific monitoring programs depending on the regulatory requirements. The sampling methodology described in this paper assumes that the monitoring goal is to sample monitoring wells for the presence of contaminants and it is applicable whether mobile colloids are a concern or not and whether the analytes of concern are metals (and metal-loids) or organic compounds.

II. Monitoring Objectives and Design Considerations

The following issues are important to consider prior to the design and implementation of any ground-water monitoring program, including those which anticipate using low-flow purging and sampling procedures.

A. Data Quality Objectives (DQOs)

Monitoring objectives include four main types: detection, assessment, corrective-action evaluation and resource evaluation, along with *hybrid* variations such as site-assessments for property transfers and water availability investigations. Monitoring objectives may change as contamination or water quality problems are discovered. However, there are a number of common components of monitoring programs which should be recognized as important regardless of initial objectives. These components include:

- 1) Development of a conceptual model that incorporates elements of the regional geology to the local geologic framework. The conceptual model development also includes initial site characterization efforts to identify hydrostratigraphic units and likely flow-paths using a minimum number of borings and well completions;
- 2) Cost-effective and well documented collection of high quality data utilizing simple, accurate, and reproducible techniques; and
- 3) Refinement of the conceptual model based on supplementary data collection and analysis.

These fundamental components serve many types of monitoring programs and provide a basis for future efforts that evolve in complexity and level of spatial detail as purposes and objectives expand. High quality, reproducible data collection is a common goal regardless of program objectives.

High quality data collection implies data of sufficient accuracy, precision, and completeness (i.e., ratio of valid analytical results to the minimum sample number called for by the program design) to meet the program objectives. Accuracy depends on the correct choice of monitoring tools and procedures to minimize sample and subsurface disturbance from collection to analysis. Precision depends on the repeatability of sampling and analytical protocols. It can be assured or improved by replication of sample analyses including blanks, field/lab standards and reference standards.

B. Sample Representativeness

An important goal of any monitoring program is collection of data that is truly representative of conditions at the site. The term *representativeness* applies to chemical and hydrogeologic data collected via wells, borings, piezometers, geophysical and soil gas measurements, lysimeters, and temporary sampling points. It involves a recognition of the statistical variability of individual subsurface physical properties, and contaminant or major ion concentration levels, while explaining extreme values. Subsurface temporal and spatial variability are facts. Good professional practice seeks to maximize representativeness by using proven accurate and reproducible techniques to define limits on the distribution of measurements collected at a site. However, measures of representativeness are dynamic and are controlled by evolving site characterization and monitoring objectives. An evolutionary site characterization model, as shown in Figure 1, provides a systematic approach to the goal of consistent data collection.

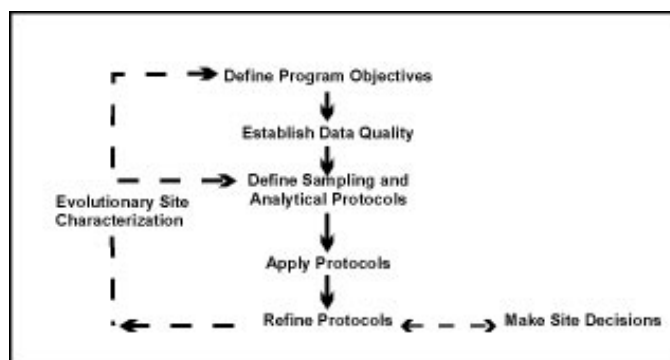


Figure 1. Evolutionary Site Characterization Model

The model emphasizes a recognition of the causes of the variability (e.g., use of inappropriate technology such as using bailers to purge wells; imprecise or operator-dependent methods) and the need to control avoidable errors.

1) Questions of Scale

A sampling plan designed to collect representative samples must take into account the potential scale of changes in site conditions through space and time as well as the chemical associations and behavior of the parameters that are targeted for investigation. In subsurface systems, physical (i.e., aquifer) and chemical properties over time or space are not statistically independent. In fact, samples taken in close proximity (i.e., within distances of a few meters) or within short time periods (i.e., more frequently than monthly) are highly auto-correlated. This means that designs employing high-sampling frequency (e.g., monthly) or dense spatial monitoring designs run the risk of redundant data collection and misleading inferences regarding trends in values that aren't statistically valid. In practice, contaminant detection and assessment monitoring programs rarely suffer these *over-sampling* concerns. In corrective-action evaluation programs, it is also possible that too little data may be collected over space or time. In these cases, false interpretation of the spatial extent of contamination or underestimation of temporal concentration variability may result.

2) Target Parameters

Parameter selection in monitoring program design is most often dictated by the regulatory status of the site. However, background water quality constituents, purging indicator parameters, and contaminants, all represent targets for data collection programs. The tools and procedures used in these programs should be equally rigorous and applicable to all categories of data, since all may be needed to determine or support regulatory action.

C. Sampling Point Design and Construction

Detailed site characterization is central to all decision-making purposes and the basis for this characterization resides in identification of the geologic framework and major hydro-stratigraphic units. Fundamental data for sample point location include: subsurface lithology, head-differences and background geochemical conditions. Each sampling point has a proper use or uses which should be documented at a level which is appropriate for the program's data quality objectives. Individual sampling points may not always be able to fulfill multiple monitoring objectives (e.g., detection, assessment, corrective action).

1) Compatibility with Monitoring Program and Data Quality Objectives

Specifics of sampling point location and design will be dictated by the complexity of subsurface lithology and variability in contaminant and/or geochemical conditions. It should be noted that, regardless of the ground-water sampling approach, few sampling points (e.g., wells, drive-points, screened augers) have zones of influence in excess of a few

feet. Therefore, the spatial frequency of sampling points should be carefully selected and designed.

2) Flexibility of Sampling Point Design

In most cases *well-point* diameters in excess of 1 7/8 inches will permit the use of most types of submersible pumping devices for low-flow (minimal drawdown) sampling. It is suggested that *short* (e.g., less than 1.6 m) screens be incorporated into the monitoring design where possible so that comparable results from one device to another might be expected. *Short*, of course, is relative to the degree of vertical water quality variability expected at a site.

3) Equilibration of Sampling Point

Time should be allowed for equilibration of the well or sampling point with the formation after installation. Placement of well or sampling points in the subsurface produces some disturbance of ambient conditions. Drilling techniques (e.g., auger, rotary, etc.) are generally considered to cause more disturbance than *direct-push* technologies. In either case, there may be a period (i.e., days to months) during which water quality near the point may be distinctly different from that in the formation. Proper development of the sampling point and adjacent formation to remove fines created during emplacement will shorten this water quality *recovery* period.

III. Definition of Low-Flow Purging and Sampling

It is generally accepted that water in the well casing is non-representative of the formation water and needs to be purged prior to collection of ground-water samples. However, the water in the screened interval may indeed be representative of the formation, depending upon well construction and site hydrogeology. Wells are purged to some extent for the following reasons: the presence of the air interface at the top of the water column resulting in an oxygen concentration gradient with depth, loss of volatiles up the water column, leaching from or sorption to the casing or filter pack, chemical changes due to clay seals or backfill, and surface infiltration.

Low-flow purging, whether using portable or dedicated systems, should be done using pump-intake located in the middle or slightly above the middle of the screened interval. Placement of the pump too close to the bottom of the well will cause increased entrainment of solids which have collected in the well over time. These particles are present as a result of well development, prior purging and sampling events, and natural colloidal transport and deposition. Therefore, placement of the pump in the middle or toward the top of the screened interval is suggested. Placement of the pump at the top of the water column for sampling is only recommended in unconfined aquifers, screened across the water table, where this is the desired sampling point. Low-

flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval.

A. Low-Flow Purging and Sampling

Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface which can be affected by flow regulators or restrictions. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practical taking into account established site sampling objectives. Typically, flow rates on the order of 0.1 - 0.5 L/min are used, however this is dependent on site-specific hydrogeology. Some extremely coarse-textured formations have been successfully sampled in this manner at flow rates to 1 L/min. The effectiveness of using low-flow purging is intimately linked with proper screen location, screen length, and well construction and development techniques. The reestablishment of natural flow paths in both the vertical and horizontal directions is important for correct interpretation of the data. For high resolution sampling needs, screens less than 1 m should be used. Most of the need for purging has been found to be due to passing the sampling device through the overlying casing water which causes mixing of these stagnant waters and the dynamic waters within the screened interval. Additionally, there is disturbance to suspended sediment collected in the bottom of the casing and the displacement of water out into the formation immediately adjacent to the well screen. These disturbances and impacts can be avoided using dedicated sampling equipment, which precludes the need to insert the sampling device prior to purging and sampling.

Isolation of the screened interval water from the overlying stagnant casing water may be accomplished using low-flow minimal drawdown techniques. If the pump intake is located within the screened interval, most of the water pumped will be drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone. However, if the wells are not constructed and developed properly, zones other than those intended may be sampled. At some sites where geologic heterogeneities are sufficiently different within the screened interval, higher conductivity zones may be preferentially sampled. This is another reason to use shorter screened intervals, especially where high spatial resolution is a sampling objective.

B. Water Quality Indicator Parameters

It is recommended that water quality indicator parameters be used to determine purging needs prior to sample collection in each well. Stabilization of parameters such as pH, specific conductance, dissolved oxygen, oxida-

tion-reduction potential, temperature and turbidity should be used to determine when formation water is accessed during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by oxidation-reduction potential, dissolved oxygen and turbidity. Temperature and pH, while commonly used as purging indicators, are actually quite insensitive in distinguishing between formation water and stagnant casing water; nevertheless, these are important parameters for data interpretation purposes and should also be measured. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. Instruments are available which utilize in-line flow cells to continuously measure the above parameters.

It is important to establish specific well stabilization criteria and then consistently follow the same methods thereafter, particularly with respect to drawdown, flow rate and sampling device. Generally, the time or purge volume required for parameter stabilization is independent of well depth or well volumes. Dependent variables are well diameter, sampling device, hydrogeochemistry, pump flow rate, and whether the devices are used in a portable or dedicated manner. If the sampling device is already in place (i.e., dedicated sampling systems), then the time and purge volume needed for stabilization is much shorter. Other advantages of dedicated equipment include less purge water for waste disposal, much less decontamination of equipment, less time spent in preparation of sampling as well as time in the field, and more consistency in the sampling approach which probably will translate into less variability in sampling results. The use of dedicated equipment is strongly recommended at wells which will undergo routine sampling over time.

If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization. Turbidity is always the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. It should be noted that natural turbidity levels in ground water may exceed 10 nephelometric turbidity units (NTU).

C. Advantages and Disadvantages of Low-Flow (Minimum Drawdown) Purging

In general, the advantages of low-flow purging include:

- samples which are representative of the *mobile* load of contaminants present (dissolved and colloid-associated);
- minimal disturbance of the sampling point thereby minimizing sampling artifacts;
- less operator variability, greater operator control;

- reduced stress on the formation (minimal drawdown);
- less mixing of stagnant casing water with formation water;
- reduced need for filtration and, therefore, less time required for sampling;
- smaller purging volume which decreases waste disposal costs and sampling time;
- better sample consistency; reduced artificial sample variability.

Some disadvantages of low-flow purging are:

- higher initial capital costs,
- greater set-up time in the field,
- need to transport additional equipment to and from the site,
- increased training needs,
- resistance to change on the part of sampling practitioners,
- concern that new data will indicate a *change in conditions* and trigger an *action*.

IV. Low-Flow (Minimal Drawdown) Sampling Protocols

The following ground-water sampling procedure has evolved over many years of experience in ground-water sampling for organic and inorganic compound determinations and as such summarizes the authors' (and others) experiences to date (Barcelona et al., 1984, 1994; Barcelona and Helfrich, 1986; Puls and Barcelona, 1989; Puls et. al. 1990, 1992; Puls and Powell, 1992; Puls and Paul, 1995). High-quality chemical data collection is essential in ground-water monitoring and site characterization. The primary limitations to the collection of *representative* ground-water samples include: mixing of the stagnant casing and *fresh* screen waters during insertion of the sampling device or ground-water level measurement device; disturbance and resuspension of settled solids at the bottom of the well when using high pumping rates or raising and lowering a pump or bailer; introduction of atmospheric gases or degassing from the water during sample handling and transfer, or inappropriate use of vacuum sampling device, etc.

A. Sampling Recommendations

Water samples should not be taken immediately following well development. Sufficient time should be allowed for the ground-water flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and methods of installation but often exceeds one week.

Well purging is nearly always necessary to obtain samples of water flowing through the geologic formations in the screened interval. Rather than using a general but arbitrary guideline of purging three casing volumes prior to

sampling, it is recommended that an in-line water quality measurement device (e.g., flow-through cell) be used to establish the stabilization time for several parameters (e.g., pH, specific conductance, redox, dissolved oxygen, turbidity) on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

The following are recommendations to be considered before, during and after sampling:

- use low-flow rates (<0.5 L/min), during both purging and sampling to maintain minimal drawdown in the well;
- maximize tubing wall thickness, minimize tubing length;
- place the sampling device intake at the desired sampling point;
- minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion;
- make proper adjustments to stabilize the flow rate as soon as possible;
- monitor water quality indicators during purging;
- collect unfiltered samples to estimate contaminant loading and transport potential in the subsurface system.

B. Equipment Calibration

Prior to sampling, all sampling device and monitoring equipment should be calibrated according to manufacturer's recommendations and the site Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP). Calibration of pH should be performed with at least two buffers which bracket the expected range. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

C. Water Level Measurement and Monitoring

It is recommended that a device be used which will least disturb the water surface in the casing. Well depth should be obtained from the well logs. Measuring to the bottom of the well casing will only cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure well depth after sampling is completed. The water level measurement should be taken from a permanent reference point which is surveyed relative to ground elevation.

D. Pump Type

The use of low-flow (e.g., 0.1-0.5 L/min) pumps is suggested for purging and sampling all types of analytes. All pumps have some limitation and these should be investigated with respect to application at a particular site. Bailers are inappropriate devices for low-flow sampling.

1) General Considerations

There are no unusual requirements for ground-water sampling devices when using low-flow, minimal drawdown techniques. The major concern is that the device give consistent results and minimal disturbance of the sample across a range of *low* flow rates (i.e., < 0.5 L/min). Clearly, pumping rates that cause minimal to no drawdown in one well could easily cause *significant* drawdown in another well finished in a less transmissive formation. In this sense, the pump should not cause undue pressure or temperature changes or physical disturbance on the water sample over a reasonable sampling range. Consistency in operation is critical to meet accuracy and precision goals.

2) Advantages and Disadvantages of Sampling Devices

A variety of sampling devices are available for low-flow (minimal drawdown) purging and sampling and include peristaltic pumps, bladder pumps, electrical submersible pumps, and gas-driven pumps. Devices which lend themselves to both dedication and consistent operation at definable low-flow rates are preferred. It is desirable that the pump be easily adjustable and operate reliably at these lower flow rates. The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and some volatiles loss. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid.

Clearly, bailers and other *grab* type samplers are ill-suited for low-flow sampling since they will cause repeated disturbance and mixing of *stagnant* water in the casing and the *dynamic* water in the screened interval. Similarly, the use of inertial lift foot-valve type samplers may cause too much disturbance at the point of sampling. Use of these devices also tends to introduce uncontrolled and unacceptable operator variability.

Summaries of advantages and disadvantages of various sampling devices are listed in Herzog et al. (1991), U. S. EPA (1992), Parker (1994) and Thurnblad (1994).

E. Pump Installation

Dedicated sampling devices (left in the well) capable of pumping and sampling are preferred over any other type of device. Any portable sampling device should be slowly and carefully lowered to the middle of the screened interval or slightly above the middle (e.g., 1-1.5 m below the top of a 3 m screen). This is to minimize excessive mixing of the stagnant water in the casing above the screen with the screened interval zone water, and to minimize resuspension of solids which will have collected at the bottom of the well. These two disturbance effects have been shown to directly affect the time required for purging. There also appears to be a direct correlation between size of portable sampling devices relative to the well bore and resulting purge volumes and times. The key is to minimize disturbance of water and solids in the well casing.

F. Filtration

Decisions to filter samples should be dictated by sampling objectives rather than as a *fix* for poor sampling practices, and field-filtering of certain constituents should not be the default. Consideration should be given as to what the application of field-filtration is trying to accomplish. For assessment of truly dissolved (as opposed to operationally *dissolved* [i.e., samples filtered with 0.45 µm filters]) concentrations of major ions and trace metals, 0.1 µm filters are recommended although 0.45 µm filters are normally used for most regulatory programs. Alkalinity samples must also be filtered if significant particulate calcium carbonate is suspected, since this material is likely to impact alkalinity titration results (although filtration itself may alter the CO₂ composition of the sample and, therefore, affect the results).

Although filtration may be appropriate, filtration of a sample may cause a number of unintended changes to occur (e.g. oxidation, aeration) possibly leading to filtration-induced artifacts during sample analysis and uncertainty in the results. Some of these unintended changes may be unavoidable but the factors leading to them must be recognized. Deleterious effects can be minimized by consistent application of certain filtration guidelines. Guidelines should address selection of filter type, media, pore size, etc. in order to identify and minimize potential sources of uncertainty when filtering samples.

In-line filtration is recommended because it provides better consistency through less sample handling, and minimizes sample exposure to the atmosphere. In-line filters are available in both disposable (barrel filters) and non-disposable (in-line filter holder, flat membrane filters) formats and various filter pore sizes (0.1-5.0 µm). Disposable filter cartridges have the advantage of greater sediment handling capacity when compared to traditional membrane filters. Filters must be pre-rinsed following manufacturer's recommendations. If there are no recommendations for rinsing, pass through a minimum of 1 L of ground water following purging and prior to sampling. Once filtration has begun, a filter cake may develop as particles larger than the pore size accumulate on the filter membrane. The result is that the effective pore diameter of the membrane is reduced and particles smaller than the stated pore size are excluded from the filtrate. Possible corrective measures include prefiltering (with larger pore size filters), minimizing particle loads to begin with, and reducing sample volume.

G. Monitoring of Water Level and Water Quality Indicator Parameters

Check water level periodically to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 m) during purging. This goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience. In-line water quality indicator parameters should be continuously monitored during purging. The water quality

indicator parameters monitored can include pH, redox potential, conductivity, dissolved oxygen (DO) and turbidity. The last three parameters are often most sensitive. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every three to five minutes if the above suggested rates are used. Stabilization is achieved after all parameters have stabilized for three successive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or DO. Three successive readings should be within ± 0.1 for pH, $\pm 3\%$ for conductivity, ± 10 mv for redox potential, and $\pm 10\%$ for turbidity and DO. Stabilized purge indicator parameter trends are generally obvious and follow either an exponential or asymptotic change to stable values during purging. Dissolved oxygen and turbidity usually require the longest time for stabilization. The above stabilization guidelines are provided for rough estimates based on experience.

H. Sampling, Sample Containers, Preservation and Decontamination

Upon parameter stabilization, sampling can be initiated. If an in-line device is used to monitor water quality parameters, it should be disconnected or bypassed during sample collection. Sampling flow rate may remain at established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates less than 0.5 L/min are appropriate. The same device should be used for sampling as was used for purging. Sampling should occur in a progression from least to most contaminated well, if this is known. Generally, volatile (e.g., solvents and fuel constituents) and gas sensitive (e.g., Fe^{2+} , CH_4 , $\text{H}_2\text{S}/\text{HS}^-$; alkalinity) parameters should be sampled first. The sequence in which samples for most inorganic parameters are collected is immaterial unless filtered (dissolved) samples are desired. Filtering should be done last and in-line filters should be used as discussed above. During both well purging and sampling, proper protective clothing and equipment must be used based upon the type and level of contaminants present.

The appropriate sample container will be prepared in advance of actual sample collection for the analytes of interest and include sample preservative where necessary. Water samples should be collected directly into this container from the pump tubing.

Immediately after a sample bottle has been filled, it must be preserved as specified in the site (QAPP). Sample preservation requirements are based on the analyses being performed (use site QAPP, FSP, RCRA guidance document [U. S. EPA, 1992] or EPA SW-846 [U. S. EPA, 1982]). It may be advisable to add preservatives to sample bottles in a controlled setting prior to entering the field in order to reduce the chances of improperly preserving sample bottles or

introducing field contaminants into a sample bottle while adding the preservatives.

The preservatives should be transferred from the chemical bottle to the sample container using a disposable polyethylene pipet and the disposable pipet should be used only once and then discarded.

After a sample container has been filled with ground water, a Teflon™ (or tin)-lined cap is screwed on tightly to prevent the container from leaking. A sample label is filled out as specified in the FSP. The samples should be stored inverted at 4°C.

Specific decontamination protocols for sampling devices are dependent to some extent on the type of device used and the type of contaminants encountered. Refer to the site QAPP and FSP for specific requirements.

I. Blanks

The following blanks should be collected:

- (1) field blank: one field blank should be collected from each source water (distilled/deionized water) used for sampling equipment decontamination or for assisting well development procedures.
- (2) equipment blank: one equipment blank should be taken prior to the commencement of field work, from each set of sampling equipment to be used for that day. Refer to site QAPP or FSP for specific requirements.
- (3) trip blank: a trip blank is required to accompany each volatile sample shipment. These blanks are prepared in the laboratory by filling a 40-mL volatile organic analysis (VOA) bottle with distilled/deionized water.

V. Low-Permeability Formations and Fractured Rock

The overall sampling program goals or sampling objectives will drive how the sampling points are located, installed, and choice of sampling device. Likewise, site-specific hydrogeologic factors will affect these decisions. Sites with very low permeability formations or fractures causing discrete flow channels may require a unique monitoring approach. Unlike water supply wells, wells installed for ground-water quality assessment and restoration programs are often installed in low water-yielding settings (e.g., clays, silts). Alternative types of sampling points and sampling methods are often needed in these types of environments, because low-permeability settings may require extremely low-flow purging (<0.1 L/min) and may be technology-limited. Where devices are not readily available to pump at such low flow rates, the primary consideration is to avoid dewatering of

the well screen. This may require repeated recovery of the water during purging while leaving the pump in place within the well screen.

Use of low-flow techniques may be impractical in these settings, depending upon the water recharge rates. The sampler and the end-user of data collected from such wells need to understand the limitations of the data collected; i.e., a strong potential for underestimation of actual contaminant concentrations for volatile organics, potential false negatives for filtered metals and potential false positives for unfiltered metals. It is suggested that comparisons be made between samples recovered using low-flow purging techniques and samples recovered using passive sampling techniques (i.e., two sets of samples). Passive sample collection would essentially entail acquisition of the sample with no or very little purging using a dedicated sampling system installed within the screened interval or a passive sample collection device.

A. Low-Permeability Formations (<0.1 L/min recharge)

1. Low-Flow Purging and Sampling with Pumps

- a. "portable or non-dedicated mode" - Lower the pump (one capable of pumping at <0.1 L/min) to mid-screen or slightly above and set in place for minimum of 48 hours (to lessen purge volume requirements). After 48 hours, use procedures listed in Part IV above regarding monitoring water quality parameters for stabilization, etc., but do not dewater the screen. If excessive drawdown and slow recovery is a problem, then alternate approaches such as those listed below may be better.
- b. "dedicated mode" - Set the pump as above at least a week prior to sampling; that is, operate in a dedicated pump mode. With this approach significant reductions in purge volume should be realized. Water quality parameters should stabilize quite rapidly due to less disturbance of the sampling zone.

2. Passive Sample Collection

Passive sampling collection requires insertion of the device into the screened interval for a sufficient time period to allow flow and sample equilibration before extraction for analysis. Conceptually, the extraction of water from low yielding formations seems more akin to the collection of water from the unsaturated zone and passive sampling techniques may be more appropriate in terms of obtaining "representative" samples. Satisfying usual sample volume requirements is typically a problem with this approach and some latitude will be needed on the part of regulatory entities to achieve sampling objectives.

B. Fractured Rock

In fractured rock formations, a low-flow to zero purging approach using pumps in conjunction with packers to isolate the sampling zone in the borehole is suggested. Passive multi-layer sampling devices may also provide the most "representative" samples. It is imperative in these settings to identify flow paths or water-producing fractures prior to sampling using tools such as borehole flowmeters and/or other geophysical tools.

After identification of water-bearing fractures, install packer(s) and pump assembly for sample collection using low-flow sampling in "dedicated mode" or use a passive sampling device which can isolate the identified water-bearing fractures.

VI. Documentation

The usual practices for documenting the sampling event should be used for low-flow purging and sampling techniques. This should include, at a minimum: information on the conduct of purging operations (flow-rate, drawdown, water-quality parameter values, volumes extracted and times for measurements), field instrument calibration data, water sampling forms and chain of custody forms. See Figures 2 and 3 and "Ground Water Sampling Workshop -- A Workshop Summary" (U. S. EPA, 1995) for example forms and other documentation suggestions and information. This information coupled with laboratory analytical data and validation data are needed to judge the "useability" of the sampling data.

VII. Notice

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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 _____

[illegible]

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $\text{Vol}_{\text{cyl}} = \pi r^2 h$, $\text{Vol}_{\text{sphere}} = 4/3 \pi r^3$

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 _____

[illegible]

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $\text{Vol}_{\text{cyl}} = \pi r^2 h$, $\text{Vol}_{\text{sphere}} = 4/3 \pi r^3$

Hydro Tech Environmental, Corp.



Monitoring Well Sampling Log Sheet

Job No.: _____ Well No.: _____ Date: ____ / ____ / ____

Well Depth: _____ Screen Length: _____ Well Diameter: _____ Casing Type: _____

Sampling Device: _____ **Tubing Type:** _____ **Initial DTP:** _____ **Initial DTW:** _____

Well Volume: _____ Total Volume Purged: _____

Sampling Personnel: _____

Low Flow Sampling required ? Yes : No:

Order of stabilization

a	b	c	e	f	d
± 1		$\pm 3\%$	$\pm 10\%$	$\pm 10\%$	$\pm 10\text{ mv}$

Deviation

[illegible]

ATTACHMENT D
SAMPLE CHAIN OF CUSTODY FORM

Field Chain-of-Custody Record

120 RESEARCH DR. STRATFORD, CT 06615
(203) 325-1371 FAX (203) 357-0166

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	Turn-Around Time 24 hr _____ 48 hr _____ 72 hr _____ 5 Day _____ Standard _____	Report Type/Deliverbles
Company: _____	Company: _____	Company: _____	Purchase Order No.	Summary _____ QA/QC Summary _____ Results Only RCP Package _____ ASP B Pkg _____ ASP A Pkg _____ Excel format _____ EDD _____ OTHER _____		
Address: _____	Address: _____	Address: _____				
_____	_____	_____				
Phone No. _____	Phone No. _____	Phone No. _____				
Contact Person: _____	Attention: _____	Attention: _____				
E-Mail Address: _____	E-Mail Address: _____	E-Mail Address: _____				

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.

<i>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.</i>			Volatiles	Semi-Vols.	Pest/PCB/Herb	Metals	Misc. Org.	Full Lists	Miscellaneous Parameters			Special
			8260 full	TICs	8270 or 625	8082PCB	RCRA8	TPH GRO	Pri.Poll.	Corrosivity	Nitrate	Color
<div> <div>Samples Collected/Authorized By (Signature)</div> <div>Name (printed)</div> </div>			624	Site Spec.	STARS	8081Pest	PP13	TPH DRO	TCL Organics	Reactivity	Nitrite	Phenols
			STARS	SPLPorTCLP	BN Only	8151Herb	PAL	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	SPLPorTCLP	SPLPorTCLP	Air TO15	Part.360-Baseline	TOX	Phosphate	BOD28
			CT RCP	Oxygenates	TCL list	TCLP Pest	<u>Indiv. Metals</u>	Air STARS	Part.360-Expanded No Decons-Futures	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	SPLPorTCLP	608 Pest	Se, Ti, Sb, Cu,	Methane	NYSECSewer	Asbestos	pH	TDS
8021B list	5035	TCLP BNA	608 PCB	Na, Mn, Ag, etc.	Helium	TAGM	Silica	MBAS	TPH - IR			

[illegible]

<i>Comments</i>	Preservation	4°C _____ Frozen _____	4°C _____	4°C _____	HNO ₃ _____	4°C _____	4°C _____	4°C _____	H ₂ SO ₄ _____	NaOH _____	Temperature on Receipt _____ °C	
	Check those Applicable	HCl _____ MeOH _____			4°C _____	H ₂ SO ₄ _____	Other _____	ZnAc _____	Ascorbic _____	Other _____		
		Samples Relinquished By _____ Date/Time _____					Samples Received By _____ Date/Time _____					
		Samples Relinquished By _____ Date/Time _____					Samples Received in LAB by _____ Date/Time _____					

ATTACHMENT E
CONVENTIONAL LABORATORY QA/QC



120 Research Drive
Stratford, CT 06615
203-325-1371



Quality Manual

Laboratory Director:

Ben Gulizia

Quality Manager:

Teresa V. Weikel

Date of Issue:


April 12, 2013

Revision:

2.4



Controlled Copy #:

	Quality Manual York Analytical Laboratories, Inc.	Issue Date: Apr. 12, 2013	Rev.: 2.4

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

Controlled Copy in Canary Yellow only

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ATTACHMENT A – Laboratory Functional Organization Chart
 ATTACHMENT B – Master List of Documents

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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

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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-Quality Systems

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4. Management Requirements

4.1 Organization

This section discusses general positions and quality-related responsibilities which provide for the implementation of the Quality 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

State of Connecticut Department of Health (CTDOH) License no. PH-0723
 New York State Department of Health (NYSDOH) ELAP/NELAP License no. 10854
 State of New Jersey Dept. of Environmental Protection (NJDEP) License 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

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Classical Chemistry Group
 Organic Preparations Group
 Atomic Spectroscopy Group
 Gas Chromatography Group
 Gas Chromatography/Mass Spectrometry Groups (Volatiles and Semi-Volatiles)
 Aquatic Toxicity Group
 Report production/Data Management Group

4.1.3 Scope of Management System

The management system covers activities in the laboratory's permanent facility at 120 Research Drive, Stratford, CT 06615. The fields of activities include:

Analysis of environmental samples (water, wastewater, soil, sludge, and air) for Federal and State regulated contaminants.

The laboratory's scope of tests is listed in the our specific licenses and encompasses volatile organics, semi-volatile organics, pesticides, herbicides, PCBs, metals, Aquatic Toxicity 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).

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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

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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.

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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
- determines action plans to meet the needs of stakeholders
- represents organization to major Clients, government agencies, shareholders, and the public
- 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
- ensures personnel are trained for the duties they perform - includes substitutes when regular personnel are absent
- maintains current job descriptions
- maintains records and manages all aspects of testing activities

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 laboratory accreditation activities
- handles the maintenance and distribution of the Quality Manual and associated documents

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- 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
- 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

Client Services Managers

- 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

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- 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.

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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 Teresa Weikel 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 Laboratory Director will assume his/her responsibilities.

In the absence of the Group Leader, the Laboratory 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:

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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

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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

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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

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- to make test method changes to improve performance
- to participate in proficiency testing or quality evaluation programs with peer laboratories
- 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
- to establish and report on quality savings

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.

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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 Test 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:

- organizational chart (section 4.1.5.E)
- 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 plan (section 5.3.1)

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4.2.6 Technical Management and the Quality Assurance Officer

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.

4.2.7 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

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4.3 Document Control

4.3.1 Policies and Procedures

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.

4.3.2 Document Approval and Issue

4.3.2.1 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.

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4.3.2.2 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)

4.3.2.3 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)

4.3.3 Document Changes

4.3.3.1 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.

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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.

4.3.3.2 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.

4.3.3.3 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.

4.3.3.4 Computerized Documents

Policy and Details:

The SOP# ADMINDOC043010 details how changes in documents maintained in computerized systems are made and controlled.

Revision History

Revision 2.0	04/30/2010	First Issue of Rewritten Quality Manual
Revision 2.1	06/29/2012	Modified Master List information, and hand amendments

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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:

- the Client requirements including the methods to be used are adequately defined, documented and understood (see section 5.4.2)
- the laboratory has the licensing, capability and resources to meet the requirements
- 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:

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- 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.

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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.

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4.5 Subcontracting of Analyses and Calibrations

4.5.1 Subcontractor Competence

Policy:

Work that must be subcontracted due to:

- unforeseen circumstances
- 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
- registration under the ISO 9001 standard
- satisfactory performance of appropriate quality control check samples, certified reference material, in-house reference material or replicate analysis
- 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.

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.

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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.

Details:

The approved register of subcontractors and all relevant records are maintained by the Quality Assurance Officer.

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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.

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. 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

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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.

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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.

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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.

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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).

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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

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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.

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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.

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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

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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.

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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.

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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.

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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 three months 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.

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.

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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

Nonconformances 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 records 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.

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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 at the network by instrument and date.

C - Instrument Maintenance Logs

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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 NVLAP, 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.

4.13.1.4 RECORD CONTROL

The individual responsible for the records management system is part of the Data Management Group. This person shall:

- Initiate new project files including project index
- Add new records to existing files, initiate new files within a category, and update the 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

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- 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 records is set at **five** 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 Record 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 is password protected.

Backups ensure integrity and availability of data / information in the event of a system / power failure.

4.13.3 Technical Records

4.13.3.1 Record Information

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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.

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 repetition. Records include:

- date of sampling
- sample receipt
- sample handling, storage, and disposal
- 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:

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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.

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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
- 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.

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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
- audit report distribution

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 in the laboratory.

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 CAR is issued.

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4.15 Management Reviews

4.15.1 Review of Quality Management System and Testing

Policy:

Top management periodically (at least 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

A minimum period for conducting a management review is once a 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.

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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 provide initial data integrity training and on-going annual training to laboratory managers and staff. Senior managers ensure that only staff who sign the ethics agreement are allowed to work in the laboratory.

The QAO shall maintain 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.

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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 QAO and/or Laboratory Director, 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.

Blind known reference samples may be submitted for analysis as real samples by the QAO, (blind to the analyst) as part of any project or event. Data and results of the reference sample are reviewed by the QAO to verify that all data integrity requirements are met.

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 locked filing cabinets and password protected electronic files. If client disclosure is determined to be necessary by senior laboratory management, then such disclosures and outcomes are recorded.

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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)

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	_____ Title	_____ Date
_____ Signature	_____ Title	_____ Date
_____ Signature	_____ Title	_____ Date
_____ Signature	_____ Title	_____ Date
_____ Signature	_____ Title	_____ Date

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5.0 Technical Requirements

5.1 General

5.1.1 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)

5.1.2 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.

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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

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of the laboratory. SOP# [QSP 5-2-1](#) 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 than 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 Managing 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 degree level. 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:

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- 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 Log.

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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. O

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 45-50 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.

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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 be 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.

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

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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.

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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
- 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

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.

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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.

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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)

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- 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.

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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 is 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.

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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 Fit 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.

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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

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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 which is performed at prescribed intervals for instrumentation, such as balances.

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

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- 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.

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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 calibration. 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.

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Records for periodically calibrated instrumentation shall be maintained in the Laboratory Operation 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 average response factor) of the same compound at different concentrations. Records of these calibrations are 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, 2010 on Volatiles GC/MS # 1, the batch QA/QC data is placed in a QB file identified as QBV1040110A. 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 projects are processed together, calibration data is included in a batch folder.

- The specific SOPs detail:
- Calibration instructions (curve preparation, linear ranges, etc.).
- Procedures for chemical standards preparations.

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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 or 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, even though they are AR grade or better, may vary from one source to another. The Analyst must determine, through the use of reagent and/or solvent blanks, if materials are free from 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.

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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 linearity 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 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 mass calibration and abundance pattern.
- Documentation of GC/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

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(BNA) compounds or p-bromofluorobenzene (BFB) for volatile compounds. 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 criteria of the method for 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.

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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 methods TO14A/15. 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 ICP and ICP/MS 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

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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

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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 weights 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 meteorologically 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

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- 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 following SOP QC040402 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.

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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

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.

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. For further details see:

http://www.fda.gov/ora/compliance_ref/part11/

Revision History

Revision 2.0	04/30/2010	First Issue of Rewritten Quality Manual
Revision 2.1	06/29/2012	Modified balance calibration procedure, tolerances.

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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 the instrumentation's 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, including that used for sampling, 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:

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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 of 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:

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
- performance history, where appropriate (e.g., response time, drift, noise level)

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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 nonconformances. Not only do we do this for ethical reasons in support of our client, but minor nonconformances are often indicative of 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.

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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.

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.

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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 located in the appropriate room where the instrumentation is located. SOP# [QSP 5-5-1](#) outlines a general maintenance plan for instrumentation and includes various checks. 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

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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 labelled 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

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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.

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 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

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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.

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:

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Reference standards are obtained from the National Institute of Standards and Technology (NIST), if applicable.

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.

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:

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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 or containers.

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5.7 Sample Handling, Receipt and Initiation of Testing

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 Assurance Program, 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. 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

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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 Lab 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

Prior to collecting samples, the 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.

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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.

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°C until arrival at the laboratory. Upon receipt, the temperature (as measured by an infrared temperature probe) and condition of the samples is recorded on the Chain-of-Custody form.

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It is imperative that the analyses requested be clearly provided so that analytical requirements are maintained with respect to sample holding times.

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 Service, documented and passed on immediately to the Sample Control. The Sample Control Group shall note that the shipment is expected and notify the Lab Manager, Client Service and Group Leaders when samples are received. This is especially important for RUSH requests where coordination is essential to meet project deadlines. The communication is done via the RUSH NOTIFICATION form.

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 resampled, 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 Lab Manager or Client Service.
- 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

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- 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 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 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 $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Extracting and/or analyzing samples within the prescribed holding time for the parameters of interest.

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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 RUSH 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.

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In general, York will not maintain samples and extracts longer than thirty (30) days beyond completion of analysis, unless otherwise specified.

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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.

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The Quality Manager 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 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.

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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.

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 issued as either hard copy or by electronic data transfer.

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

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Details:

Signing authority for test reports is the responsibility of the Managing Director. Records for individuals with signing authority for test reports are approved by the Managing Director and maintained by the Quality Assurance Officer.

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
- 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

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- 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 mixed-up with inspections and product certifications 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
- fulfilment of contractual requirements
- recommendations on how to use the results
- guidance to be used for improvements

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).

 ANALYTICAL LABORATORIES, INC.	Quality Manual YORK ANALYTICAL LABORATORIES, INC.		
Section 5. Technical Requirements		Issue date 04/30/2010	Rev 1.0

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. ____”. Such amendments meet all the requirements in this Quality Manual.

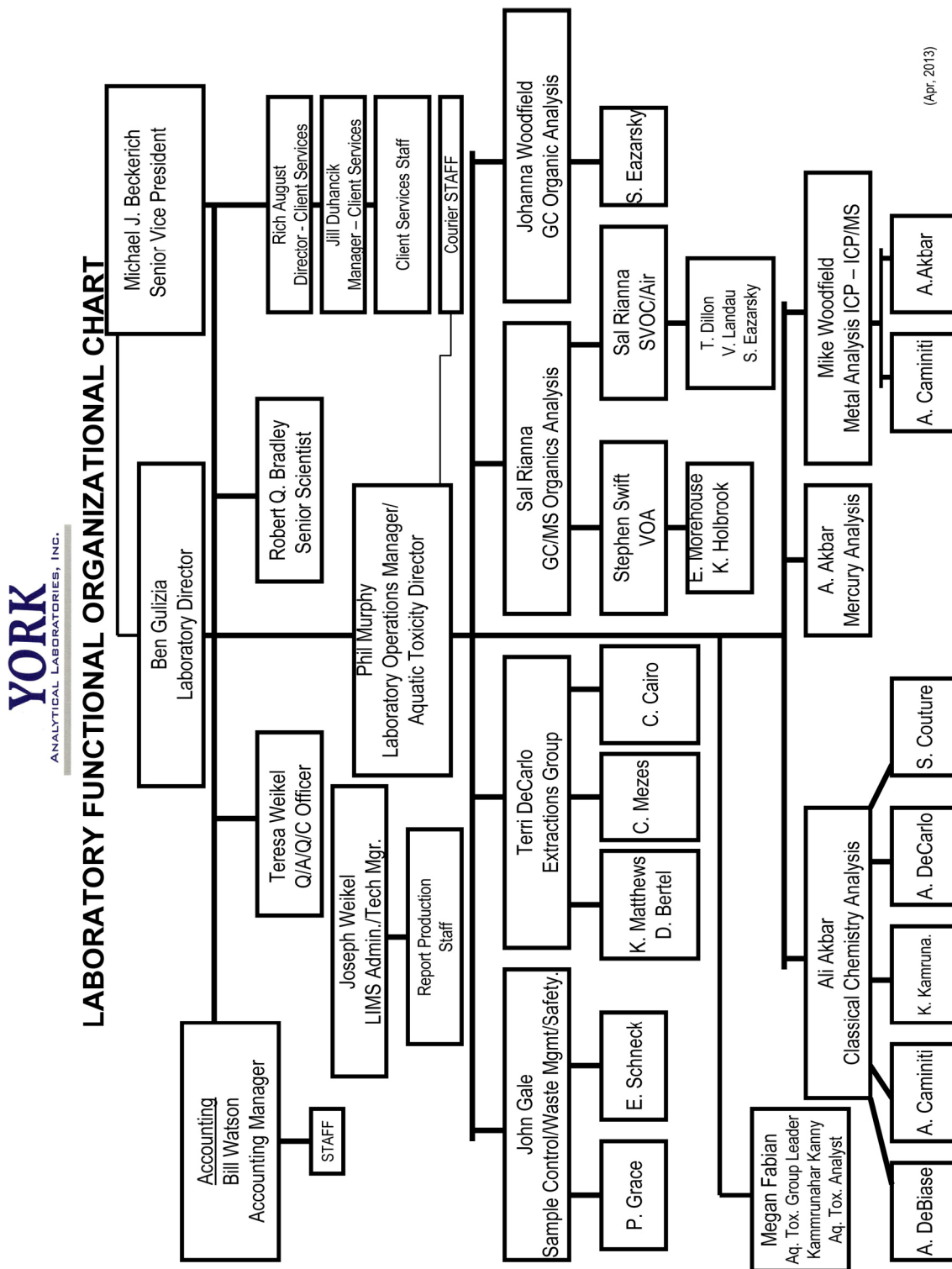
Details:

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



(Apr. 2013)

	Quality Manual YORK ANALYTICAL LABORATORIES, INC.		
ATTACHMENTS		Issue date 12/26/2012	

ATTACHMENT B
York Analytical Laboratories, Inc

MASTER LIST of CONTROLLED DOCUMENTS on 04/01/2013

Description	SOP No.	Date of Issue	Revision No.	Date of Revision
GC/MS - Air				
1 VOCs in AIR by EPA TO-14A/TO-15	GCMSAIR 111692	11/16/1992	9.2	3/12/2012
2 Cleaning of Summa Canisters	SummaClean111507	11/15/2007	1.0	
3 Calibration of Flow Controllers	FLOWCONT010312	1/3/2012	1.0	
GC/MS - Volatiles				
1 Volatile Organics by GC/MS	GCMSVOC 011700	1/17/2000	2.7	1/9/2012
2 Volatiles in Drinking Water by GC/MS by EPA 524.2	GCMSVOC524.2 011700	1/17/2000	1.9	10/22/2012
3 Soil Sampling 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 011700	1/17/2000	2.3	4/4/2012
Gas Chromatography				
1 PCBs using GC/ECD by EPA 8082	GCPCB 011799	1/17/1999	1.5	10/19/2012
2 TPH-DRO Using Solvent Extraction Followed by GC/FID Analysis	TPHDROGC091009	9/10/2009	1.2	11/14/2012
3 Pesticides (Chlorinated) using GC/ECD by EPA 8081	GCPEST011799	1/17/1999	1.4	10/19/2012
4 Herbicides using GC/ECD by EPA 8151	GCHERB011999	1/19/1999	1.3	5/13/2010
5 Organochlorine Pesticides & PCBs in Potable Water using GC/ECD by EPA 505	505GCPEST092010	9/20/2010	1.0	
6 CT-ETPH in Environmental Extracts	GCETPH111704	11/17/2004	1.6	2/29/2012

	Quality Manual YORK ANALYTICAL LABORATORIES, INC.		
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<i>Extractions</i>					
1	Preparation/Extraction of Soil Samples for the Analysis of Target Herbicides	EXTSoilherb052600	5/26/2000	1.4	10/22/2012
2	Preparation/Extraction of Aqueous Samples for the Analysis of Target Herbicides	EXTAQHRB052600	5/26/2000	1.2	4/26/2010
3	Extraction of Solid Samples for the Analysis of SVOCs using UltraSonic Extraction	EXTSSVOC052600	5/26/2000	2.1	6/29/2012
4	Extraction of Solid Samples for the Analysis of SVOCs using ASE Extraction	EXTSVOCASE 083106	8/31/2006	1.8	6/29/2012
5	Extraction of Aqueous Samples for Analysis of Semi-Volatile Compounds	EXTAQSVOC052600	5/26/2000	2.4	6/29/2012
6	Extraction of Polyurethane Foam Sampling Media for the Analysis of Target Pesticides and PCBs	EXTSVOCASEPUF043010	4/30/2010	1.0	
7	Extraction Laboratory Glassware Washing Procedure	EXTGP052600	5/26/2000	1.1	4/3/2012
8	Extraction of Solid Samples for Analysis of PCBs using Soxhlet Techniques	EXTPCBSOX102110	10/22/2010	1.0	
9	Extraction of Aqueous and Soil Samples for the Analysis of Massachusetts EPH (MA-EPH)	EXTMAEPHAQASE121207	12/12/2007	2.0	10/22/2009
10	Spike and Surrogate Standard Preparation for Extractables	EXTSVOCStd062912	6/29/2012	1.0	
<i>Metals Analysis/Prep</i>					
1	Analysis of Trace Metals in Environmental Samples using ICP/MS by EPA SW-846 6020 and EPA 200.8	ICPMS 6020 080106	8/1/2006	1.2	11/25/2008
2	Preparation of Standards for Axial ICP Analysis	ICPSTD030495	3/4/1995	1.1	4/7/2000
3	Preparation of Environmental Samples for Trace Metals Analysis by ICP and ICP/MS	METALSPrep030695	3/6/1995	1.2	9/12/2007
4	Analysis of Environmental Sample Digestates Using Axial ICP by EPA SW846 6010B and 200.7	ICP031195	3/11/1995	1.3	9/11/2007
5	Analysis of Trace Metals in Drinking Water Samples using ICP/MS by EPA 200.8	ICPMS200.8080106	8/1/2006	1.0	
6	Digestion and Analysis of Aqueous, Soil, and Sludge Samples for Mercury by Cold Vapor Technique (CV) EPA SW-846 7470 and 7471	Hg 120998	12/10/1998	1.5	10/15/2012
<i>Wet Chemistry/IC</i>					
1	Chemical Oxygen Demand (COD) [SM 5220D]	WC COD 100400	10/4/2000	2.1	9/18/2012
2	TKN, Ammonia and TON [SM 4500-N _{org} C, 4500-NH ₃ D]	WC TKN 100400	10/4/2000	1.4	9/11/2012

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3	Reactivity-Cyanide [SW-846 Ch 7.3.3]	WC CNR 080800	8/8/2000	1.2	10/16/2012
4	Hexavalent Chromium in Aqueous Samples [SW-846 7196]	WC Cr+6 070900	7/9/2000	1.4	9/11/2012
5	Hexavalent Chromium in Soil Samples [SW-846 7196A, 3060A]	WC Cr+6S 111811	11/18/2011	1.1	9/17/2012
6	Total Cyanide [EPA 335.2]	WC CNT 070900	7/9/2000	1.5	9/17/2012
7	Reactivity-Sulfide [SW-846 Ch 7.3.3]	WC ReacSulf 061296	6/12/1996	1.3	10/19/2012
8	Alkalinity [EPA 310.1]	WC T-Alk 022600	2/26/2000	1.2	10/19/2012
9	Hexane Extractable Material [EPA 1664]	WC HemGrav 110606	11/16/2006	1.5	10/22/2012
10	Ion Chromatography [EPA 300.0]	WC IC 011400	1/14/2000	1.7	12/17/2012
11	Biochemical Oxygen Demand (BOD) [SM 5210B]	WC BOD 011700	1/17/2000	1.4	11/9/2012
12	TSS / VSS in Aqueous Samples [EPA 160.2, 160.4]	WC TSS 040795	4/7/1995	1.3	11/9/2012
13	pH [SW-846 9040C, 9045D]	WC pH 040695	4/6/1995	1.5	10/11/2012
14	T-Phosphorous and Ortho-Phosphate [EPA 365.3, SM 4500]	WC Phos 051000	5/10/2000	1.3	9/22/2012
15	TCLP / SPLP Extraction [SW-846 1311, 1312]	WC TCLPEX 010400	1/4/2000	1.3	10/11/2012
16	Cyanide Amenable to Chlorination [EPA 335.1]	WC CNA 110200	11/4/2000	1.2	9/17/2012
17	Ignitability of Solids	WC IGN 040795	4/7/1995	1.1	4/11/2000
18	Flash Point [SW-846 1010A]	WC FP 040795	4/7/1995	1.4	10/3/2012
19	Methylene Blue Active Substances (MBAS) [SM 5540C]	WC MBAS 042610	4/26/2010	1.1	10/11/2012
20	TS / TDS in Aqueous Samples [SM 2540B, C]	WC TSTDs 042610	4/26/2010	1.1	9/18/2012
21	Color	WC Color 042610	4/26/2010	1.0	
22	Glassware Washing	WC GlassPrep 090299	9/2/1999	2.0	9/2/1999
23	Total Phenols (Low Level) [EPA 420.1]	WC PhenolsLL 102711	10/27/2011	1.3	10/22/2012
24	Total Phenols [EPA 420.1]	WC Phenols 022912	2/29/2012	1.2	10/22/2012

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25	Conductivity [EPA 120.1]	WC Cond 022912	2/29/2012	1.1	10/11/2012
26	Turbidity [EPA 180.1]	WC Turbidity 022912	2/29/2012	1.2	10/11/2012
27	TS, FS, VS and % Moisture in Soil Samples [SM 2540G]	WC TS%M 022912	2/29/2012	1.0	
28	Extractable Organic Halogens in solids [SW-846 9023]	WC EOX 041112	4/11/2012	1.2	11/9/2012
29	Total Organic Carbon in Aqueous Samples [SM 5310C]	WC TOC 041812	4/18/2012	1.1	11/13/2012

<i>Aquatic Toxicity</i>					
1	Acute Toxicity Test Method for Cyprinodon variegatus by EPA Method 821-R-02-012 / 2004.0	AT ACupV013013	01/30/2013	1.0	01/30/2013
2	Acute Toxicity Test Method for Daphnia pulex by EPA Method 821-R-02-012 / 2021.0	AT DapP013013	01/30/2013	1.0	01/30/2013
3	Acute Toxicity Test Method for Mysidopsis bahia by EPA Method 821-R-02-012 / 2007.0	AT AmysB01313	01/30/2013	1.0	01/30/2013
4	Acute Toxicity Test Method for Pimephales promelas by EPA Method 821-R-02-012/ 2000.0	AT APimP01313	01/30/2013	1.0	01/30/2013
5	Reference Toxicant Test Method using Copper Nitrate Acute- Daphnia pulex EPA Test Method 821-R-02-012/ 2021.0	AT RTADapP012313	01/30/2013	1.0	01/30/2013
6	Reference Toxicant Test Method using Copper Nitrate Acute- Pimephales promelas EPA Test Method 821-R-02-012/ 2000.0	AT RTAPimP013013	01/30/2013	1.0	01/30/2013
7	Reference Toxicant Test Method using Sodium Lauryl Sulfate Acute- Cyprinodon variegatus by EPA Method 821-R-02-012/ 2004.0	AT RTACypV013013	01/30/2013	1.0	01/30/2013
8	Reference Toxicant Test Method using Sodium Lauryl Sulfate Acute- Mysidopsis bahia by EPA Method 821-R-02-012/ 2007.0	AT RTAMysB013013	01/30/2013	1.0	01/30/2013
9	Chronic Toxicity Test Method for Cyprinodon variegatus by EPA Method 821-R-02-014 / 1004.0	AT CCypV013013	01/30/2013	1.0	01/30/2013
10	Chronic Toxicity Test Method for Ceriodaphnia dubia by EPA Method 821-R-02-013 / 1002.0	AT CCer013013	01/30/2013	1.0	01/30/2013
11	Chronic Toxicity Test Method for Mysidopsis bahia by EPA Method 821-R-02-014 1007.0	AT CMysB01313	01/30/2013	1.0	01/30/2013
12	Chronic Toxicity Test Method for Pimephales promelas by EPA Method 821-R-02-013 / 1000.0	AT CPimP01313	01/30/2013	1.0	01/30/2013

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13	Reference Toxicant Test Method using Sodium Chloride Chronic- Ceriodaphnia dubia EPA Test Method 1002.0	AT RTCCer012313	01/30/2013	1.0	01/30/2013
14	Reference Toxicant Test Method using Sodium Chloride Chronic- Pimephales promelas EPA Test Method 1000.0	AT RTCPimP013013	01/30/2013	1.0	01/30/2013
15	Reference Toxicant Test Method using Sodium Lauryl Sulfate Chronic- Cynodon variegatus by EPA Method 821-R-02-014 / 1004.0	AT RTCCypV013013	01/30/2013	1.0	01/30/2013
16	Reference Toxicant Test Method using Sodium Lauryl Sulfate Chronic- Mysidopsis bahia by EPA Method 821-R-02-014 / 1007.0	AT RTCMysB013013	01/30/2013	1.0	01/30/2013

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 and Verification	GL LOQLOD 122812	12/28/2012	1.0	
Sample Control					
1	Sample Control - Sample Receipt, Log-in, Storage, Archival and Disposal	SC011500	1/15/2000	2.1	11/19/2012
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	Couriers091207	9/12/2007	1.0	
Administration					
1	Laboratory Safety and Health	Safety011600	1/16/2000	1.0	
2	Purchasing	ADMINPurchasing 043010	4/18/2012	1.1	
3	QC Review/Evaluation of Data	QC040402	4/4/2002	1.1	4/30/2010
4	Education and Training in Ethics & Legal Responsibilities	Adm040102	4/1/2002	1.1	4/1/2002
5	Training of Personnel	Adm080206	8/6/2006	1.3	1/16/2012
6	Manual Integration of Chromatographic Data	ADMIN Integration 09/11/07	9/11/2007	2.1	2/9/2012

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7	Control and Use of Laboratory Notebooks	LABNOTE091107	9/12/2007	1.0	
8	Control of Records	ADMINRECORDS043010	4/30/2010	1.1	11/9/2012
9	Preventive Action	ADMINPREV ACTION043010	4/30/2010	1.0	
10	Control of Nonconforming Work	QSP 4-9-1	4/30/2010	1.0	
11	Management Review	ADMINMGMTREVIEW043010	4/30/2010	1.0	
12	Internal Quality Audit`	ADMINAUDIT043010	4/30/2010	1.0	
13	Estimation of Uncertainty	ADMINESTUNCERT043010	4/30/2010	1.0	
14	Document Control	ADMINDOC043010	4/30/2010	1.2	6/2/2012
15	Corrective Action	ADMINCORRACTION043010	4/30/2010	1.0	
16	Complaints	QSP 4-8-1	4/30/2010	1.0	
17	Review of Chromatographic Data for Detection of Manual Re-Integration Issues	ADMINManINTRReview04302010	4/30/2010	1.0	
18	Additional Policies/Procedures	Additional Policies 05/07/10	5/7/2010	1.1	07/11/2012
19	EDDs and Reports for Client Connect	ADMINEDDRptCC 091610	9/16/2010	1.0	
20	Preparation of CTDEP RCP Deliverables	ADMINRCPDELIVS 080210	8/2/2010	1.0	
Quality Manual					
1	Quality Manual	QM	1/4/1996	2.3	12/26/2012

ATTACHMENT 8

**NYSDOH ELAP-CERTIFICATION FOR YORK ANALYTICAL
LABORATORIES INC.**

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER



Expires 12:01 AM April 01, 2014
Issued April 01, 2013
Revised October 21, 2013

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:*

Acrylates

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
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Characteristic Testing

Corrosivity	EPA 9045D
Ignitability	EPA 1010A
Reactivity	SW-846 Ch7 Sec. 7.3
Synthetic Precipitation Leaching Proc.	EPA 1312
TCLP	EPA 1311

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B
4,4'-DDE	EPA 8081B
4,4'-DDT	EPA 8081B
Aldrin	EPA 8081B

Chlorinated Hydrocarbon Pesticides

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
Toxaphene	EPA 8081B

Chlorinated Hydrocarbons

1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 8270D
2-Chloronaphthalene	EPA 8270D
Hexachlorobenzene	EPA 8270D

Serial No.: 49723

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Chlorinated Hydrocarbons

Hexachlorobutadiene	EPA 8270D
Hexachlorocyclopentadiene	EPA 8270D
Hexachloroethane	EPA 8270D

Chlorophenoxy Acid Pesticides

2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
Dicamba	EPA 8151A

Haloethers

4-Bromophenylphenyl ether	EPA 8270D
4-Chlorophenylphenyl ether	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 8270D
Bis(2-chloroethyl)ether	EPA 8270D
Bis(2-chloroisopropyl) ether	EPA 8270D

Metals I

Barium, Total	EPA 6010C
	EPA 6020A
Cadmium, Total	EPA 6010C
	EPA 6020A
Calcium, Total	EPA 6010C
Chromium, Total	EPA 6010C
	EPA 6020A
Copper, Total	EPA 6010C
	EPA 6020A

Metals I

Iron, Total	EPA 6010C
Lead, Total	EPA 6010C
	EPA 6020A
Magnesium, Total	EPA 6010C
Manganese, Total	EPA 6010C
	EPA 6020A
Nickel, Total	EPA 6010C
	EPA 6020A
Potassium, Total	EPA 6010C
Silver, Total	EPA 6010C
	EPA 6020A
Sodium, Total	EPA 6010C

Metals II

Aluminum, Total	EPA 6010C
	EPA 6020A
Antimony, Total	EPA 6010C
	EPA 6020A
Arsenic, Total	EPA 6010C
	EPA 6020A
Beryllium, Total	EPA 6010C
	EPA 6020A
Chromium VI	EPA 7196A
Mercury, Total	EPA 7471B
	EPA 7473
Selenium, Total	EPA 6010C

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All approved analytes are listed below:

Metals II

Selenium, Total	EPA 6020A
Vanadium, Total	EPA 6010C
	EPA 6020A
Zinc, Total	EPA 6010C
	EPA 6020A

Nitrosoamines

N-Nitrosodimethylamine	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 8270D
N-Nitrosodiphenylamine	EPA 8270D

Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015D
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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

PCB-1016	EPA 8082A
PCB-1221	EPA 8082A
PCB-1232	EPA 8082A
PCB-1242	EPA 8082A
PCB-1248	EPA 8082A
PCB-1254	EPA 8082A
PCB-1260	EPA 8082A
PCB-1262	EPA 8082A
PCB-1268	EPA 8082A

Polynuclear Aromatic Hydrocarbons

Acenaphthene	EPA 8270D
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Metals III

Cobalt, Total	EPA 6010C
	EPA 6020A
Molybdenum, Total	EPA 6020A
Thallium, Total	EPA 6010C
	EPA 6020A
Tin, Total	EPA 6020A
Titanium, Total	EPA 6020A

Miscellaneous

Boron, Total	EPA 6020A
Cyanide, Total	EPA 9014
Extractable Organic Halides	EPA 9023

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	EPA 8270D
2,6-Dinitrotoluene	EPA 8270D
Isophorone	EPA 8270D
Nitrobenzene	EPA 8270D
Pyridine	EPA 8270D

Serial No.: 49723

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Polynuclear Aromatic Hydrocarbons

Acenaphthylene	EPA 8270D
Anthracene	EPA 8270D
Benzo(a)anthracene	EPA 8270D
Benzo(a)pyrene	EPA 8270D
Benzo(b)fluoranthene	EPA 8270D
Benzo(ghi)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-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

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
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

Volatile Aromatics

1,2,4-Trichlorobenzene, Volatile	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

Serial No.: 49723

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER



Expires 12:01 AM April 01, 2014
Issued April 01, 2013
Revised October 21, 2013

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 Aromatics

4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 8260C
Ethyl benzene	EPA 8260C
Isopropylbenzene	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	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

1,2-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
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

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

Serial No.: 49723

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER



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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

Trichlorofluoromethane	EPA 8260C
Vinyl chloride	EPA 8260C

Sample Preparation Methods

EPA 3585
EPA 5035A-H
EPA 5035A-L
EPA 9010C

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 3005A
EPA 3010A
EPA 3031
EPA 3040A
EPA 3050B
EPA 3060A
EPA 3545A
EPA 3550C
EPA 3580A

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NEW YORK

state department of

HEALTH

Nirav R. Shah, M.D., M.P.H.
Commissioner

Sue Kelly
Executive Deputy Commissioner

LAB ID: 10854

October 21, 2013

MR. ROBERT Q. BRADLEY
YORK ANALYTICAL LABORATORIES INC
120 RESEARCH DRIVE
STRATFORD, CT 06615

Dear Mr. Bradley,

A revised certificate has been generated because of the change(s) listed below.

If the changes to your certification are due to insufficient proficiency tests and/or proficiency test (PT) failures, the expired certificates must be returned to the Environmental Laboratory Approval Program (ELAP) office within 10 days of the date of this letter. In addition, your laboratory must investigate the root cause for any insufficient and/or unsatisfactory proficiency tests.

In addition, your laboratory must investigate and document the root cause for any insufficient and/or unsatisfactory proficiency tests. If your lab lost accreditation due to two PT failures, you must submit the corrective action response to ELAP for review before accreditation will be re-instated.

AppCat	Analyte Name Method Name	Comments	Date
SW - NELAC	Titanium, Total EPA 3005A	Raised to Approved	10/17/2013
SW - NELAC	Titanium, Total EPA 3010A	Raised to Approved	10/17/2013
SW - NELAC	Titanium, Total EPA 6020A	Raised to Approved	10/17/2013
SW - NELAC	Titanium, Total EPA 3050B	Raised to Approved	10/17/2013

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER



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Revised December 20, 2013

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

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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:*

Drinking Water 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

Drinking Water Metals II

Aluminum, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Antimony, Total	EPA 200.8 Rev. 5.4
Beryllium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

Drinking Water Metals II

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

Drinking Water 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

Drinking Water Non-Metals

Alkalinity	SM 18-21 2320B (97)
Calcium Hardness	EPA 200.7 Rev. 4.4
Chloride	EPA 300.0 Rev. 2.1
Color	SM 18-21 2120B (01)
Fluoride, Total	EPA 300.0 Rev. 2.1
Nitrate (as N)	EPA 300.0 Rev. 2.1
Nitrite (as N)	EPA 300.0 Rev. 2.1
Orthophosphate (as P)	EPA 300.0 Rev. 2.1
Solids, Total Dissolved	SM 18-21 2540C (97)
Specific Conductance	EPA 120.1 Rev. 1982
Sulfate (as SO ₄)	EPA 300.0 Rev. 2.1

Serial No.: 49896

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER



Expires 12:01 AM April 01, 2014
Issued April 01, 2013
Revised December 20, 2013

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:

Drinking Water Trihalomethanes

Bromodichloromethane	EPA 524.2
Bromoform	EPA 524.2
Chloroform	EPA 524.2
Dibromochloromethane	EPA 524.2

Fuel Additives

Methyl tert-butyl ether	EPA 524.2
Naphthalene	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
4-Chlorotoluene	EPA 524.2
Benzene	EPA 524.2
Bromobenzene	EPA 524.2
Chlorobenzene	EPA 524.2
Ethyl benzene	EPA 524.2
Hexachlorobutadiene	EPA 524.2
Isopropylbenzene	EPA 524.2
n-Butylbenzene	EPA 524.2
n-Propylbenzene	EPA 524.2
p-Isopropyltoluene (P-Cymene)	EPA 524.2

Volatile Aromatics

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
cis-1,2-Dichloroethene	EPA 524.2
cis-1,3-Dichloropropene	EPA 524.2
Dibromomethane	EPA 524.2

Serial No.: 49896

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER



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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:

Volatile Halocarbons

Dichlorodifluoromethane	EPA 524.2
Methylene chloride	EPA 524.2
Tetrachloroethene	EPA 524.2
trans-1,3-Dichloropropene	EPA 524.2
Trichloroethene	EPA 524.2
Trichlorofluoromethane	EPA 524.2
Vinyl chloride	EPA 524.2

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Serial No.: 49896

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NEW YORK

state department of

HEALTH

Nirav R. Shah, M.D., M.P.H.
Commissioner

Sue Kelly
Executive Deputy Commissioner

LAB ID: 10854

December 20, 2013

MR. ROBERT Q. BRADLEY
YORK ANALYTICAL LABORATORIES INC
120 RESEARCH DRIVE
STRATFORD, CT 06615

Dear Mr. Bradley,

A revised certificate has been generated because of the change(s) listed below.

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In addition, your laboratory must investigate and document the root cause for any insufficient and/or unsatisfactory proficiency tests. If your lab lost accreditation due to two PT failures, you must submit the corrective action response to ELAP for review before accreditation will be re-instated.

AppCat	Analyte Name Method Name	Comments	Date
PW - NELAC	trans-1,2-Dichloroethene EPA 524.2	Dropped from Approved	12/05/2013
PW - NELAC	Turbidity EPA 180.1 Rev. 2.0	Dropped from Approved	12/05/2013
PW - NELAC	2-Chlorotoluene EPA 524.2	Dropped from Approved	12/05/2013

NEW YORK STATE DEPARTMENT OF HEALTH
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ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:*

Drinking Water 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

Drinking Water Metals II

Aluminum, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Antimony, Total	EPA 200.8 Rev. 5.4
Beryllium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

Drinking Water Metals II

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

Drinking Water 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

Drinking Water Miscellaneous

Turbidity	EPA 180.1 Rev. 2.0
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Drinking Water Non-Metals

Alkalinity	SM 18-21 2320B (97)
Calcium Hardness	EPA 200.7 Rev. 4.4
Chloride	EPA 300.0 Rev. 2.1
Color	SM 18-21 2120B (01)
Fluoride, Total	EPA 300.0 Rev. 2.1
Nitrate (as N)	EPA 300.0 Rev. 2.1
Nitrite (as N)	EPA 300.0 Rev. 2.1
Orthophosphate (as P)	EPA 300.0 Rev. 2.1
Solids, Total Dissolved	SM 18-21 2540C (97)
Specific Conductance	EPA 120.1 Rev. 1982

Serial No.: 49756

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER



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Issued April 01, 2013
Revised November 01, 2013

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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:*

Drinking Water Non-Metals

Sulfate (as SO₄) EPA 300.0 Rev. 2.1

Drinking Water Trihalomethanes

Bromodichloromethane EPA 524.2
Bromoform EPA 524.2
Chloroform EPA 524.2
Dibromochloromethane EPA 524.2

Fuel Additives

Methyl tert-butyl ether EPA 524.2
Naphthalene 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

Volatile Aromatics

Isopropylbenzene EPA 524.2
n-Butylbenzene EPA 524.2
n-Propylbenzene EPA 524.2
p-Isopropyltoluene (P-Cymene) 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

Serial No.: 49756

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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:*

Volatile Halocarbons

Chloromethane	EPA 524.2
cis-1,2-Dichloroethene	EPA 524.2
cis-1,3-Dichloropropene	EPA 524.2
Dibromomethane	EPA 524.2
Dichlorodifluoromethane	EPA 524.2
Methylene chloride	EPA 524.2
Tetrachloroethene	EPA 524.2
trans-1,2-Dichloroethene	EPA 524.2
trans-1,3-Dichloropropene	EPA 524.2
Trichloroethene	EPA 524.2
Trichlorofluoromethane	EPA 524.2
Vinyl chloride	EPA 524.2

Serial No.: 49756

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WADSWORTH CENTER



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YORK ANALYTICAL LABORATORIES INC
120 RESEARCH DRIVE
STRATFORD, CT 06615

NY Lab Id No: 10854

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ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Acrylates

Acrolein (Propenal)	EPA 624
	EPA 8260C
Acrylonitrile	EPA 624
	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 625
	EPA 8270D
Pyridine	EPA 625
	EPA 8270D

Benzidines

3,3'-Dichlorobenzidine	EPA 625
	EPA 8270D
Benzidine	EPA 625
	EPA 8270D

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 608
	EPA 8081B

Chlorinated Hydrocarbon Pesticides

4,4'-DDE	EPA 608
	EPA 8081B
4,4'-DDT	EPA 608
	EPA 8081B
Aldrin	EPA 608
	EPA 8081B
alpha-BHC	EPA 608
	EPA 8081B
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 608
	EPA 8081B
Chlordane Total	EPA 608
	EPA 8081B
delta-BHC	EPA 608
	EPA 8081B
Dieldrin	EPA 608
	EPA 8081B
Endosulfan I	EPA 608
	EPA 8081B
Endosulfan II	EPA 608
	EPA 8081B
Endosulfan sulfate	EPA 608
	EPA 8081B
Endrin	EPA 608
	EPA 8081B
Endrin aldehyde	EPA 608

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER



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Revised November 01, 2013

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

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ENVIRONMENTAL ANALYSES NON POTABLE WATER
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Chlorinated Hydrocarbon Pesticides

Endrin aldehyde	EPA 8081B
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 608
	EPA 8081B
Heptachlor epoxide	EPA 608
	EPA 8081B
Lindane	EPA 608
	EPA 8081B
Methoxychlor	EPA 608
	EPA 8081B
Toxaphene	EPA 608
	EPA 8081B

Chlorinated Hydrocarbons

1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 625
	EPA 8270D
2-Chloronaphthalene	EPA 625
	EPA 8270D
Hexachlorobenzene	EPA 625
	EPA 8270D
Hexachlorobutadiene	EPA 625
	EPA 8270D
Hexachlorocyclopentadiene	EPA 625

Chlorinated Hydrocarbons

Hexachlorocyclopentadiene	EPA 8270D
Hexachloroethane	EPA 625
	EPA 8270D

Chlorophenoxy Acid Pesticides

2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
Dicamba	EPA 8151A

Demand

Biochemical Oxygen Demand	SM 18-21 5210B (01)
Carbonaceous BOD	SM 18-21 5210B (01)
Chemical Oxygen Demand	SM 18-21 5220D (97)

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

Haloethers

4-Bromophenylphenyl ether	EPA 625
	EPA 8270D
4-Chlorophenylphenyl ether	EPA 625

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Haloethers

4-Chlorophenylphenyl ether	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 625
	EPA 8270D
Bis(2-chloroethyl)ether	EPA 625
	EPA 8270D
Bis(2-chloroisopropyl) ether	EPA 625
	EPA 8270D

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
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

Mineral

Alkalinity	SM 18-21 2320B (97)
Calcium Hardness	EPA 200.7 Rev. 4.4
Chloride	EPA 300.0 Rev. 2.1
Fluoride, Total	EPA 300.0 Rev. 2.1
Hardness, Total	EPA 200.7 Rev. 4.4
Sulfate (as SO ₄)	EPA 300.0 Rev. 2.1

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	EPA 625
	EPA 8270D
2,6-Dinitrotoluene	EPA 625
	EPA 8270D
Isophorone	EPA 625
	EPA 8270D
Nitrobenzene	EPA 625
	EPA 8270D

Nitrosoamines

N-Nitrosodimethylamine	EPA 625
	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 625
	EPA 8270D
N-Nitrosodiphenylamine	EPA 625
	EPA 8270D

Nutrient

Ammonia (as N)	SM 19-21 4500-NH ₃ D or E (97)
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Nutrient		Polychlorinated Biphenyls	
Kjeldahl Nitrogen, Total	SM 19-21 4500-NH3 D or E (97)	PCB-1016	EPA 8082A
Nitrate (as N)	EPA 300.0 Rev. 2.1	PCB-1221	EPA 608
Nitrite (as N)	EPA 300.0 Rev. 2.1		EPA 8082A
Orthophosphate (as P)	EPA 300.0 Rev. 2.1	PCB-1232	EPA 608
Phosphorus, Total	SM 18-21 4500-P E		EPA 8082A
Organophosphate Pesticides		PCB-1242	EPA 608
Atrazine	EPA 8270D		EPA 8082A
Petroleum Hydrocarbons		PCB-1248	EPA 608
Diesel Range Organics	EPA 8015D		EPA 8082A
Phthalate Esters		PCB-1254	EPA 608
Benzyl butyl phthalate	EPA 625		EPA 8082A
	EPA 8270D	PCB-1260	EPA 608
Bis(2-ethylhexyl) phthalate	EPA 625		EPA 8082A
	EPA 8270D	PCB-1262	EPA 8082A
		PCB-1268	EPA 8082A
Diethyl phthalate	EPA 625	Polynuclear Aromatics	
	EPA 8270D	Acenaphthene	EPA 625
Dimethyl phthalate	EPA 625		EPA 8270D
	EPA 8270D	Acenaphthylene	EPA 625
Di-n-butyl phthalate	EPA 625		EPA 8270D
	EPA 8270D	Anthracene	EPA 625
Di-n-octyl phthalate	EPA 625		EPA 8270D
	EPA 8270D	Benzo(a)anthracene	EPA 625
Polychlorinated Biphenyls			EPA 8270D
PCB-1016	EPA 608	Benzo(a)pyrene	EPA 625

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Polynuclear Aromatics

Benzo(a)pyrene	EPA 8270D
Benzo(b)fluoranthene	EPA 625
	EPA 8270D
Benzo(ghi)perylene	EPA 625
	EPA 8270D
Benzo(k)fluoranthene	EPA 625
	EPA 8270D
Chrysene	EPA 625
	EPA 8270D
Dibenzo(a,h)anthracene	EPA 625
	EPA 8270D
Fluoranthene	EPA 625
	EPA 8270D
Fluorene	EPA 625
	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 625
	EPA 8270D
Naphthalene	EPA 625
	EPA 8270D
Phenanthrene	EPA 625
	EPA 8270D
Pyrene	EPA 625
	EPA 8270D

Priority Pollutant Phenols

2,3,4,6 Tetrachlorophenol	EPA 8270D
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Priority Pollutant Phenols

2,4,5-Trichlorophenol	EPA 625
	EPA 8270D
2,4,6-Trichlorophenol	EPA 625
	EPA 8270D
2,4-Dichlorophenol	EPA 625
	EPA 8270D
2,4-Dimethylphenol	EPA 625
	EPA 8270D
2,4-Dinitrophenol	EPA 625
	EPA 8270D
2-Chlorophenol	EPA 625
	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 625
	EPA 8270D
2-Methylphenol	EPA 625
	EPA 8270D
2-Nitrophenol	EPA 625
	EPA 8270D
4-Chloro-3-methylphenol	EPA 625
	EPA 8270D
4-Methylphenol	EPA 625
	EPA 8270D
4-Nitrophenol	EPA 625
	EPA 8270D
Cresols, Total	EPA 8270D
Pentachlorophenol	EPA 625

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Priority Pollutant Phenols

Pentachlorophenol	EPA 8270D
Phenol	EPA 625
	EPA 8270D

Residue

Settleable Solids	SM 18-21 2540 F (97)
Solids, Total	SM 18-21 2540B (97)
Solids, Total Dissolved	SM 18-21 2540C (97)
Solids, Total Suspended	SM 18-21 2540D (97)

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
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
1,2,4-Trimethylbenzene	EPA 8260C

Volatile Aromatics

1,2-Dichlorobenzene	EPA 624
	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 624
	EPA 8260C
1,4-Dichlorobenzene	EPA 624
	EPA 8260C
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 624
	EPA 8260C
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 624
	EPA 8260C
Ethyl benzene	EPA 624
	EPA 8260C
Isopropylbenzene	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 624
	EPA 8260C
tert-Butylbenzene	EPA 8260C
Toluene	EPA 624

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Volatile Aromatics

Toluene	EPA 8260C
Total Xylenes	EPA 624
	EPA 8260C

Volatile Halocarbons

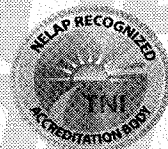
1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 624
	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 624
	EPA 8260C
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 624
	EPA 8260C
1,1-Dichloroethane	EPA 624
	EPA 8260C
1,1-Dichloroethene	EPA 624
	EPA 8260C
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8011
	EPA 8260C
1,2-Dibromoethane	EPA 8011
	EPA 8260C
1,2-Dichloroethane	EPA 624
	EPA 8260C
1,2-Dichloropropane	EPA 624

Volatile Halocarbons

1,2-Dichloropropane	EPA 8260C
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloroethylvinyl ether	EPA 624
	EPA 8260C
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 624
	EPA 8260C
Bromoform	EPA 624
	EPA 8260C
Bromomethane	EPA 624
	EPA 8260C
Carbon tetrachloride	EPA 624
	EPA 8260C
Chloroethane	EPA 624
	EPA 8260C
Chloroform	EPA 624
	EPA 8260C
Chloromethane	EPA 624
	EPA 8260C
cis-1,2-Dichloroethene	EPA 624
	EPA 8260C
cis-1,3-Dichloropropene	EPA 624
	EPA 8260C
Dibromochloromethane	EPA 624
	EPA 8260C

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Volatile Halocarbons

Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 624
	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260C
Methylene chloride	EPA 624
	EPA 8260C
Tetrachloroethene	EPA 624
	EPA 8260C
trans-1,2-Dichloroethene	EPA 624
	EPA 8260C
trans-1,3-Dichloropropene	EPA 624
	EPA 8260C
trans-1,4-Dichloro-2-butene	EPA 8260C
Trichloroethene	EPA 624
	EPA 8260C
Trichlorofluoromethane	EPA 624
	EPA 8260C
Vinyl chloride	EPA 624
	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

Volatiles Organics

Carbon Disulfide	EPA 8260C
Cyclohexane	EPA 8260C
Methyl acetate	EPA 8260C
Methyl cyclohexane	EPA 8260C
Vinyl acetate	EPA 8260C

Wastewater Metals I

Barium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Calcium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Iron, Total	EPA 200.7 Rev. 4.4

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Wastewater Metals I

Iron, Total	EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Lead, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Magnesium, Total	EPA 200.7 Rev. 4.4 EPA 6010C
Manganese, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Nickel, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Potassium, Total	EPA 200.7 Rev. 4.4 EPA 6010C
Silver, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Sodium, Total	EPA 200.7 Rev. 4.4 EPA 6010C

Wastewater Metals II

Aluminum, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Antimony, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Arsenic, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Beryllium, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Chromium VI	EPA 7196A SM 20-21 3500-Cr B (01)
Mercury, Total	EPA 245.1 Rev. 3.0 EPA 245.2 Rev. 1974 EPA 7470A EPA 7473
Selenium, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A

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Wastewater Metals II

Vanadium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A

Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A

Wastewater Metals III

Cobalt, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A

Molybdenum, Total	EPA 200.8 Rev. 5.4
	EPA 6020A

Thallium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A

Tin, Total	EPA 200.8 Rev. 5.4
	EPA 6020A

Titanium, Total	EPA 200.8 Rev. 5.4
	EPA 6020A

Wastewater Miscellaneous

Boron, Total	EPA 200.8 Rev. 5.4
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Wastewater Miscellaneous

Boron, Total	EPA 6020A
Bromide	EPA 300.0 Rev. 2.1
Color	SM 18-21 2120B (01)
Cyanide, Total	SM 18-21 4500-CN E (99)

Oil and Grease Total Recoverable (HEM)	EPA 1664A
Organic Carbon, Total	SM 18-21 5310C (00)
Phenols	EPA 420.1 Rev. 1978
Specific Conductance	EPA 120.1 Rev. 1982
Sulfide (as S)	SM 19-21 4500-S F (00)
Surfactant (MBAS)	SM 18-21 5540C (00)
Turbidity	EPA 180.1 Rev. 2.0

Sample Preparation Methods

EPA 3005A
EPA 3010A
EPA 3020A
EPA 3510C
EPA 5030C
SM 18-20 4500-CN C
SM 18-21 4500-N Org B or C (97)
SM 18-21 4500-P b.5

Serial No.: 49757

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.



NEW YORK

state department of

HEALTHNirav R. Shah, M.D., M.P.H.
CommissionerSue Kelly
Executive Deputy Commissioner

LAB ID: 10854

November 01, 2013

MR. ROBERT Q. BRADLEY
YORK ANALYTICAL LABORATORIES INC
120 RESEARCH DRIVE
STRATFORD, CT 06615

Dear Mr. Bradley,

A revised certificate has been generated because of the change(s) listed below.

If the changes to your certification are due to insufficient proficiency tests and/or proficiency test (PT) failures, the expired certificates must be returned to the Environmental Laboratory Approval Program (ELAP) office within 10 days of the date of this letter. In addition, your laboratory must investigate the root cause for any insufficient and/or unsatisfactory proficiency tests.

In addition, your laboratory must investigate and document the root cause for any insufficient and/or unsatisfactory proficiency tests. If your lab lost accreditation due to two PT failures, you must submit the corrective action response to ELAP for review before accreditation will be re-instated.

AppCat	Analyte Name Method Name	Comments	Date
NW - NELAC	Barium, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Manganese, Total EPA 6020A	Raised to Approved	10/29/2013
NW	Magnesium, Total EPA 200.8 Rev. 5.4	Dropped from Approved	11/01/2013
NW - NELAC	Manganese, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Nickel, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Zinc, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Iron, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013

NEW YORK

state department of

HEALTHNirav R. Shah, M.D., M.P.H.
CommissionerSue Kelly
Executive Deputy Commissioner

AppCat	Analyte Name Method Name	Comments	Date
NW - NELAC	Vanadium, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Aluminum, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Iron, Total EPA 6020A	Raised to Approved	10/29/2013
PW - NELAC	1,1,2,2-Tetrachloroethane EPA 524.2	Raised to Approved	10/24/2013
NW - NELAC	Aluminum, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Zinc, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Nickel, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Cobalt, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Cobalt, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Antimony, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Silver, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Silver, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Antimony, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Barium, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Vanadium, Total EPA 6020A	Raised to Approved	10/29/2013

ATTACHMENT 9

RESUMES OF KEY PERSONNEL INVOLVED WITH THE PROJECT

TAREK Z. KHOURI, P.E. *Senior Vice President*

Education

M.S. Environmental Engineering,
University of Central Florida

B.S. Chemistry, University of Central
Florida

Professional Registration

Professional Engineer (P.E.)

Connecticut # 0031583

D.C. # 908711

Maryland # 49155

Massachusetts # 52601

New Jersey # 24GE04697200

New York # 086611

Pennsylvania # PE084919

Rhode Island # 12059

Texas # 125442

Virginia # 0402056415

Certifications

OSHA: 40 Hour HAZWOPER; 8
Hour Supervisor Management;
10 Hour Construction Safety

USACE Construction Quality
Management

Affiliations

Transportation & Infrastructure
Committee, NY Building Congress
(NYBC), NY, USA

Environmental and Energy
Committee, American Society of
Engineering Companies (ACEC) NY,
USA

Chairman (2013), Solid Waste
Committee, Qatar Green Building
Council (QGBC) Qatar

Legislative Committee (2008-2010),
National Brownfield Association
(NBA), NY, USA

Environmental Council (2008-2010),
The Business Council of NY State
(BCNY), NY, USA

Summary of Experience

Mr. Khouri has more than 20 years of experience in the Real Estate Development, Construction and Engineering industries. He has been providing environmental consulting and risk management advisory services to developers, real estate property owners, assets investors, and public agencies throughout the world (USA, UAE, KSA, Qatar, Oman, Lebanon, West Africa, and France). Mr. Khouri integrates environmental risk management with land use planning and sustainable development to meet the needs and objectives of diverse clients and stakeholders for residential, commercial, and industrial real estate, in urban and rural environment.

Mr. Khouri has participated and managed the remediation and reuse of contaminated properties for over 20 years. He has performed, directed, and overseen environmental investigations and remedial actions at petroleum and chlorinated solvent spill sites, fuel farms, refineries, former manufactured gas, landfills, and a variety of residential, commercial and industrial settings. Mr. Khouri utilizes his technical expertise as well as his leadership and management skills to direct and oversee teams of professionals for the successful completion of these complex projects.

Relevant Experience

- **Senior Vice President** – HAKS (2015-Present)
- **Vice President** – Langan Engineering and Environmental Services, USA. (2013-2015)
- **Managing Director** – Averda Environmental Services, Qatar. (2011-2013)
- **Managing Director** – Clean Planet International, USA, Africa and Middle East. (2010-2011)
- **Associate** – Langan Engineering and Environmental Services, USA and Middle East. (2004-2010)
- **Senior Project Manager** – URS Corporation, USA and Middle East. (1998-2004)
- **Senior Scientist** – Solidere, Lebanon. (1996-1998)
- **Environmental Engineer** – University of Central Florida, USA. (1994-1996)
- **Environmental Impact Assessments, Phase I ESAs, and Phase II ESIs - Clients: Developers, Property Managers, Environmental Attorneys, Architects, Banks, and Insurance Firms** - Conducted 100s of environmental assessments for various entities specializing in urban renewal: Mixed use, residential, commercial, retail, warehouses, manufacturing facilities, gas stations and vacant lands. I also designed and executed subsurface investigations for soil, groundwater, and soil gas.

- **Remedial Investigation, Remedial Design and Associated Remediation Projects - Clients: Developers, Property Managers, Environmental Attorneys, Architects, Banks, Insurance Firms** - Managed myriads of environmental investigations and remedial actions at petroleum and chlorinated solvent spill sites, former manufactured gas and a variety of other commercial and industrial settings. Constituents of concern have included LNAPLs and DNAPLs, petroleum hydrocarbons, chlorinated solvents, soil vapor, coal tar, creosote, PCBs, and metals. Managed and participated in historical research, sample collection and data evaluation, synthesis of information to determine site-specific cleanup levels, remedial technology evaluation, design of treatment systems, site cleanup, installation and operation of treatment systems, optimizing systems, and performance monitoring.
- **LIRR/MTA East Side Access Project, New York, NY - Client: MTA** - The project involves the construction of new metro tunnels system in densely developed areas of midtown Manhattan, new tunnels system construction beneath active Amtrak, Metro North and NYCTA facilities, construction of new terminals, ventilation facilities, off street entrances, and yards development. In addition to establishing the guidelines of the project specific environmental management system, I provided direct and extensive public and community relations outreach, educational and awareness programs, as well technical support for the design engineering and construction teams, inspectors, and environmental sub consultants, so that construction of the project proceeds in compliance with environmental commitments, be conducted under budget and on time, while maintaining the utmost quality. Another key component of the project success was the direct and constant coordination between the environmental department and the multiple agencies and operators/owners of the project, such as USEPA, NYSDEC, NYSDOH, NYCDOT, NYCDEP, NYCDOB, MTA, LIRR, NYCTA, Amtrak, and Metro North. Construction Cost: \$8.4 Billion
- **Columbia University Manhattanville Expansion Project, New York, NY – Client: Columbia University** - Columbia University new campus will be built within a 17-acre area and will be comprised of academic and research facilities, housing, as well as commercial retail stores and open space areas. As the senior environmental project manager, I oversaw all environmental engineering related activities, including site assessment prior to the development, pre-construction support for demolition, recycling, soil and groundwater management, air quality controls, and LEED certification support. Construction Cost: \$2+ Billion
- **Potable Water System Testing for Lead in NYCDOE Facilities, New York, NY – Client: NYCSCA** - Directly managed the emergency work for the sampling, testing, evaluation and reporting of lead in the potable water of approximately 300 public schools in New York City. HAKS was one of the main consultants working for NYCSCA to implement a potable water system testing protocol which included coordination with school facilities, field work encompassing flushing and sampling, laboratory testing, analyzing, and reporting sample results. The project was conducted on a tight 24/7 timetable. The project was completed successfully under the direct supervision and daily coordination with the NYCSCA, with limited to no disturbance to schools schedule and extracurricular activities, on time and on budget.
- **New York Jets Stadium, New York, NY – Client: NY Jets** - Served as the environmental project manager for the due diligence, investigation, and preliminary design phases of the proposed Jets Stadium. The work included subsurface investigation for soil, groundwater, and soil gas, and required close interaction with multiple entities including the MTA, LIRR, NYCTA, NYCDOS, NYSDEC, and Amtrak. Construction Cost: \$1.4 Billion
- **54 Rutledge St, Insitu Bio-Remediation, Brooklyn, NY – Client: Fortis Property Group** - Managed the implementation of a remedial action for major petroleum and gasoline spills. The remedial action consisted of a multi-phased approach to site cleanup, which included excavation

and removal of contaminated soil and groundwater, removal of underground storage tanks, injection of chemical oxidation compounds into the groundwater table, installation of permanent remedial injection and monitoring points, installation of a soil vapor mitigation system, and delineation of off-site contamination. Fees: \$1.0 Million

- **Constructability Review – Justice Sonia Sotomayor Houses, Bronx, NY – Client: NYCHA** - Constructability Review for the upgrading/rehabilitation of the Justice Sonia Sotomayor Houses in the Bronx for the New York City Housing Authority (NYCHA). The scope of work includes such repairs as Local Law 11 Brick Facade repair/waterproofing for areas of significant disrepair (including brick masonry, window sills/lintels, and brick parapet replacement with metal railing); roof replacement (asbestos abatement, 4-ply insulated roofing, roof drains); interior repairs/sheet rock/painting to apartments with water damage, new window installation at all locations; replacement of the water tanks, pumps, and repairs to the water tank structures in particular buildings; repairs to the property's main loop and improvements to entrances, lobbies and security. Construction Cost: \$102 Millions

Mark E. Robbins, C.P.G., C.E.I.
Vice President, Senior Geologist

Mr. Robbins has over nine (9) years experience in geology and hydrogeology, involving such activities as Phase I Environmental Site Assessments, Phase II Environmental Site Assessments, Subsurface Investigations, Remedial Actions, data acquisition, evaluation and contouring, and geotechnical investigations. Mr. Robbins has performed over 400 Phase I Assessments involving residential through heavy industrial properties and over 200 Subsurface Investigations throughout the United States. Mr. Robbins has also designed and implemented over 20 remediation systems for both public and private sectors.

Representative Occupational Experience

- ❑ *Environmental Site Assessments*
Conducted Phase I and II Environmental Site Assessments, analysis of site investigation reports, identifying contamination locations and sources. Soil, soil-vapor and water sampling, analyzing laboratory results for QA/QC, magnetometer and Ground-Penetrating Radar surveys for locating buried drums and underground storage tanks (USTs), estimating UST and other subsurface leaks, monitoring well logging, Project Management, liability assessments and estimating costs to attain compliance.
- ❑ *Remedial Investigation and Feasibility Studies*
Oversight/planning of site investigations; data analysis, including statistical analysis and geostatistical contouring utilizing SURFER; performance of feasibility studies, including technology evaluations, alternatives development and evaluation and cost estimations.
- ❑ *Due- Diligence Programs*
Designed and implemented due-diligence programs (ranging from Phase I Assessment to Comprehensive Hydrogeologic Investigations) to assess environmental liabilities for numerous land development clientele.
- ❑ *Delineation of Chlorinated Organic Plumes*
Supervised the delineation of a dissolved chlorinated organic plume from underground tank loss. Developed a remedial action program in accordance with New York State regulatory guidelines to abate soil and groundwater contamination.
- ❑ *Remedial Action*
Prepared numerous Remedial Action Plans. Designed and implemented hydrocarbon and chlorinated solvent remediation systems for soil and groundwater.
- ❑ *Pump Test Aquifer Analysis*
Conducted several pump tests and pump test analysis and field coordination in relation to dewatering permit requirements for Keyspan Energy and the private sector.

Employment

2001 - Present

Vice President, Senior Geologist
Hydro Tech Environmental Corp., Commack, New York

- | | |
|-------------|--|
| 2000 – 2001 | Assistant Director, Professional Services
Fenley & Nicol Environmental, Inc., Deer Park, New York |
| 1999 – 2000 | Senior Geologist
Fenley & Nicol Environmental, Inc. Deer Park, New York |
| 1995 – 1999 | Operations Director
Advanced Cleanup Technologies, Inc., Farmingdale, New York |
| 1992 – 1995 | Project Geologist
Advanced Cleanup Technologies, Inc., Roslyn Heights, New York |

Education

B.S. Geology, State University of New York at Oneonta, 1991

Affiliations and Certifications

- American Institute of Professional Geologists
- American Association of Petroleum Geologists
- Long Island Geologist Organization
- Geological Society of America
- American Standards in Testing Materials – E50 Committee Member
- Environmental Assessment Association
- OSHA 40-Hour & 8-Hour, Supervisor

Registrations and Certifications

- Certified Professional Geologist (C.P.G. # 10527)
- Certified Environmental Inspector (C.E.I. # 73383)
- GPR Operator's Course, Geophysical Survey Systems, Inc., 1993.

Publications/Presentations

- *A Case Study of the Impact of MTBE on the Investigation and Remediation of a Fuel Oil Release*, National Groundwater Focus Conference MTBE in Groundwater: Assessment, Remediation Technologies & Public Policy, Baltimore, MD June 4-5, 2001.
- *Is MTBE in Fuel Oil? Why MTBE Plays a Major Concern on Long Island*, Long Island Business News, February 2001.

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 fluorochemicals 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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Paul I. Matli (Ph.D.)

EXPERIENCES

Senior Project Manager

Hydro Tech Environmental Corp. - USA

Apr. 2005 - Nov. 2005 & July 2006 - Present

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”

Saint Joseph University – Lebanon

Nov. 2003 - Feb. 2004

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

Lebanese Agricultural Research Institute - Lebanon

May 2003 - Jan. 2004

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

Tokyo University of Agriculture and Technology - Japan

Apr. 1999-Sept. 2002

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 stakeholders 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)

Tokyo University of Agriculture and Technology- Japan

Apr. 1999 - Sept. 2002

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)

International Center for Advanced Mediterranean Agronomic Studies - Greece

Sept. 1995 - Sept. 1997

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

International Center for Advanced Mediterranean Agronomic Studies - Greece

Nov. 1994 - Aug. 1995

Diploma of Agricultural Engineer ^(c)

University of Saint Joseph - Lebanon

Sept. 1989 - July 1994

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 CO₂ 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.

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.

DORINA ALIU

67-11 Austin Street #4A, Forest Hills, New York 11375

347.249.1880 – lleshi46@gmail.com

EDUCATION

The Cooper Union for the Advancement of Science and Art, New York, NY

M.E. Chemical Engineering GPA 3.8

B.E. Chemical Engineering

Full-Tuition Merit Scholarship, B.E, M.E

EXPERIENCE

HAKS Environmental Engineer

Provided multifaceted environmental engineering support services to developers, real estate property owners, environmental attorneys, architects and public agencies

Performed, directed, and oversaw Phase I and II ESAs; remedial investigation, design, and oversight; and community air monitoring for several residential, commercial and industrial properties

Representative projects include:

Edgestone Group LLC Waterfront Residential Development, Whitestone, NY

Managed remediation of 12 acre NYS Brownfield site to Track 2 Residential Soil Cleanup Objectives to prepare site for a high end residential development; Responsible for oversight over air monitoring, storm water, and dust controls and reporting all site activities and testing results to NYSDEC

United Properties Corporation Vleigh Place Venting System Design, Flushing, NY

Environmental Engineer for the design of a vapor mitigation system to address the impact of chlorinated solvents in the soil and groundwater of a commercial property which was undergoing remediation under the NYSDEC Brownfield Cleanup Program. Involved in the design and implementation of the vapor mitigation system, including all system components and follow-up testing.

Ever Nu Metals Remediation of Industrial Metal Work Facility, Brooklyn, NY

Environmental Engineer for the implementation of an interim remedial measure (IRM) consisting of the design and implementation of a soil vapor extraction (SVE) system. The project site is a 13,722-square-foot metal plating and sandblasting facility that is undergoing remediation under the New York State Brownfield Cleanup Program (BCP). Involved in the review and evaluation of reports to determine the viability of proposed engineering controls, coordination with regulatory authorities, preparation and implementation of an SVE pilot study, preparation of SVE design specifications and plans, and remedial oversight.

New York City School Construction Authority (SCA) Potable Water Supply System Testing for Lead in NYCDOE Facilities, New York City, NY

Played a vital role in the emergency work for the sampling, testing, evaluation and reporting of lead in the potable water of approximately 300 public schools in New York City. Successfully managed staff and deliverables for \$1.6 million project to directly support NYCSCA's decision-making processes.

Hunterdon County Educational Services Commission and Educational Services Commission of New Jersey Water Testing for Lead in New Jersey School Districts, Various Townships, NJ

Managed water testing efforts for various school districts in townships throughout New Jersey. Testing was mandated by the New Jersey Board of Education according to regulations adopted in July 2016. In response to this mandate, HAKS was one of the key consultants providing consulting and sampling services to help address the possible presence of lead in potable water systems at these schools. The project included sampling, reviewing analytical results, and providing guidance on effective remedial measures.

Con Edison, Management Associate, GOLD Program

Operating Supervisor, Gas Distribution Services, Gas Operations

Supervised group of 62 field mechanics responsible for emergency leak response, meter exchanges and regulatory inspections

Launched new field technology to bring about work practice improvements associated with approximately \$1,000,000 in annual cost savings

Revised gas operating procedures and incorporated Human Performance Improvement initiatives

Operating Supervisor, Steam Distribution Services - Steam Operations

Supervised group of 29 mechanics performing routine steam-system maintenance and responding to steam system emergencies (cold traps, steam pipe breaches, and high pressure conditions)

Participated in multiple coordinated Emergency Rain Response events which ensure system safety and prevent service interruptions

Managed \$500,000 Meter Conversion Project and implemented process improvements to automate project tracking, facilitate communication between company and contractor forces, and ultimately increase productivity by 50%

Sustainability Associate, Engineering & Construction - Environment Health & Safety

Conducted company-wide assessment of water quality standards to ensure continued alignment with state and federal regulations and to prevent millions of dollars in potential non-compliance fines

Developed corrective actions for existing water discharge vulnerabilities, calculated alternative system improvement

June 2016

May 2012

January 2016 – Present

June 2014 – Dec 2015

costs, and summarized recommendations and financial analysis in a 30-page report (and in webinar delivered to dept.)
Benchmarked with external agencies such as EPRI and Ceres in order to develop corporate-level environment, health, safety, and community performance metrics that align with corporate Sustainability Strategy
Presented KPI proposal to Senior Management and implemented metrics at Vice President level
Revised corporate procedures to ensure alignment with current regulatory requirements
Compiled data for use in company's voluntary CDP disclosure and Sustainability Report which capture the company's environmental performance and are used for benchmarking with industry peers

March 2013 – June 2014

Con Edison, Engineering Aide, New York, NY

Developed statistical model to predict risk of failures for 26,000 network transformer, using Excel, Tableau, and Discriminant Analysis software, to ensure system safety and reliability
Redesigned existing transmitter inspection database in Distribution Equipment group to enhance resource management
Developed Electric Operations tracking sheet for use in rate case hearings and for company record-keeping
Compiled technical reports used in rate case hearings to negotiate 2-year electric rate contract

Summer 2012

Zetroz LLC., Biomedical Engineering Intern, Ithaca, NY

Lead clinical trial on effect of low intensity ultrasound device on venous stasis ulcer treatment Developed ergonomic design for polyurethane transducer housing using 3-D printing Characterized hydrogel coupling mechanism and designed marketing and packaging
Tested pig skin samples and Strat-M membrane to determine transmission and permeation effects of ultrasound application for pharmacological and cosmetic applications
Evaluated device component materials and helped streamline manufacturing process

December 2016

Awards

Professional Women in Construction 20 Under 40
HAKS Environmental Project Manager of the Year

Teresa V. Weikel
Quality Assurance Officer

As an analytical chemist, Ms. Weikel has had over 10 years of experience in environmental laboratories with specialized expertise in Organics Analysis including organic extractions, Gas Chromatography/Mass Spectrometry and Gas Chromatography methods. She also experienced in metals analysis by ICP, and classical chemistry methods. She has also been heavily involved with QA/QC protocols for all disciplines in the Laboratory. She is fully versed in all NELAC(TNI) and ISO-17025 protocols for Quality Systems.

In the capacities of Chem ist and Senior Chem ist at various environm ental testing laboratories, she performed and was frequently solely resp onsible for a wide vari ety of both organic and inorganic analyses and extractions in varying environmental matrices following EPA, WA State and occasional self-designed methods.

In addition to chemist responsibilities, Ms. Weikel also was responsible for setup and use of specific programs and appropriate record keep ing for various governm ent/state certifications, organization and delegation of incoming laboratory work and as a Quality Control Specialist at a biotechnology company, she wrote raw materi al specifications a nd standard operating procedures according to FDA document traceability standards.

She has had QA spec ific training on Intern al Audit Procedures and Understanding and Implementing ISO-17025 in laboratories. She is familiar with the requirements of the NELAC 2003 standard.

At York, she holds full responsibility for the in-house Quality Systems.

Her current responsibilities focus on quality system s monitoring and im plementation, technical training, data review, SOP preparation and revision, new procedure review and approval, data package review, and ethics training.

Education: B.S. Chemistry, Pacific Lutheran University

Tacoma, WA

APPENDIX 5

STORM-WATER POLLUTION PREVENTION PLAN

I. PROJECT DETAILS

1. Project Description

The purpose of the project is to remediate a 0.9-acre property located at 77-39/63 Vleigh Place in Kew Garden Hills neighborhood of Flushing Section of the County of Queens, New York under the Brownfield Cleanup Program (BCP) and make it protective of human health and the environment consistent with the contemplated new residential and commercial development with a full basement. The entire property will be disturbed during this remedial construction period.

2. Site Description

The Site is approximately 39,000 square feet (0.9 acres) in area and is bounded by Vleigh Place to the west, three 3-story multi-family building to the east, 78th Avenue to the south and 77th Road to north in the Kew Garden Hills neighborhood of Flushing Section of the County of Queens, NY. The Site is currently vacant with one-story commercial building with full basement developed along the eastern portion and a open unpaved yard in the western portion. The building at the Site was completed destroyed by a recent fire was condemned by order of the NYCDOB due to unsafe building condition requiring a full demolition. The Site is secured by a plywood fence along the northern and western boundary and wire fence along the southern and eastern boundary below.

3. Adjacent Property

Land use in the vicinity is residential, commercial and institutional properties. The Site is bounded by Vleigh Place to the east, 77th Road to the south and 78th Avenue to the north and is bordered by three 3-story multi-family buildings (Kew Gardens Owners. Corp) to the east. A park (Judge Moses Weinstein Playground) is located to the southwest of the Site.

4. Soils

The soil at the Site is mapped with fill material at shallow depth to approximately 10 feet bgs. The fill layer is underlain by fine-grained silty to variable depth ranging between 32 and 34 feet bgs. Silty sand is considered to have a low degree of permeability, with the coefficient of permeability (k) ranging between $10^{-3} < k < 10^{-5}$. The soil erodibility factor (K value) ranges from 0.42 at the surface to 0.28 in the subsoil.

Due to the soil/fill permeability of the shallow subsoil that will be exposed during excavation, a surface wetness or runoff problems are not anticipated following significant rainfall events. The lower portion of excavations may fill with groundwater following significant rainfall events. However, since Site excavation is not expected to extend to the depth of soil and groundwater interface, any accumulated water in the pit is

not expected to percolate fast due low infiltration rate and as such this accumulated water may require removal by mechanical means, i.e vacuum truck or via a dewatering system.

II. PLANNED EROSION AND SEDIMENT CONTROL PRACTICES

1. Sediment Basin

No sediment basin will be required. Soil/fill will be excavated across the entire Site to variable depths consistent with the plan of construction as well as the plan for SGCs established for this Site. Soil will be removed to the depth of 12 feet bgs across the entire Site and to the depth of 20 feet bgs beneath the elevator pit in the southeastern portion. Should a dewatering system is required to remove accumulated rainwater in the excavated pit, this system will incorporate a frac tanks designed to retain sediments prior to discharging groundwater into the NYC combined sewer system following any necessary treatment.

2. Temporary Gravel Construction Entrance/Exit

A temporary gravel construction entrance will be installed on the western side of the property towards Vleigh Place. This will be done to reduce the amount of sediment transported on to roads by construction vehicles and run-off. During wet weather it may be necessary to wash vehicle tires at this location. The entrance will be graded so that runoff water will be directed to an inlet protection structure and away from the steep fill area.

3. Tree Preservation and Protection

No tree preservation and protection will be required.

4. Land Grading

No land grading will be required as soils will be excavated and disposed of as a result of Site development.

5. Temporary Sediment Trap

No temporary sediment trap will be required. All soils will be excavated and disposed of as a result of Site remedial development.

6. Sediment Fence

A sediment fence will be constructed around any temporary soil stockpiles to prevent sediment from entering non-excavated areas or areas off-site.

7. Surface Stabilization

Support of excavation (SOE) measures will be required during Site excavation as a results of site remedial development activities. These measures will be implemented in accordance with NYCDOB-approved SOE plans.

8. Dust Control

Dust control is not expected to be a problem due to relatively short time of exposure (not exceeding 3 months). Should excessive dust be generated, it will be controlled by sprinkling. Street sweeping will also be employed wherever required. Additional details regarding dust control can be found in Section 4.1.6 of the RAWP (Community Air Monitoring Plan).

III. CONSTRUCTION SCHEDULE

1. Obtain plan approval and other applicable permits.
2. Maintain construction fence before start of any construction activity.
3. Hold pre-construction conference at least one week prior to starting construction.
4. Install temporary gravel construction entrance/exit.
5. Install & operate dewatering system.
6. Commence excavation and disposal.
7. Construct foundations.
8. Estimated time before final stabilization – 3 months

IV. MAINTENANCE PLAN

1. General Conditions

Any erosion and sediment control measures will be checked for stability and operation following every runoff-producing rainfall but in no case less than once every week. Any needed repairs will be made immediately to maintain all practices as designed.

2. Construction Fence

- a. A temporary construction fence is currently installed per NYCDOB code around the destroyed building at the Site along Vleigh Place to the west, 78th Avenue to the south and 77th Road to the north. The purpose of the construction fence is to prevent exposure of pedestrians to unsafe building condition.
- b. The construction fence be maintained around the Site during building demolition and during construction in order to prohibit the undesirable use of the construction area during Site remedial development.
- c. The construction fence should maintain a minimum height of 8 feet.

3. Temporary Gravel Construction Entrance/Exit

- a. A temporary gravel construction entrance will be constructed to reduce the amount of sediment transported on to roads by construction vehicles and run-off.
- b. Clear the entrance and exit area from of all vegetation, roots and other objectable material.
- c. Grade the road foundation so that entrance/exit slopes towards south of the entrance.
- d. The construction entrance will be built to a minimum width of 20 feet, minimum length of 30 feet and to minimum 6” thickness.
- e. 2” to 3” washed stone will be used at the construction entrance.
- f. If wet conditions are anticipated a geotextile fabric will be placed over the graded foundation to improve stability.
- g. Maintain the gravel pad in a condition to prevent mud or sediment from leaving the site. Mud tracked or washed onto road, will be removed immediately.

4. Sediment Fence

- a. A sediment fencing will be maintained to surround any temporary soil stockpiles.
- b. Any sediment fence utilized will be inspected at the end of each day to ensure its integrity.

5. Dust Control

- a. A min. 275-g water tank or tools to access via permit to use a fire hydrant and 50 feet of garden hose with spray nozzle will be maintained at the construction entrance.
- b. All vehicles leaving property will be inspected for dust and sprayed as necessary.

APPENDIX 6

COMMUNITY AIR MONITORING PLAN

COMMUNITY AIR MONITORING PLAN (CAMP)

**77-57 Vleigh Place
Block 6630; Lot 1
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 proposed as a part of the Brownfield Cleanup Program (BCP) Remedial Action Work Plan (RAWP) activities at 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 #E241168). 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/m³.

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 endpoint soil samples. 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 Remedial Investigation Report (RIR).

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 exceeding 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 $150 \text{ mcg}/\text{m}^3$ 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 $150 \text{ mcg}/\text{m}^3$ or greater above the upwind level, work will be stopped and a re-evaluation of activities initiated. Work will resume if dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within $150 \text{ mcg}/\text{m}^3$ of the upwind level and in preventing visible dust migration. All readings will be recorded in a daily field log.

APPENDIX 7
CITIZEN PARTICIPATION PLAN



New York State Department of Environmental Conservation

Brownfield Cleanup Program

Citizen Participation Plan for **77-57 Vleigh Place**

77-39/63 Vleigh Place
Kew Gardens Hills, NY 11367

May 2015

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* * * * *

Note: The information presented in this Citizen Participation Plan was current as of the date of its approval by the New York State Department of Environmental Conservation. Portions of this Citizen Participation Plan may be revised during the site’s investigation and cleanup process.

Applicant: **Denis Rodger**
Site Name: **77-57 Vleigh Place (“Site”)**
Site Address: **77-39/63 Vleigh Place, Kew Gardens Hills, NY**
Site County: **Queens**
Site Number: **C241168**

1. What is New York’s Brownfield Cleanup Program?

New York’s Brownfield Cleanup Program (BCP) works with private developers to encourage the voluntary cleanup of contaminated properties known as “brownfields” so that they can be reused and developed. These uses include recreation, housing, and business.

A *brownfield* is any real property that is difficult to reuse or redevelop because of the presence or potential presence of contamination. A brownfield typically is a former industrial or commercial property where operations may have resulted in environmental contamination. A brownfield can pose environmental, legal, and financial burdens on a community. If a brownfield is not addressed, it can reduce property values in the area and affect economic development of nearby properties.

The BCP is administered by the New York State Department of Environmental Conservation (NYSDEC) which oversees Applicants that conduct brownfield site investigation and cleanup activities. An Applicant is a person who has requested to participate in the BCP and has been accepted by NYSDEC. The BCP contains investigation and cleanup requirements, ensuring that cleanups protect public health and the environment. When NYSDEC certifies that these requirements have been met, the property can be reused or redeveloped for the intended use.

For more information about the BCP, go online at: <http://www.dec.ny.gov/chemical/8450.html>.

2. Citizen Participation Activities

Why NYSDEC Involves the Public and Why It Is Important

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well-being. NYSDEC provides opportunities for citizen involvement and encourages early two-way communication with citizens before decision-makers form or adopt final positions.

Involving citizens affected and interest in site investigation and cleanup programs is important for many reasons. These include:

- Promoting the development of timely, effective site investigation and cleanup programs that protect public health and the environment;

- Improving public access to, and understanding of, issues and information related to a particular site and that site's investigation and cleanup process;
- Providing citizens with early and continuing opportunities to participate in NYSDEC's site investigation and cleanup process;
- Ensuring that NYSDEC makes site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community; and
- Encouraging dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of site and community issues and concerns, and improves decision-making.

This Citizen Participation (CP) Plan provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the site identified above. The public information and involvement program will be carried out with assistance, as appropriate, from the Applicant.

Project Contacts

Appendix A identifies NYSDEC project contact(s) to whom the public should address questions or request information about the site's investigation and cleanup program. The public's suggestions about this CP Plan and the CP program for the Site are always welcome. Interested people are encouraged to share their ideas and suggestions with the project contacts at any time.

Locations of Reports and Information

The locations of the reports and information related to the site's investigation and cleanup program also are identified in Appendix A. These locations provide convenient access to important project documents for public review and comment. Some documents may be placed on the NYSDEC website. If this occurs, NYSDEC will inform the public in fact sheets distributed about the Site and by other means, as appropriate.

Site Contact List

Appendix B contains the site contact list. This list has been developed to keep the community informed about, and involved in, the site's investigation and cleanup process. The site contact list will be used periodically to distribute fact sheets that provide updates about the status of the project. These will include notifications of upcoming activities at the site (such as fieldwork), as well as availability of project documents and announcements about public comment periods. The site contact list includes, at a minimum:

- Chief executive officer and planning board chairperson of each county, city, town and village in which the Site is located;
- Residents, owners, and occupants of the Site and properties adjacent to the Site;
- The public water supplier which services the area in which the Site is located;
- Any person who has requested to be placed on the site contact list;
- The administrator of any school or day care facility located on or near the Site for purposes of posting and/or dissemination of information at the facility; and
- Location(s) of reports and information.

The site contact list will be reviewed periodically and updated as appropriate. Individuals and organizations will be added to the site contact list upon request. Such requests should be submitted to the NYSDEC project contact(s) identified in Appendix A. Other additions to the site contact list may be made at the discretion of the NYSDEC project manager, in consultation with other NYSDEC staff as appropriate.

CP Activities

The table at the end of this section identifies the CP activities, at a minimum, that have been and will be conducted during the site's investigation and cleanup program. The flowchart in Appendix D shows how these CP activities integrate with the site investigation and cleanup process. The public is informed about these CP activities through fact sheets and notices distributed at significant points during the program. Elements of the investigation and cleanup process that match up with the CP activities are explained briefly in Section 5.

- **Notices and fact sheets** help the interested and affected public to understand contamination issues related to a site, and the nature and progress of efforts to investigate and clean up a site.
- **Public forums, comment periods and contact with project managers** provide opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about a site's investigation and cleanup.

{Instruction to preparer: Additional information can be provided here as appropriate, for example, if a web-page dedicated to the site has been set up, additional repositories have been established, newsletters or other supplemental communication are planned, etc.}

The public is encouraged to contact project staff at any time during the site's investigation and cleanup process with questions, comments, or requests for information.

This CP Plan may be revised due to changes in major issues of public concern identified in Section 3 or in the nature and scope of investigation and cleanup activities. Modifications may include additions to the site contact list and changes in planned citizen participation activities.

Technical Assistance Grant

NYSDEC must determine if the site poses a significant threat to public health or the environment. This determination generally is made using information developed during the investigation of the site, as described in Section 5.

If the site is determined to be a significant threat, a qualifying community group may apply for a Technical Assistance Grant (TAG). The purpose of a TAG is to provide funds to the qualifying group to obtain independent technical assistance. This assistance helps the TAG recipient to interpret and understand existing environmental information about the nature and extent of contamination related to the site and the development/implementation of a remedy.

An eligible community group must certify that its membership represents the interests of the community affected by the site, and that its members' health, economic well-being or enjoyment of the environment may be affected by a release or threatened release of contamination at the Site.

For more information about TAGs, go online at <http://www.dec.ny.gov/regulations/2590.html>

Note: The table identifying the citizen participation activities related to the site's investigation and cleanup program follows on the next page:

Citizen Participation Requirements (Activities)	Timing of CP Activity(ies)
<p align="center">Application Process:</p> <ul style="list-style-type: none"> • Prepare site contact list • Establish document repositories • Preparation of a Remedial Investigation Report <hr/> <ul style="list-style-type: none"> • Publish notice in Environmental Notice Bulletin (ENB) announcing receipt of application and 30-day public comment period • Publish above ENB content in local newspaper • Mail above ENB content to site contact list • Conduct 30-day public comment period 	
<p align="center">After Execution of Brownfield Site Cleanup Agreement:</p> <ul style="list-style-type: none"> • Prepare Citizen Participation (CP) Plan 	
<p align="center">Before NYSDEC Approves Remedial Investigation (RI) Work Plan:</p> <ul style="list-style-type: none"> • Distribute fact sheet to site contact list about proposed RI activities and announcing 30-day public comment period about draft RI Work Plan • Conduct 30-day public comment period 	
<p align="center">After Applicant Completes Remedial Investigation:</p> <ul style="list-style-type: none"> • Distribute fact sheet to site contact list that describes RI results 	
<p align="center">Before NYSDEC Approves Remedial Work Plan (RWP):</p> <ul style="list-style-type: none"> • Distribute fact sheet to site contact list about proposed RWP and announcing 45-day public comment period • Public meeting by NYSDEC about proposed RWP (if requested by affected community or at discretion of NYSDEC project manager) • Conduct 45-day public comment period 	
<p align="center">Before Applicant Starts Cleanup Action:</p> <ul style="list-style-type: none"> • Distribute fact sheet to site contact list that describes upcoming cleanup action 	
<p align="center">After Applicant Completes Cleanup Action:</p> <ul style="list-style-type: none"> • Distribute fact sheet to site contact list that announces that cleanup action has been completed and that summarizes the Final Engineering Report • Distribute fact sheet to site contact list announcing issuance of Certificate of Completion (COC) 	

3. Major Issues of Public Concern

This section of the CP Plan identifies major issues of public concern that relate to the Site. Additional major issues of public concern may be identified during the course of the site's investigation and cleanup process.

The Site is not located in an Environmental Justice Area. Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities.

Although the Site is not located in an Environmental Justice Area, Census Data indicates that 26% of the surrounding neighborhood is Hispanic American. Therefore, all future fact sheets will be translated into Spanish as well.

In addition, there may be noise, odor and truck traffic impacts with regards to the cleanup. Furthermore, the Site is located in a largely Jewish section.

Based on the results of previous environmental investigations, Tetrachloroethene (PCE) contamination in soil and groundwater and PCE in soil vapors represent an issue of public concern at the Site and also off-site. The Site is not near any public water supply or private water wells. The future on-site use and remediation will not create any restrictions on community activities but will render the Site protective of public health and the environment.

It should be noted that during future remedial activities at the Site and the proposed use of the eastern portion of the Site as a parking lot, potential contaminants known to be present in the soil, and potential unknown contaminants especially Semi-Volatile Organic Compounds (SVOCs) and metals may become airborne and pose potential health risks to existing tenants spaces, workers and occupants on adjacent properties. However, a NYSDEC Community Air Monitoring Program (CAMP) is in place for the proposed remedial activities and will be followed to safeguard the workers and other occupants against any potential exposures.

4. Site Information

Site Description

The Site is located in the Kew Gardens Hills section in Queens, New York and is identified as Block 6330 and Lot 1 on the New York City Tax Map. The Site is 39,000-square feet and is bounded by Vleigh Place to the west, a 3-story multi-family building to the east, 78 Avenue to the south and 77

Road to north. Currently, the Site consists of an approximately 11,500 square foot one-story commercial building housing thirteen (13) tenant spaces and a rear open yard covered by bare soil and utilized for parking by on-Site tenants.

The Site is located in a residential, commercial, and institutional neighborhood. Stepping Stone Day School is located across the southern boundary of the Site.

Appendix C contains a map identifying the location of the site.

History of Site Use, Investigation, and Cleanup

Historic Fire Insurance Maps and Regulatory Agency documents indicated the Site was vacant prior to existing commercial development. The Site has been utilized and occupied by for thirteen (13) commercial tenants.

Potential impacts associated with a dry cleaner identified as Paragon Cleaners and situated in the southeastern portion of the Site were investigated in a Phase II investigation performed during October 2013, two focused subsurface investigations performed during January 2014 and August 2014 and a Subsurface Investigation performed during November 2014.

The following provides a list of reports that summarize the prior environmental assessments and investigation activities conducted at the property, which have been previously provided to NYSDEC and referenced in the BCP application submitted by Applicant:

1. Subsurface Investigation, 77-57 Vleigh Place, Flushing, NY, Submitted to NYSDEC April 2015, Hydro Tech Environmental, Corp.
2. Subsurface Investigation, 77-57 Vleigh Place, Flushing, NY, Submitted to NYSDEC January 2015, Hydro Tech Environmental, Corp.
3. Focused Subsurface Investigation, 77-57 Vleigh Place, Flushing, NY, August 19, 2014, Hydro Tech Environmental, Corp.
4. Focused Subsurface Investigation, 77-57 Vleigh Place, Flushing, NY, February 14, 2014, Hydro Tech Environmental, Corp.
5. Phase II Environmental Site Assessment (ESA), 77-39 to 77-63 Vleigh Place, Flushing, NY, October 15, 2013, Hydro Tech Environmental, Corp.
6. Phase I Environmental Site Assessment, 77-39 to 77-63 Vleigh Place, Flushing, NY, August 6, 2013, Environmental Affiliates, Inc.

7. Phase I Environmental Site Assessment Report, 77-39 to 77-63 Vleigh Place, Flushing, NY, July 22, 1999, Middleton, Konekosta Associates., Ltd.
8. Environmental Property Assessment, 77-39 to 77-63 Vleigh Place, Flushing, NY, July 16, 1993, Merritt Engineering Consultants, P.C.

5. Investigation and Cleanup Process

Application

The Applicant has applied for and been accepted into New York's Brownfield Cleanup Program as a **Participant**. This means **that the Applicant was the owner of the site at the time of the disposal or discharge of contaminants or was otherwise liable for the disposal or discharge of the contaminants. The Participant must fully characterize the nature and extent of contamination on-site, as well as the nature and extent of contamination that has migrated from the Site. The Participant also must conduct a qualitative exposure assessment, a process that characterizes the actual or potential exposures of people, fish and wildlife to contaminants on the Site and to contamination that has migrated from the Site.**

The Applicant in its Application proposes that the site will be used for **restricted** commercial purposes.

To achieve this goal, the Applicant will conduct **investigation and/or cleanup** activities at the site with oversight provided by NYSDEC. The Brownfield Cleanup Agreement executed by NYSDEC and the Applicant sets forth the responsibilities of each party in conducting these activities at the site.

Investigation

The Applicant has completed a **partial** site investigation before it entered into the BCP. **For the partial investigation, NYSDEC will determine if the data are useable.**

The Applicant will conduct an investigation of the site officially called a "remedial investigation" (RI). This investigation will be performed with NYSDEC oversight. The Applicant must develop a remedial investigation workplan, which is subject to public comment.

The site investigation has several goals:

- 1) define the nature and extent of contamination in soil, surface water, groundwater and any other parts of the environment that may be affected;
- 2) identify the source(s) of the contamination;
- 3) assess the impact of the contamination on public health and the environment; and
- 4) provide information to support the development of a proposed remedy to address the contamination or the determination that cleanup is not necessary.

When the investigation is complete, the Applicant will prepare and submit a report that summarizes the results. This report also will recommend whether cleanup action is needed to address site-related contamination. The investigation report is subject to review and approval by NYSDEC.

NYSDEC will use the information in the investigation report to determine if the site poses a significant threat to public health or the environment. If the site is a significant threat, it must be cleaned up using a remedy selected by NYSDEC from an analysis of alternatives prepared by the Applicant and approved by NYSDEC. If the site does not pose a significant threat, the Applicant may select the remedy from the approved analysis of alternatives.

Remedy Selection

When the investigation of the site has been determined to be complete, the project likely would proceed in one of two directions:

1. The Applicant may recommend in its investigation report that no action is necessary at the Site. In this case, NYSDEC would make the investigation report available for public comment for 45 days. NYSDEC then would complete its review, make any necessary revisions, and, if appropriate, approve the investigation report. NYSDEC would then issue a Certificate of Completion (described below) to the Applicant.

or

2. The Applicant may recommend in its investigation report that action needs to be taken to address site contamination. After NYSDEC approves the investigation report, the Applicant may then develop a cleanup plan, officially called a Remedial Work Plan. The Remedial Work Plan describes the Applicant's proposed remedy for addressing contamination related to the site.

When the Applicant submits a proposed Remedial Work Plan for approval, NYSDEC would announce the availability of the proposed plan for public review during a 45-day public comment period.

Cleanup Action

NYSDEC will consider public comments, and revise the draft cleanup plan if necessary, before approving the proposed remedy. The New York State Department of Health (NYSDOH) must concur with the proposed remedy. After approval, the proposed remedy becomes the selected remedy.

The Applicant may then design and perform the cleanup action to address the site contamination. NYSDEC and NYSDOH oversee the activities. When the Applicant completes cleanup activities, it will prepare a Final Engineering Report (FER) that certifies that cleanup requirements have been achieved or will be achieved within a specific time frame. NYSDEC will review the report to be certain that the cleanup is protective of public health and the environment for the intended use of the Site.

Certificate of Completion

When NYSDEC is satisfied that cleanup requirements have been achieved or will be achieved for the site, it will approve the FER. NYSDEC then will issue a Certificate of Completion (COC) to the Applicant. The COC states that cleanup goals have been achieved, and relieves the Applicant from future liability for site-related contamination, subject to certain conditions. The Applicant would be eligible to redevelop the site after it receives a COC.

Site Management

Site management is the last phase of the site cleanup program. This phase begins when the COC is issued. Site management may be conducted by the Applicant under NYSDEC oversight, if contamination will remain in place. Site management incorporates any institutional and engineering controls required to ensure that the remedy implemented for the site remains protective of public health and the environment. All significant activities are detailed in a Site Management Plan.

An institutional control is a non-physical restriction on use of the Site, such as a deed restriction that would prevent or restrict certain uses of the property. An institutional control may be used when the cleanup action leaves some contamination that makes the site suitable for some, but not all uses.

An engineering control is a physical barrier or method to manage contamination. Examples include: caps, covers, barriers, fences, and treatment of water supplies.

Site management also may include the operation and maintenance of a component of the remedy, such as a system that is pumping and treating groundwater. Site management continues until NYSDEC determines that it is no longer needed.

Appendix A

Project Contacts and Locations of Reports and Information

Project Contacts

For information about the site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

MD Hoque
Project Manager
NYSDEC
NYS Division of Environmental Remediation
625 Broadway
Albany, NY 12233
Tel: (518) 402-9475
Email: md.hoque@dec.ny.gov

Thomas Panzone
Regional Citizen Participation Specialist
NYSDEC, Region 2 Office
47-40 21st Street
Long Island City NY 11101
Tel: (718) 482-4953
Email: Thomas.panzone@dec.ny.gov

New York State Department of Health (NYSDOH):

Fcy p"J gwtkem
Project Manager
NYSDOH
Bureau of Environmental Exposure
Investigation
Empire State Plaza, Corning Tower Room
Albany, NY 12237
Tel: (518) 402-7860
Email: fcy p"J gwtkem@health.ny.gov

Locations of Reports and Information

The facilities identified below are being used to provide the public with convenient access to important project documents:

Queens Community Board #8
Att: Alvin Warshaviak
197-15 Hillside Avenue.
Hollis, NY 11423
Phone: (718) 564-7895

Queens Library – Kew Garden Hill Branch
72-33 Vleigh Place, Flushing, NY

Attn: Susan Wetjen
Phone: (718) 278-2220
Hours: Mon; 12:00 AM to 8:00 PM
Tue: 1:00 PM to 6:00 PM
Wed: 10:00 PM to 6:00 PM
Thu: 12:00 PM to 8:00 PM
Fri: 10:00 PM to 6:00 PM
Sat and Sun Closed

Appendix B

Site Contact List

Site Contact List									
Site #: C241168									
Site Name: 77-57 Vleigh Place Site			List Last Updated: 9-5-17						
Current Occupant	Name, Title	Address 1	Address 2	Address 3	Street Address	City	State	Zip	Site Name (County)
Current Occupant	Hon. Bill de Blasio	NYC Mayor			City Hall	New York	NY	10007	77-57 Vleigh Place Site (Queens)
Current Occupant	Hon. Scott Stringer	NYC Comptroller			1 Centre Street	New York	NY	10007	77-57 Vleigh Place Site (Queens)
Current Occupant	Hon. Letitia James	Public Advocate			1 Centre Street	New York	NY	10007	77-57 Vleigh Place Site (Queens)
Current Occupant	Carl Weisbrod	Commissioner, NYC Dept. of City Planning			22 Reade Street	New York	NY	10007	77-57 Vleigh Place Site (Queens)
	Vincent Sapienza	Acting Commissioner, NYC Dept. of Environmental Protection			59-17 Junction Boulevard	Flushing	NY	11373	77-57 Vleigh Place Site (Queens)
	Dan Walsh, Director	NYC Office of Environmental Remediation			100 Gold Street - 2nd Floor	New York	NY	10038	77-57 Vleigh Place Site (Queens)
	Julie Stein	Office of Environmental Assessment & Planning	NYC Dept. of Environmental Protection		96-05 Horace Harding Expressway	Flushing	NY	11373	77-57 Vleigh Place Site (Queens)
	Martha Taylor, Chairwoman	Queens Community Board #8			197-15 Hillside Avenue	Hollis	NY	11423	77-57 Vleigh Place Site (Queens)
	Marie Adam-Ovide, District Manager	Queens Community Board #8			197-15 Hillside Avenue	Hollis	NY	11423	77-57 Vleigh Place Site (Queens)
	Environmental Committee Chairman	Queens Community Board #8			197-15 Hillside Avenue	Hollis	NY	11423	77-57 Vleigh Place Site (Queens)
	Hon. Melinda Katz	Queens Borough President			120-55 Queens Boulevard	Kew Gardens	NY	11424	77-57 Vleigh Place Site (Queens)
	MD Hoque	NYSDEC Project Manager			625 Broadway	Albany	NY	12233	77-57 Vleigh Place Site (Queens)
	Thomas V. Panzone	NYSDEC Regional Citizen Participation Specialist			47-40 21st Street	Long Island City	NY	11101	77-57 Vleigh Place Site (Queens)
	Larry Ennist	NYSDEC			625 Broadway	Albany	NY	12233	77-57 Vleigh Place Site (Queens)
	Dawn Hettrick	NYSDOH Public Health Specialist		Empire State Plaza	Corning Tower, Room 1787	Albany	NY	12237	77-57 Vleigh Place Site (Queens)
	Hon. Roy Lancman	NYC Councilmember			78-40 164th Street	Hillcrest	NY	11366	77-57 Vleigh Place Site (Queens)
	Hon. Leroy Comrie Jr.	NYS Senator			113-43 Farmers Boulevard	St. Albans	NY	11412	77-57 Vleigh Place Site (Queens)
	Hon. Michael Simanowitz	NYS Assemblymember			159-06 71st Avenue	Flushing	NY	11365	77-57 Vleigh Place Site (Queens)
	Hon. Charles Schumer	U.S. Senator			780 Third Avenue, Suite 2301	New York	NY	10017	77-57 Vleigh Place Site (Queens)
	Hon. Kristin Gillibrand	U.S. Senator			780 Third Avenue, Suite 2601	New York	NY	10017	77-57 Vleigh Place Site (Queens)
	Hon. Grace Meng	U.S. House of Representatives			118-35 Queens Boulevard, 17th Floor	Forest Hills	NY	11375	77-57 Vleigh Place Site (Queens)
	Audrey Pfeffer, Queens County Clerk	Queens County Clerk's Office			88-11 Sutphin Boulevard, 1st Floor	Jamaica	NY	11439	77-57 Vleigh Place Site (Queens)
	NY1 News				75 Ninth Avenue	New York	NY	10011	77-57 Vleigh Place Site (Queens)
	New York Daily News				4 New York Plaza	New York	NY	10004	77-57 Vleigh Place Site (Queens)
	New York Post				1211 Avenue of the Americas	New York	NY	10036	77-57 Vleigh Place Site (Queens)
	Times-Ledger Newspapers				41-02 Bell Boulevard, 2nd Floor	Bayside	NY	11361	77-57 Vleigh Place Site (Queens)
	Queens Tribune				150-50 14th Road	Whitestone	NY	11357	77-57 Vleigh Place Site (Queens)
	Queens Courier				Schneps Publications Inc, 38-15 Bell Blvd	Bayside	NY	11361	77-57 Vleigh Place Site (Queens)
	Queens Chronicle				P.O. Box 74-7769	Rego Park	NY	11374	77-57 Vleigh Place Site (Queens)
	El Diario La Prensa				1 MetroTech Center, 18th Floor	Brooklyn	NY	11201	77-57 Vleigh Place Site (Queens)
	Hoy Nueva York				1 MetroTech Center, 18th Floor	Brooklyn	NY	11201	77-57 Vleigh Place Site (Queens)
	Queens Jewish Link Newspaper	info@queensjewishlink.com	queensjewishlink@gmail.com						77-57 Vleigh Place Site (Queens)
	Kew Gardens Hills Civic Association	Attn: President			P.O. Box 670085	Kew Gardens Hills	NY	11367	77-57 Vleigh Place Site (Queens)
	Queen of Peace Church	Attn: Pastor			141-36 77th Road	Flushing	NY	11367	77-57 Vleigh Place Site (Queens)
	Stepping Day School	Attn: Executive Director			77-40 Veligh Place	Flushing	NY	11367	77-57 Vleigh Place Site (Queens)
	North Queens Community High School	Attn: Winston McCarthy, Principal			141-25 77th Road	Queens	NY	11367	77-57 Vleigh Place Site (Queens)
	Young Israel of Queens Valley	Attn: Rabbi			141-55 77th Avenue	Flushing	NY	11367	77-57 Vleigh Place Site (Queens)
	P.S. 164 Queens Valley School	Attn: Lisa Liatto, Principal			138-01 77th Avenue	Flushing	NY	11367	77-57 Vleigh Place Site (Queens)
	Con Edison Corporate Affairs	Attn: Carol Consolato			59-17 Junction Boulevard, 2 nd Floor	Elmhurst	NY	11373	77-57 Vleigh Place Site (Queens)
	Carol Ann Foley, President	107th NYPD Police Precinct Council			71-01 Parsons Boulevard	Flushing	NY	11365	77-57 Vleigh Place Site (Queens)
	Engine 315 Ladder 125	FDNY			159-06 Union Turnpike	Fresh Meadows	NY	11366	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			76-01	137 STREET	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			137-32	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			137-36	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			137-38	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			137-40	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			137-42	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			137-44	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			138-02	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			138-04	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			138-06	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			138-08	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			138-12	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			138-16	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			138-18	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			138-20	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			138-22	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			138-24	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			138-26	76 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)

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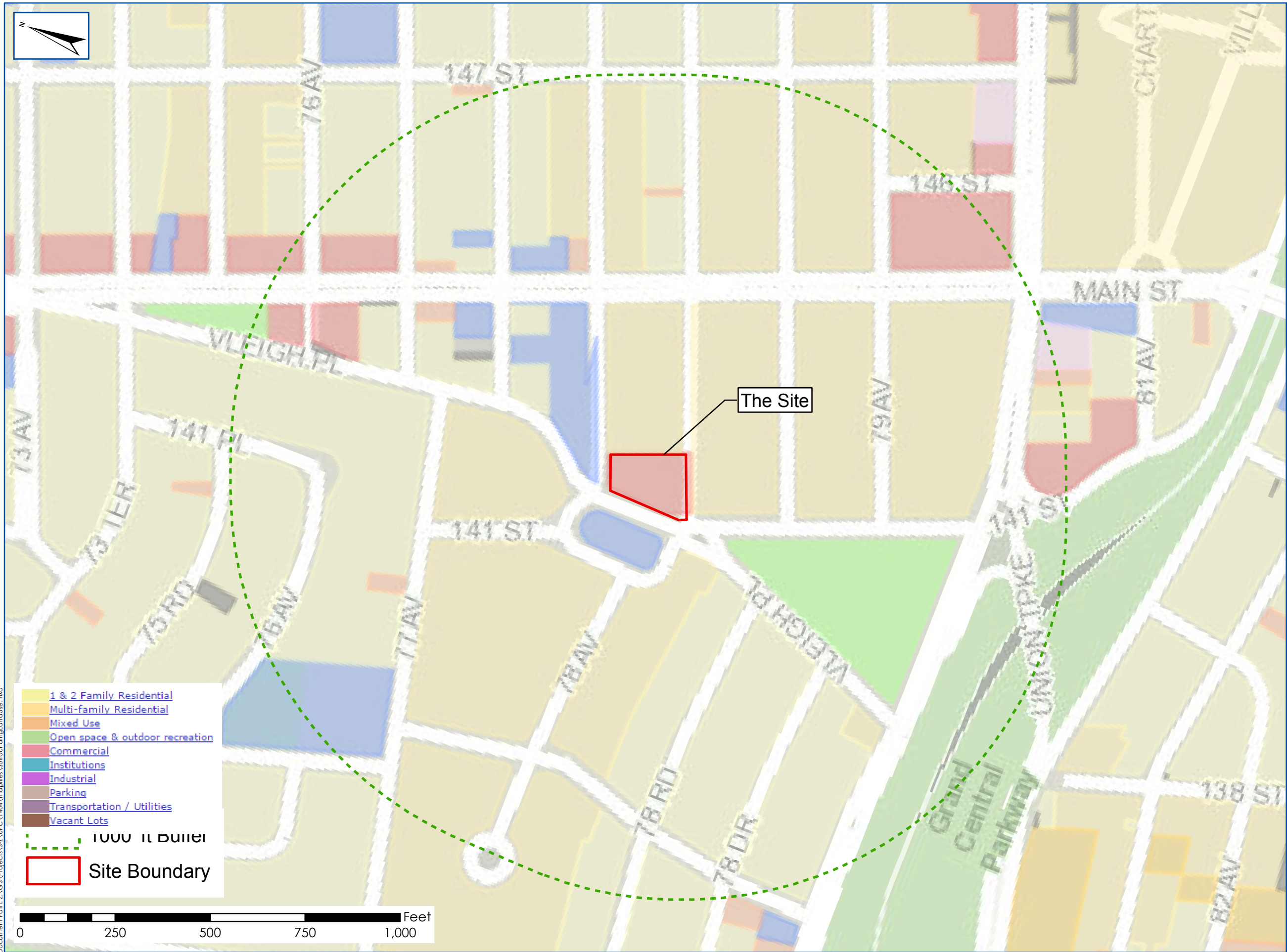
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	RESIDENT/BUSINESS OWNER			144-47	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-45	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-43	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-41	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-39	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-37	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-33	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-31	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-29	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-27	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-23	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-21	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-19	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-17	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-15	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-11	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-09	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-07	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-05	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			144-03	78 AVENUE	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)
	RESIDENT/BUSINESS OWNER			78-11	MAIN STREET	FLUSHING	NY	11367	77-57 Vleigh Place Site (Queens)

Appendix C

Site Location Map



- 1 & 2 Family Residential
- Multi-family Residential
- Mixed Use
- Open space & outdoor recreation
- Commercial
- Institutions
- Industrial
- Parking
- Transportation / Utilities
- Vacant Lots

1000 ft Buffer

Site Boundary



UNAUTHORIZED ALTERATION OR ADDITION TO THIS
DRAWING AND RELATED DOCUMENTS IS A VIOLATION
OF SEC. 7209 OF THE N.Y.S. EDUCATION LAW

DRAWING PREPARED FOR:

REVISION	DATE	INITIAL	COMMENTS
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DRAWING INFORMATION:

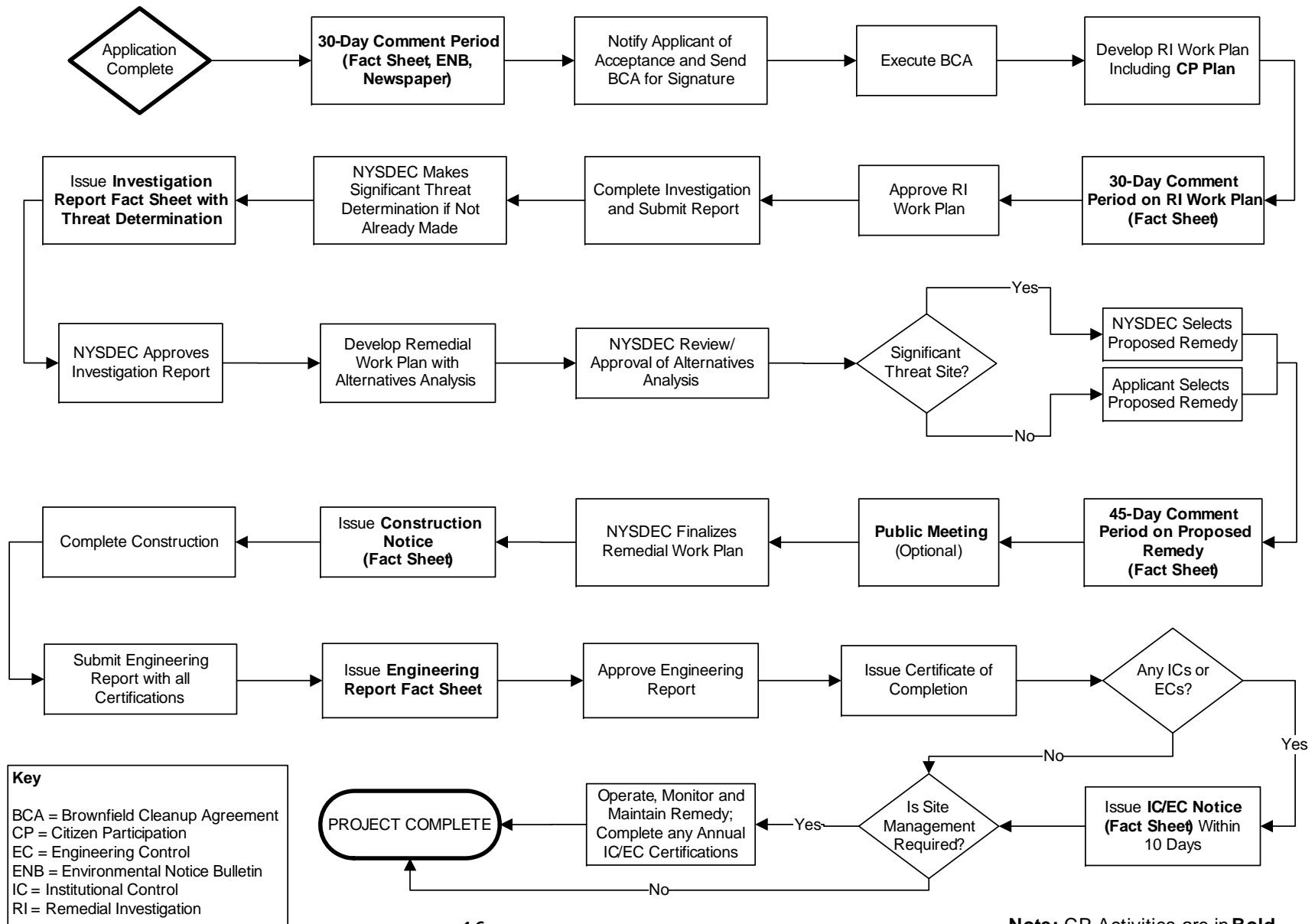
Project:	Designed by:
Date:	Drawn by:
Scale:	AS SHOWN
	Approved by:

**SURROUNDING
LAND USE**
77-39/63 VLEIGH PL
FLUSHING, NY

FIGURE NO:

SHEET:

Appendix D– Brownfield Cleanup Program Process



APPENDIX 8
HEALTH AND SAFETY PLAN

HEALTH & SAFETY PLAN

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

NYSDEC BCP Site Number: C241168

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Figures

1. Directions to Hospital

Attachments

- A. 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 Vleish 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, Groundwater remediation and Remedial excavation;
- Performance of Community Air Monitoring Program (CAMP);
- Collection of end-point soil samples;
- Oversight of installation of vapor barrier and composite cover elements.

EMERGENCY NUMBERS

<u>Contact</u>	<u>Phone Number</u>
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

<u>Title</u>	<u>Contact</u>	<u>Phone Number</u>	<u>Cell Phone</u>
QEP	Mark E. Robbins	(631) 462-5866	(631) 457-0032
CSO	Dorina Aliu	(631) 462-5866	(631) 457-0032
PM/SSO	Paul Matli	(718) 636-0800	(631) 457-0033

Directions to Jamaica Hospital Medical Center (See Figure 1)

Upon leaving the Site, start going north on Vleish 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 Plan (Supplemental RIWP).

SITE SAFETY OFFICER (SSO)

- Directs and coordinates health and safety monitoring activities.
- Ensures that field teams utilize proper personal protective equipment (PPE).
- Conducts initial onsite, 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 HASP.
- Completes and maintains Accident/Incident Report Forms.
- Notifies Hydro Tech corporate administration of all accidents/incidents.
- Determines upgrade or downgrade of PPE based on site conditions and/or downgrade of PPE based on site conditions and/or real-time monitoring results.
- Ensures that monitoring instruments are calibrated daily or as determined by manufacturer suggested instructions.
- Maintains health and safety field log books.
- Develops and ensures implementation of the HASP.
- Approves revised or new safety protocols for field operations.
- Coordinates revisions of this HASP with field personnel and the SSO Division Contracting Officer.
- Responsible for the development of new company safety protocols and procedures and resolution of any outstanding safety issues which may arise during the conduction of site work.
- Reviews personnel and subcontractors current and up-to-date medical examination and acceptability of health and safety training.

FIELD PERSONNEL AND SUBCONTRACTORS (IF ANY)

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

3.0 Chemical & Waste Description/Characterization

The following list of chemicals is based on the materials either once stored onsite or believed to be formerly stored onsite:

- Unknown 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, Groundwater Remediation and Remedial excavation;
- Collection of end-point soil samples;
- Installation of vapor barrier and composite cover elements.

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. These 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 medical assistance quickly! As first aid treatment, the person should be moved to a cool place. Soaking the person's clothes with water and fanning them should reduce body heat artificially, but not too rapidly.

Steps that can be taken to reduce heat stress are:

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

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

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

- The skin turns white or grayish-yellow
- 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 do not provide the physical restraint that a lock would.
 - b. Tags may provide a false sense of security.
 - c. Tags may become detached during use.

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

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

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

STANDARD OPERATING PROCEDURES –where necessary, Hydro Tech will provide the necessary devices to effectively lockout or tagout energy isolating devices. Lockout/tagout devices will be the only

devices used for controlling energy and shall not be used for other purposes. Any device used for lockout/tagout will be capable of withstanding the environment to which they are exposed for the maximum period they are to be exposed. The devices will be substantial enough to prevent removal without excessive force. Excessive force for a locking device would be bolt cutters or other metal cutting 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, steam 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, every 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 supervisor may personally remove the lock. The supervisor must assure that the equipment is once again locked out, or the employee notified that the equipment has been re-energized, before the employee resumes work. Employees will recheck locked out equipment if they have left the equipment (breaks, lunch, and end of shift) to make sure it is still de-energized and locked out.

III. TEMPORARY REMOVAL OF LOCKOUT/TAGOUT PROTECTION

- A. In situations when the equipment must be temporarily energized to test or position the equipment or its components, the following steps will be followed:
 - 1. Clear the equipment of tools and materials that are non-essential to the operation.

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

IV. SHIFT OR PERSONNEL CHANGES

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

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

V. CONTRACTOR NOTIFICATION

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

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

DEFINITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

GENERAL MACHINERY AND EQUIPMENT LIST

EQUIPMENT/LOCATION

- A. Excavator/backhoe
- B. Dewatering pumps and piping system

ENERGY SOURCES/LOCATION

- Diesel Engine
- 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 course of the project. Such additional training could be in the safe operation of heavy or power tool equipment or hazard communication training.

SUBCONTRACTOR TRAINING

Subcontractor personnel who work onsite, only occasionally, for a specific limited task and who are unlikely to be exposed over permissible exposure limits, may be exempted from the initial 40-hour training requirement. The SSO will determine if this exemption is allowed. In any case, the subcontractor personnel who are exposed to hazards are not exempted from the 40-hours training requirement nor medical surveillance requirements found in Section 8.1.

6.0 Medical Surveillance

GENERAL

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

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

MEDICAL SURVEILLANCE PROTOCOL

The medical surveillance protocol to be implemented is the occupational physicians' responsibility, but shall meet the requirements of CFR 1910.120 and ANSI Z88.2 (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 than 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
Thumbs down

OK, I'm all right; I understand
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 (O₂) 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/O₂ meter shall be used to monitor for combustible gases and oxygen content in the boreholes during drilling activities.

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

ACTION LEVELS

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

MONITORING DURING FIELD ACTIVITIES

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

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

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

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

The record keeping will include:

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

Excavation Operations - Monitoring will be performed continuously during all excavation and demolition operations. A PID and/or FID shall be utilized to monitor the breathing zone, the excavated area and any material taken from the excavation. A CGI/O₂ meter shall be used to monitor the excavation for the presence of combustible gases.

ACTION LEVELS OF AIRBORNE CONTAMINANTS

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

PERSONNEL MONITORING PROCEDURE

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

Procedures to be followed include:

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

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

For example: when work is being conducted to excavate at an underground tank location, those persons closest to the excavation and most intimately involved with the work should be sampled. If a backhoe operator solely conducted the excavation, then that employee should be monitored. However, if there are

additional workers who must enter the excavation and work with the freshly excavated soil, these persons would be closer to the potential contaminants and they should be sampled.

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

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

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

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

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

AIR MONITORING REPORTS

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

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

9.0 Safety Considerations

GENERAL

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

- The site will be suitably marked or barricaded as necessary to prevent unauthorized visitors but not hinder emergency services if needed.
- As needed, all open holes, trenches and obstacles will be properly barricaded in accordance with local site requirements. These requirements will be determined by proximity to traffic ways, both pedestrian and vehicular, and site of the hole, trench or obstacle. If holes are required to be left open during non-working hours, they will be adequately decked over or barricaded and sufficiently lighted.

- Before any digging or boring operations are conducted, underground utility locations will be identified. All boring, excavation and other site work will be planned and performed with consideration for underground lines. Any excavation work will be performed in accordance with Hydro Tech's Standard Operating Procedures for Excavations.
- Either workers or other people will enact dust-mitigating procedures when there exists the potential for the inhalation of dust particles.
- The act of smoking and ignition sources in the vicinity of potentially flammable or contaminated material is strictly prohibited.
- Drilling, boring, and use of cranes and drilling rigs, erection of towers, movement of vehicles and equipment and other activities will be planned and performed with consideration for the location, height, and relative position of aboveground utilities and fixtures, including signs; canopies; building and other structures and construction; and natural features such as trees, boulders, bodies of water, and terrain.
- When working in areas where flammable vapors may be present, particular care shall be exercised with tools and equipment that may be sources of ignition. All tools and equipment provided must be properly bonded and/or grounded. Metal buttons and zippers are prohibited on safety clothing for areas that may contain a flammable or explosive atmosphere.
- Approved and appropriate safety equipment (as specified in this HASP), such as eye protection, hard hats, foot protection, and respirators, must be worn in areas where required. In addition, eye protection must be worn when sampling soil or water that may be contaminated.
- Beards interfere with respirator fit and are not allowed within the site boundaries because all site personnel may be called upon to use respirator protection in 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

No other additional safety considerations at this time.

10.0 Decontamination and Disposal Procedures

CONTAMINATION PREVENTION

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

Personnel:

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

Sampling and Monitoring:

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

Heavy Equipment:

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

PERSONNEL DECONTAMINATION

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

EQUIPMENT DECONTAMINATION

Equipment used at the Site that is potentially contaminated shall be decontaminated to prevent hazardous materials from leaving the Site. All heavy equipment will be decontaminated at the decontamination pad and inspected by the SSO and Project Manager before it leaves the Site. The decontamination area will provide for the containment of all wastewater from the decontamination process. Respirators, airline and any other personnel equipment that comes in contact with contaminated soils shall pass through a field wash.

DECONTAMINATION DURING MEDICAL EMERGENCIES

If emergency 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 advise 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 lightning. 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.

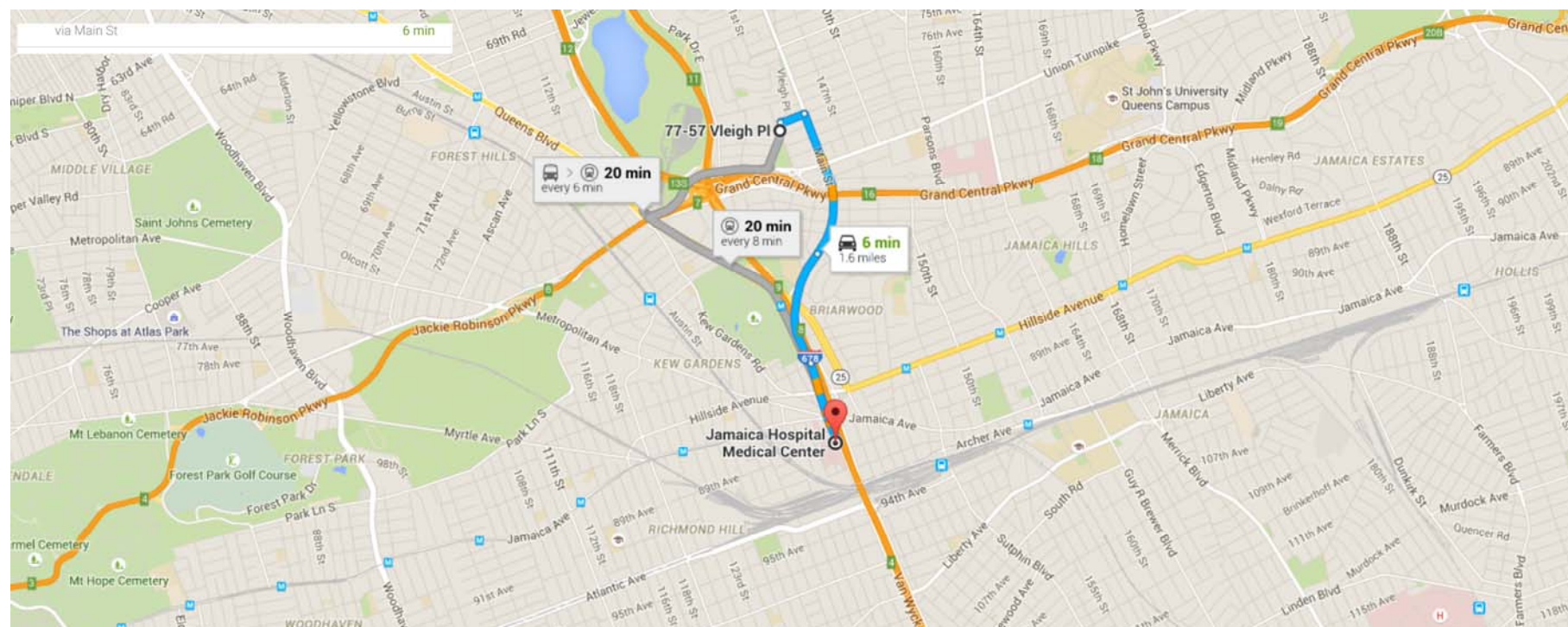
13. Sanitation

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.

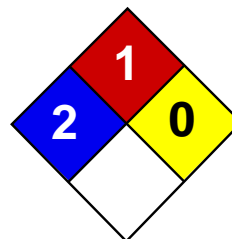
Personnel and subcontractors sites shall follow decontamination procedures described in the HASP, or as directed by the SSO. This will generally include at a minimum site-specific training in shower usage and cleanup, personal hygiene requirements and the donning of protective equipment/clothing.

FIGURE 1
DIRECTIONS TO HOSPITAL



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ATTACHMENT A
HEALTH AND SAFETY FACT SHEETS



Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Trichloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Trichloroethylene

Catalog Codes: SLT3310, SLT2590

CAS#: 79-01-6

RTECS: KX4560000

TSCA: TSCA 8(b) inventory: Trichloroethylene

CI#: Not available.

Synonym:

Chemical Formula: C₂HCl₃

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Trichloroethylene	79-01-6	100

Toxicological Data on Ingredients: Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse].
DERMAL (LD50): Acute: 20001 mg/kg [Rabbit].

Section 3: Hazards Identification

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

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH.

MUTAGENIC EFFECTS: Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not

available. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

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

Serious Skin Contact:

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

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

Serious Inhalation:

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

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 420°C (788°F)

Flash Points: Not available.

Flammable Limits: LOWER: 8% UPPER: 10.5%

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

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/

spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

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

Personal Protection:

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

Personal Protection in Case of a Large Spill:

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

Exposure Limits:

TWA: 50 STEL: 200 (ppm) from ACGIH (TLV) TWA: 269 STEL: 1070 (mg/m³) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 131.39 g/mole

Color: Clear Colorless.

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

Boiling Point: 86.7°C (188.1°F)

Melting Point: -87.1°C (-124.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.4649 (Water = 1)

Vapor Pressure: 58 mm of Hg (@ 20°C)

Vapor Density: 4.53 (Air = 1)

Volatility: Not available.

Odor Threshold: 20 ppm

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

Ionicity (in Water): Not available.

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

Solubility:

Easily soluble in methanol, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity:

Extremely corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

Acute oral toxicity (LD50): 2402 mg/kg [Mouse]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in human. Detected in maternal milk in human.

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Trichloroethylene : UN1710 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Trichloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Trichloroethylene Pennsylvania RTK: Trichloroethylene Florida: Trichloroethylene Minnesota: Trichloroethylene Massachusetts RTK: Trichloroethylene New Jersey: Trichloroethylene TSCA 8(b) inventory: Trichloroethylene CERCLA: Hazardous substances.: Trichloroethylene

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

Other Classifications:

WHMIS (Canada):

CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R36/38- Irritating to eyes and skin. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

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

Section 16: Other Information

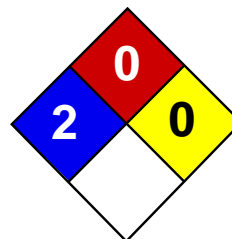
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:54 PM

Last Updated: 11/01/2010 12:00 PM

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Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet

Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

Synonym: Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolve; Tetrachloroethene; Tetraleno; Tetralox; Tetravec; Tetrogue; Tetropil

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C₂Cl₄

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

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1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

Toxicological Data on Ingredients: Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50): Acute: 5200 ppm 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

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

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:

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

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:

Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

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

Exposure Limits:

TWA: 25 (ppm) from OSHA (PEL) [United States] TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States] TWA: 170 (mg/m3) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

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

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.4

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Miscible with alcohol, ether, chloroform, benzene, hexane. It dissolves in most of the fixed and volatile oils. Solubility in water: 0.015 g/100 ml @ 25 deg. C It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Oxidized by strong oxidizing agents. Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium, barium. Protect from light.

Special Remarks on Corrosivity: Slowly corrodes aluminum, iron, and zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2629 mg/kg [Rat]. Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS).

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of ingestion.

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Dose/Conc: LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg LDL [Dog] - Route: Oral; Dose: 4000 mg/kg LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic). May cause cancer.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes skin irritation with possible dermal blistering or burns. Symptoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain. Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorientation, seizures, emotional instability, stupor, coma). It may cause pulmonary edema. Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation. Ingestion/Inhalation: Chronic exposure can affect the liver (hepatitis, fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/central nervous system/peripheral nervous system (impaired memory, numbness of extremities, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:

Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fathead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene Connecticut hazardous material survey.: Tetrachloroethylene Illinois toxic substances disclosure to employee act: Tetrachloroethylene Illinois chemical safety act: Tetrachloroethylene New York release reporting list: Tetrachloroethylene Rhode Island RTK hazardous substances: Tetrachloroethylene Pennsylvania RTK: Tetrachloroethylene Minnesota: Tetrachloroethylene Michigan critical material: Tetrachloroethylene Massachusetts RTK: Tetrachloroethylene Massachusetts spill list: Tetrachloroethylene New Jersey: Tetrachloroethylene New Jersey spill list: Tetrachloroethylene Louisiana spill reporting: Tetrachloroethylene California Director's List of Hazardous Substances: Tetrachloroethylene TSCA 8(b) inventory: Tetrachloroethylene TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97 SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

Other Regulations:

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

Other Classifications:**WHMIS (Canada):**

CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

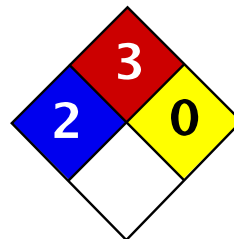
R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):**Health Hazard:** 2**Fire Hazard:** 0**Reactivity:** 0**Personal Protection:** g**National Fire Protection Association (U.S.A.):****Health:** 2**Flammability:** 0**Reactivity:** 0**Specific hazard:****Protective Equipment:**

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information**References:** Not available.**Other Special Considerations:** Not available.**Created:** 10/10/2005 08:29 PM**Last Updated:** 11/01/2010 12:00 PM

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Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet p-Xylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: p-Xylene

Catalog Codes: SLX1120

CAS#: 106-42-3

RTECS: ZE2625000

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

CI#: Not applicable.

Synonym: p-Methyltoluene

Chemical Name: 1,4-Dimethylbenzene

Chemical Formula: C₆H₄(CH₃)₂

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

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CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

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

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

Section 3: Hazards Identification

Potential Acute Health Effects:

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

Potential Chronic Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant).

Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to blood, kidneys, the nervous system, liver.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

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

Skin Contact:

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

Serious Skin Contact:

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

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

Serious Inhalation: Not available.

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

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

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

Flammable Limits: LOWER: 1.1% UPPER: 7%

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

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

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable liquid, insoluble in water.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:

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

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

Large Spill:

Toxic flammable liquid, insoluble or very slightly soluble in water.

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

Section 7: Handling and Storage

Precautions:

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

Storage:

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

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

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

Personal Protection:

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

Personal Protection in Case of a Large Spill:

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

Exposure Limits:

TWA: 100 STEL: 150 (ppm) from ACGIH (TLV)

TWA: 434 STEL: 651 (mg/m3) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless.

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

Boiling Point: 138°C (280.4°F)

Melting Point: 12°C (53.6°F)

Critical Temperature: Not available.

Specific Gravity: 0.86 (Water = 1)

Vapor Pressure: 9 mm of Hg (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.62 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

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

Solubility:

Easily soluble in methanol, diethyl ether.

Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.

Acute oral toxicity (LD50): 5000 mg/kg [Rat].

Acute dermal toxicity (LD50): 12400 mg/kg [Rabbit].

Acute toxicity of the vapor (LC50): 4550 ppm 4 hour(s) [Rat].

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

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (irritant).

Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

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

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Xylene : UN1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: p-Xylene

Florida: p-Xylene

Massachusetts RTK: p-Xylene

New Jersey: p-Xylene

TSCA 8(b) inventory: p-Xylene

SARA 313 toxic chemical notification and release reporting: p-Xylene

CERCLA: Hazardous substances.: p-Xylene

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

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).

CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R10- Flammable.

R38- Irritating to skin.

R41- Risk of serious damage to eyes.

R48/20- Harmful: danger of serious

damage to health by prolonged exposure through inhalation.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Splash goggles.

Section 16: Other Information

References:

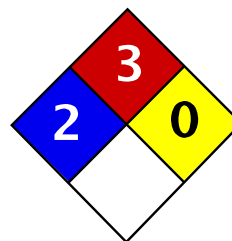
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- The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
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Other Special Considerations: Not available.

Created: 10/10/2005 08:33 PM

Last Updated: 10/10/2005 08:33 PM

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Health	2
Fire	3
Reactivity	0
Personal Protection	J

Material Safety Data Sheet m-Xylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: m-Xylene

Catalog Codes: SLX1066

CAS#: 108-38-3

RTECS: ZE2275000

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

CI#: Not applicable.

Synonym: m-Methyltoluene

Chemical Name: 1,3-Dimethylbenzene

Chemical Formula: C₆H₄(CH₃)₂

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

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

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

Section 3: Hazards Identification

Potential Acute Health Effects:

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

Potential Chronic Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant).

Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to blood, kidneys, the nervous system, liver.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

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

Skin Contact:

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

Serious Skin Contact:

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

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

Serious Inhalation: Not available.

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

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

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

Flammable Limits: LOWER: 1.1% UPPER: 7%

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

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

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable liquid, insoluble in water.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:

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

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

Large Spill:

Flammable liquid, insoluble in water.

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

Section 7: Handling and Storage

Precautions:

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

Storage:

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

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

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

Personal Protection: Splash goggles. Lab coat. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 100 STEL: 150 (ppm) from ACGIH (TLV)

TWA: 434 STEL: 651 (mg/m3) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless.

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

Boiling Point: 139.3°C (282.7°F)

Melting Point: -47.87°C (-54.2°F)

Critical Temperature: Not available.

Specific Gravity: 0.86 (Water = 1)

Vapor Pressure: 6 mm of Hg (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.62 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

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

Solubility:

Easily soluble in methanol, diethyl ether.

Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:

Acute oral toxicity (LD50): 5000 mg/kg [Rat.].

Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit.].

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

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (irritant).

Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

0347 Animal: embryotoxic, foetotoxic, passes through the placental barrier.

0900 Detected in maternal milk in human.

Narcotic effect; may cause nervous system disturbances.

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Xylene : UN1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: m-Xylene

Massachusetts RTK: m-Xylene

TSCA 8(b) inventory: m-Xylene

SARA 313 toxic chemical notification and release reporting: m-Xylene

CERCLA: Hazardous substances.: m-Xylene

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

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).

CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R10- Flammable.

R38- Irritating to skin.

R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: j

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

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Wear appropriate respirator when ventilation is inadequate.

Splash goggles.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.

-Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec.

-SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.

-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.

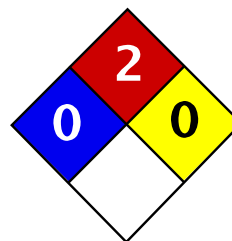
-Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

Other Special Considerations: Not available.

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Health	0
Fire	2
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Mesitylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Mesitylene

Catalog Codes: SLM2410

CAS#: 108-67-8

RTECS: OX6825000

TSCA: TSCA 8(b) inventory: Mesitylene

CI#: Not available.

Synonym: 1,3,5-Trimethylbenzene

Chemical Formula: C₉H₁₂

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

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

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

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of eye contact (irritant), of ingestion, of inhalation (lung irritant). Slightly hazardous in case of skin contact (irritant, permeator), .

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:

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

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

Skin Contact:

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

Serious Skin Contact: Not available.

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

Serious Inhalation:

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

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

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

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

Flammable Limits: Not available.

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

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

Large Spill:

Flammable liquid.

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

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

Section 7: Handling and Storage

Precautions:

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

Storage:

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

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

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

Personal Protection:

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

Personal Protection in Case of a Large Spill:

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

Exposure Limits:

TWA: 25 CEIL: 35 (ppm)

TWA: 125 CEIL: 170 (mg/m3)

Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Aromatic.

Taste: Not available.

Molecular Weight: 120.2 g/mole

Color: Not available.

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

Boiling Point: 164.7°C (328.5°F)

Melting Point: -44.8°C (-48.6°F)

Critical Temperature: Not available.

Specific Gravity: 0.8637 (Water = 1)

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

Vapor Density: 4.14 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.23 ppm

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

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Ingestion.

Toxicity to Animals:

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

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:

Hazardous in case of ingestion, of inhalation (lung irritant).
Slightly hazardous in case of skin contact (irritant, permeator), .

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

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

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information**Federal and State Regulations:**

Florida: Mesitylene

New Jersey: Mesitylene

TSCA 8(b) inventory: Mesitylene

Other Regulations:

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

EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:**WHMIS (Canada):**

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

DSCL (EEC):

R10- Flammable.

R36/37- Irritating to eyes and respiratory system.

HMIS (U.S.A.):

Health Hazard: 0

Fire Hazard: 2

Reactivity: 0

Personal Protection: h

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

Health: 0

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

<p style="text-align: center;">BENZO(B)FLUORANTHENE Benzo(e)acephenanthrylene 2,3-Benzofluoroanthene $C_{20}H_{12}$ Molecular mass: 252.3</p> <p>CAS # 205-99-2 RTECS # CU1400000 ICSC # 0720</p>			
TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
• SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• EYES		Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.
SPILLAGE DISPOSAL		STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.		Provision to contain effluent from fire extinguishing. Tightly closed.	Unbreakable packaging; put breakable packaging into closed unbreakable container.
SEE IMPORTANT INFORMATION ON BACK			
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International Chemical Safety Cards

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

I M P O R T A N T D A T A	PHYSICAL STATE; APPEARANCE: COLOURLESS TO YELLOW CRYSTALS.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol and through the skin.
	PHYSICAL DANGERS:	INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.
	CHEMICAL DANGERS: Upon heating, toxic fumes are formed.	EFFECTS OF SHORT-TERM EXPOSURE:
	OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established.	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: This substance is possibly carcinogenic to humans.
	PHYSICAL PROPERTIES	Melting point: 168°C Solubility in water: none
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.	
NOTES		
Depending on the degree of exposure, periodic medical examination is indicated. Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.		
ADDITIONAL INFORMATION		
ICSC: 0720		BENZO(B)FLUORANTHENE
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International Chemical Safety Cards

BENZO(K)FLUORANTHENE

ICSC: 0721

BENZO(K)FLUOROANTHENE 11,12-Benzofluoroanthene Dibenzo(b,j,k)fluorene $C_{20}H_{12}$ Molecular mass: 252.3 CAS # 207-08-9 RTECS # DF6350000 ICSC # 0721			
TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• INHALATION		Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
• SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• EYES		Safety goggles or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.
SPILLAGE DISPOSAL		STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.		Provision to contain effluent from fire extinguishing. Separated from strong oxidants. Tightly closed.	
SEE IMPORTANT INFORMATION ON BACK			
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International Chemical Safety Cards

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

I M P O R T A N T D A T A	PHYSICAL STATE; APPEARANCE: YELLOW CRYSTALS.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol and through the skin.
	PHYSICAL DANGERS:	INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.
	CHEMICAL DANGERS: Upon heating, toxic fumes are formed. Reacts with strong oxidants.	EFFECTS OF SHORT-TERM EXPOSURE:
	OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established.	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 480°C Melting point: 215.7°C	Solubility in water: none Octanol/water partition coefficient as log Pow: 6.84
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.	
NOTES		
Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.		
ADDITIONAL INFORMATION		
ICSC: 0721		BENZO(K)FLUORANTHENE
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International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

BENZ(a)ANTHRACENE

1,2-Benzoanthracene

Benzo(a)anthracene

2,3-Benzphenanthrene

Naphthanthrane

 $C_{18}H_{12}$

Molecular mass: 228.3

CAS # 56-55-3

RTECS # CV9275000

ICSC # 0385

EC # 601-033-00-9

BENZ(a)ANTHRACENE 1,2-Benzoanthracene Benzo(a)anthracene 2,3-Benzphenanthrene Naphthanthrane $C_{18}H_{12}$ Molecular mass: 228.3 CAS # 56-55-3 RTECS # CV9275000 ICSC # 0385 EC # 601-033-00-9			
TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.		Water spray, powder. In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		AVOID ALL CONTACT!	
• INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
• SKIN		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• EYES		Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Well closed.	T symbol R: 45 S: 53-45	

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0385

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International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

I M P O R T A N T D A T A	PHYSICAL STATE; APPEARANCE: COLOURLESS TO YELLOW-BROWN FLUORESCENT FLAKES OR POWDER.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation, through the skin and by ingestion.
	PHYSICAL DANGERS: Dust explosion possible if in powder or granular form, mixed with air.	INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.
	CHEMICAL DANGERS:	EFFECTS OF SHORT-TERM EXPOSURE:
	OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established.	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: This substance is probably carcinogenic to humans.
PHYSICAL PROPERTIES	Sublimation point: 435°C Melting point: 162°C Relative density (water = 1): 1.274	Solubility in water: none Vapour pressure, Pa at 20°C: 292 Octanol/water partition coefficient as log Pow: 5.61
ENVIRONMENTAL DATA	In the food chain important to humans, bioaccumulation takes place, specifically in seafood.	
NOTES		
This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Tetraphene is a common name.		
ADDITIONAL INFORMATION		
ICSC: 0385		BENZ(a)ANTHRACENE
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LEGAL
NOTICE:**

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Material Safety Data Sheet

Benzo[a]pyrene, 98%

ACC# 37175

Section 1 - Chemical Product and Company Identification

MSDS Name: Benzo[a]pyrene, 98%

Catalog Numbers: AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000 AC377201000

Synonyms: 3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.

Company Identification:

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

For information in North America, call: 800-ACROS-01

For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

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

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: yellow to brown powder.

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

Target Organs: Reproductive system, skin.

Potential Health Effects

Eye: May cause eye irritation.

Skin: May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.

Ingestion: May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated. May be harmful if swallowed.

Inhalation: May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.

Chronic: May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion: Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

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

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Flash Point: Not available.

Autoignition Temperature: Not available.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 2; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

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

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs

Benzo[a]pyrene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches).	0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches).
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OSHA Vacated PELs: Benzo[a]pyrene: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

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

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Powder

Appearance: yellow to brown

Odor: faint aromatic odor

pH: Not available.

Vapor Pressure: Not available.

Vapor Density: Not available.

Evaporation Rate:Not available.

Viscosity: Not available.

Boiling Point: 495 deg C @ 760 mm Hg

Freezing/Melting Point:175 - 179 deg C

Decomposition Temperature:Not available.

Solubility: 1.60x10⁻³ mg/l @25°C

Specific Gravity/Density:Not available.

Molecular Formula: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:

Not available.

Carcinogenicity:

CAS# 50-32-8:

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

Epidemiology: No information found

Teratogenicity: No information found

Reproductive Effects: Adverse reproductive effects have occurred in experimental animals.

Mutagenicity: Mutagenic effects have occurred in humans. Mutagenic effects have occurred in experimental animals.

Neurotoxicity: No information found

Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series:

CAS# 50-32-8: waste number U022.

Section 14 - Transport Information

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

Section 15 - Regulatory Information

US FEDERAL

TSCA

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

Health & Safety Reporting List

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

Chemical Test Rules

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

Section 12b

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

TSCA Significant New Use Rule

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

CERCLA Hazardous Substances and corresponding RQs

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

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

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

Section 313

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

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

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

STATE

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

California Prop 65

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

WARNING: This product contains Benzo[a]pyrene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 50-32-8: 0.06 æg/day NSRL

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T N

Risk Phrases:

R 43 May cause sensitization by skin contact.

R 45 May cause cancer.

R 46 May cause heritable genetic damage.

R 60 May impair fertility.

R 61 May cause harm to the unborn child.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

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

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

WGK (Water Danger/Protection)

CAS# 50-32-8: No information available.

Canada - DSL/NDSL

CAS# 50-32-8 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A.

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

Canadian Ingredient Disclosure List

CAS# 50-32-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information
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MSDS Creation Date: 9/02/1997

Revision #7 Date: 6/30/2006

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.

Material Safety Data Sheet

Chrysene, 98%

ACC# 95251

Section 1 - Chemical Product and Company Identification

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

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

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

Section 2 - Composition, Information on Ingredients

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

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: very light beige solid.

Caution! May cause eye and skin irritation. May cause respiratory tract irritation. May cause cancer in humans.**Target Organs:** Liver, skin.

Potential Health Effects

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

Section 4 - First Aid Measures

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

immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. This material in sufficient quantity and reduced particle size is capable of creating a dust explosion.

Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or chemical foam.

Flash Point: Not applicable.

Autoignition Temperature: Not available.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: ; Flammability: 1; Instability:

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

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

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Wash hands before eating. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Avoid breathing dust.

Storage: Store in a tightly closed container. Store in a cool, dry area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

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

Exposure Limits

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

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

Personal Protective Equipment

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

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

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

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance: very light beige

Odor: Not available.

pH: Not available.

Vapor Pressure: Not available.

Vapor Density: Not available.

Evaporation Rate: Not available.

Viscosity: Not available.

Boiling Point: 448 deg C @ 760 mm Hg

Freezing/Melting Point: 250-255 deg C

Decomposition Temperature: Not available.

Solubility: insoluble

Specific Gravity/Density: Not available.

Molecular Formula: 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) *Neaethes arenacedentata* >1ppm. (Rossi, S.S. et al Marine Pollut. Bull. 1978) Invertebrate toxicity : lethal threshold 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 : biodegraded by white rot fungus (Proc. Annu. Meet. Am. Wood-Preserv. Assoc. 1989) May be utilised by axenic cultures of microorganisms e.g. *Pseudomonas pancimobilis* EPA505, which may have novel degradative systems (Mueller, J.G. et al ppl. Environ. Microbiol. 1990; Mueller, J.G. et al Environ. Sci. Technol. 1991).

Physical: Not found.

Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series:

CAS# 218-01-9: waste number U050.

Section 14 - Transport Information

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

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 218-01-9 is listed on the TSCA inventory.

Health & Safety Reporting List

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

Chemical Test Rules

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

Section 12b

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

TSCA Significant New Use Rule

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

CERCLA Hazardous Substances and corresponding RQs

CAS# 218-01-9: 100 lb final RQ; 45.4 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

Section 313

This material contains Chrysene (CAS# 218-01-9, 98%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 218-01-9 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

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

STATE

CAS# 218-01-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

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

WARNING: This product contains Chrysene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 218-01-9: 0.35 æg/day NSRL (oral)

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T

Risk Phrases:

R 45 May cause cancer.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

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

S 53 Avoid exposure - obtain special instructions before use.

S 60 This material and its container must be disposed of as hazardous waste.

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

WGK (Water Danger/Protection)

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

Canada - DSL/NDSL

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

Canada - WHMIS

This product has a WHMIS classification of D2A.

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

Canadian Ingredient Disclosure List

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

Section 16 - Additional Information
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MSDS Creation Date: 6/30/1999

Revision #4 Date: 10/03/2005

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.

Material Safety Data Sheet

Fluoranthene, 98%

ACC# 80991

Section 1 - Chemical Product and Company Identification

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

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

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

Section 2 - Composition, Information on Ingredients

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

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: yellow needles.

Caution! Harmful. Causes eye and skin irritation and possible burns. May be harmful if absorbed through the skin. May be harmful if swallowed. May cause heart and liver injury.**Target Organs:** Heart, liver, lungs.**Potential Health Effects****Eye:** Causes eye irritation and possible burns.**Skin:** May be harmful if absorbed through the skin. Causes severe skin irritation and possible burns.**Ingestion:** May be harmful if swallowed. May cause rapid heartbeat and cardiac arrhythmias. May cause liver injury, pulmonary edema, and respiratory arrest. May cause gastrointestinal disturbances such as nausea.**Inhalation:** May cause effects similar to those described for ingestion. May produce cardiac failure and pulmonary edema.**Chronic:** Prolonged or repeated skin contact may cause defatting and dermatitis.

Section 4 - First Aid Measures

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

upper and lower eyelids. Get medical aid immediately. Do NOT allow victim to rub eyes or keep eyes closed. Extensive irrigation with water is required (at least 30 minutes).

Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes.

Ingestion: Never give anything by mouth to an unconscious person. Get medical aid immediately. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

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

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media: In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.

Flash Point: Not applicable.

Autoignition Temperature: Not applicable.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 2; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Do not get in eyes, on skin, or on clothing. Do not ingest or inhale. Use only in a chemical fume hood. Do not breathe dust.

Storage: Keep containers tightly closed. Store in a cool, dry area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

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

Exposure Limits

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

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

Personal Protective Equipment

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

Skin: Wear appropriate protective gloves and clothing to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Needles

Appearance: yellow

Odor: None reported.

pH: Not available.

Vapor Pressure: 0.01 mm Hg @ 20 deg C

Vapor Density: Not available.

Evaporation Rate: Not available.

Viscosity: Not available.

Boiling Point: 384 deg C @ 760.00mmHg

Freezing/Melting Point: 107.00 - 110.00 deg C

Decomposition Temperature: Not available.

Solubility: insoluble

Specific Gravity/Density: 1.252 g/cm³

Molecular Formula: C₁₆H₁₀

Molecular Weight: 202.25

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Incompatible materials, strong oxidants.

Incompatibilities with Other Materials: Strong oxidizing agents.

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide, acrid smoke and fumes.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 206-44-0: LL4025000

LD50/LC50:

CAS# 206-44-0:

Oral, rat: LD50 = 2 gm/kg;

Skin, rabbit: LD50 = 3180 mg/kg;

Carcinogenicity:

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

Epidemiology: IARC Group 3: Limited or insufficient evidence for carcinogenicity in both animals and humans. Experimental tumorigenic data has been reported.

Teratogenicity: No information found

Reproductive Effects: No information found

Mutagenicity: Mutation in microorganisms: Salmonella typhimurium = 5ug/plate. Mutation in mammalian somatic cells: Human Lymphocyte = 2 umol/L.

Neurotoxicity: No information found

Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Bluegill/Sunfish: 3980 um/L; 96 H; (not specified) No data available.

Environmental: Remains in the upper few cm of soil, but can be transported to groundwater. Biodegrades from soil in a few years. Will not volatilize from soil or water. Rapidly absorbed to sediment and particulates and will readily bioconcentrate. Unadsorbed substance in water will degrade by photolysis in a days to weeks. Stable in sediment for decades or more. In the atmosphere, photodegrades with half life of 4 - 5 days, but may transport long distances without settling or raining out.

Physical: No information available.

Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series:

CAS# 206-44-0: waste number U120.

Section 14 - Transport Information

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

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 206-44-0 is listed on the TSCA inventory.

Health & Safety Reporting List

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

Chemical Test Rules

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

Section 12b

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

TSCA Significant New Use Rule

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

CERCLA Hazardous Substances and corresponding RQs

CAS# 206-44-0: 100 lb final RQ; 45.4 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 206-44-0: immediate.

Section 313

This material contains Fluoranthene (CAS# 206-44-0, 98%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 206-44-0 is listed as a Priority Pollutant under the Clean Water Act. CAS# 206-44-0 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

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

STATE

CAS# 206-44-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

California Prop 65

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

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XN

Risk Phrases:

R 21/22 Harmful in contact with skin and if swallowed.

Safety Phrases:

S 22 Do not breathe dust.

S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)

CAS# 206-44-0: No information available.

Canada - DSL/NDSL

CAS# 206-44-0 is listed on Canada's NDSL List.

Canada - WHMIS

This product has a WHMIS classification of D2B.

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

Canadian Ingredient Disclosure List

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

Section 16 - Additional Information
--

MSDS Creation Date: 9/02/1997

Revision #5 Date: 10/03/2005

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.

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

MSDS**Material Safety Data Sheet**

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



Mallinckrodt
CHEMICALS



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

National Response in Canada
CANUTEC: 613-996-6666

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

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

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

LEAD METAL

1. Product Identification

Synonyms: Granular lead, pigment metal; C.I. 77575

CAS No.: 7439-92-1

Molecular Weight: 207.19

Chemical Formula: Pb

Product Codes:

J.T. Baker: 2256, 2266

Mallinckrodt: 5668

2. Composition/Information on Ingredients

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

3. Hazards Identification

Emergency Overview

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

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

Health Rating: 3 - Severe (Life)

Flammability Rating: 0 - None

Reactivity Rating: 0 - None

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES

Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:

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

Ingestion:

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

Skin Contact:

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

Eye Contact:

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

Chronic Exposure:

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

Aggravation of Pre-existing Conditions:

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

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard. Powder/dust is flammable when heated or exposed to flame.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Can produce toxic lead fumes at elevated temperatures and also react with oxidizing materials.

6. Accidental Release Measures

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

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances. Areas in which exposure to lead

metal or lead compounds may occur should be identified by signs or appropriate means, and access to the area should be limited to authorized persons. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For lead, metal and inorganic dusts and fumes, as Pb:

-OSHA Permissible Exposure Limit (PEL): 0.05 mg/m³ (TWA)

For lead, elemental and inorganic compounds, as Pb:

-ACGIH Threshold Limit Value (TLV): 0.05 mg/m³ (TWA), A3 animal carcinogen

ACGIH Biological Exposure Indices (BEI): 30 ug/100ml, notation B (see actual Indices for more information).

For lead, inorganic:

-NIOSH Recommended Exposure Limit (REL): 0.1 mg/m³ (TWA)

Ventilation System:

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

Personal Respirators (NIOSH Approved):

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

Skin Protection:

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

Eye Protection:

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

Other Control Measures:

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

9. Physical and Chemical Properties

Appearance:

Small, white to blue-gray metallic shot or granules.

Odor:

Odorless.

Solubility:

Insoluble in water.

Density:

11.34

pH:

No information found.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

1740C (3164F)

Melting Point:

327.5C (622F)

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

1.77 @ 1000C (1832F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Does not decompose but toxic lead or lead oxide fumes may form at elevated temperatures.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Ammonium nitrate, chlorine trifluoride, hydrogen peroxide, sodium azide, zirconium, disodium acetylide, sodium acetylide and oxidants.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:

Investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:

Lead and other smelter emissions are human reproductive hazards. (Chemical Council on

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

Carcinogenicity:

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

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

12. Ecological Information

Environmental Fate:

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

Environmental Toxicity:

No information found.

13. Disposal Considerations

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

14. Transport Information

Not regulated.

15. Regulatory Information

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

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

Ingredient	Korea	DSL	NDSL	Phil.
Lead (7439-92-1)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
Lead (7439-92-1)	No	No	Yes	No

-----\Federal, State & International Regulations - Part 2\-----			
Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8(d)
Lead (7439-92-1)	10	No	No

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

WARNING:

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

Australian Hazchem Code: None allocated.

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **1** Reactivity: **0**

Label Hazard Warning:

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

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe dust.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not

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

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

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

MSDS**Material Safety Data Sheet**

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



Mallinckrodt
CHEMICALS



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

National Response in Canada
CANUTEC: 613-996-6666

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

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

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

MERCURY

1. Product Identification

Synonyms: Quicksilver; hydrargyrum; Liquid Silver

CAS No.: 7439-97-6

Molecular Weight: 200.59

Chemical Formula: Hg

Product Codes:

J.T. Baker: 2564, 2567, 2569

Mallinckrodt: 1278, 1280, 1288

2. Composition/Information on Ingredients

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

3. Hazards Identification

Emergency Overview

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

SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Life)

Flammability Rating: 0 - None

Reactivity Rating: 1 - Slight

Contact Rating: 3 - Severe (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD;
PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:

Mercury vapor is highly toxic via this route. Causes severe respiratory tract damage. Symptoms include sore throat, coughing, pain, tightness in chest, breathing difficulties, shortness of breath, headache, muscle weakness, anorexia, gastrointestinal disturbance, ringing in the ear, liver changes, fever, bronchitis and pneumonitis. Can be absorbed through inhalation with symptoms similar to ingestion.

Ingestion:

May cause burning of the mouth and pharynx, abdominal pain, vomiting, corrosive ulceration, bloody diarrhea. May be followed by a rapid and weak pulse, shallow breathing, paleness, exhaustion, tremors and collapse. Delayed death may occur from renal failure. Gastrointestinal uptake of mercury is less than 5% but its ability to penetrate tissues presents some hazard. Initial symptoms may be thirst, possible abdominal discomfort.

Skin Contact:

Causes irritation and burns to skin. Symptoms include redness and pain. May cause skin allergy and sensitization. Can be absorbed through the skin with symptoms to parallel ingestion.

Eye Contact:

Causes irritation and burns to eyes. Symptoms include redness, pain, blurred vision; may cause serious and permanent eye damage.

Chronic Exposure:

Chronic exposure through any route can produce central nervous system damage. May cause muscle tremors, personality and behavior changes, memory loss, metallic taste, loosening of the teeth, digestive disorders, skin rashes, brain damage and kidney damage. Can cause skin allergies and accumulate in the body. Repeated skin contact can cause the skin to turn gray in color. A suspected reproductive hazard; may damage the developing fetus and decrease fertility in males and females.

Aggravation of Pre-existing Conditions:

Persons with nervous disorders, or impaired kidney or respiratory function, or a history of allergies or a known sensitization to mercury may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Undergoes hazardous reactions in the presence of heat and sparks or ignition. Smoke may contain toxic mercury or mercuric oxide. Smoke may contain toxic mercury or mercuric oxide.

6. Accidental Release Measures

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

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

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

7. Handling and Storage

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

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

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

Ventilation System:

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

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a half-face respirator with a mercury vapor or chlorine gas cartridge may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece respirator with a mercury vapor or chlorine gas cartridge may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator.

WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

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

Eye Protection:

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

9. Physical and Chemical Properties

Appearance:

Silver-white, heavy, mobile, liquid metal.

Odor:

Odorless.

Solubility:

Insoluble in water.

Density:

13.55

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

356.7C (675F)

Melting Point:

-38.87C (-38F)

Vapor Density (Air=1):

7.0

Vapor Pressure (mm Hg):

0.0018 @ 25C (77F)

Evaporation Rate (BuAc=1):

4

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

At high temperatures, vaporizes to form extremely toxic fumes.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Acetylenes, ammonia, ethylene oxide, chlorine dioxide, azides, metal oxides, methyl silane, lithium, rubidium, oxygen, strong oxidants, metal carbonyls.

Conditions to Avoid:

Heat, flames, ignition sources, metal surfaces and incompatibles.

11. Toxicological Information

Toxicological Data:

Investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:

All forms of mercury can cross the placenta to the fetus, but most of what is known has

been learned from experimental animals. See Chronic Health Hazards.

Carcinogenicity:

EPA / IRIS classification: Group D1 - Not classifiable as a human carcinogen.

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

12. Ecological Information

Environmental Fate:

This material has an experimentally-determined bioconcentration factor (BCF) of greater than 100. This material is expected to significantly bioaccumulate.

Environmental Toxicity:

This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are less than 1 mg/l.

13. Disposal Considerations

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

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: RQ, MERCURY

Hazard Class: 8

UN/NA: UN2809

Packing Group: III

Information reported for product/size: 1LB

International (Water, I.M.O.)

Proper Shipping Name: MERCURY

Hazard Class: 8

UN/NA: UN2809

Packing Group: III

Information reported for product/size: 1LB

International (Air, I.C.A.O.)**Proper Shipping Name:** MERCURY**Hazard Class:** 8**UN/NA:** UN2809**Packing Group:** III**Information reported for product/size:** 1LB

15. Regulatory Information

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-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA   EC    Japan  Australia
-----
Mercury (7439-97-6)                          Yes   Yes   No     Yes

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-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  DSL    NDSL   Phil.
-----
Mercury (7439-97-6)                          Yes   Yes   No     Yes

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-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-  -SARA 313-
RQ    TPQ    List  Chemical Catg.
-----
Mercury (7439-97-6)                          No    No     Yes    No

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-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     -RCRA-      -TSCA-
CERCLA  261.33  8(d)
-----
Mercury (7439-97-6)                          1          U151      No

```

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

WARNING:

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

Australian Hazchem Code: 2Z**Poison Schedule:** S7**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

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

Label Hazard Warning:

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

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Label First Aid:

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

Product Use:

Laboratory Reagent.

Revision Information:

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

Disclaimer:

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Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

Material Safety Data Sheet

Phenanthrene, 90%

ACC# 59921

Section 1 - Chemical Product and Company Identification

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

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

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

Section 2 - Composition, Information on Ingredients

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

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: brown solid.

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

Potential Health Effects

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

Section 4 - First Aid Measures

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

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

Notes to Physician: Treat symptomatically.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media: Use water spray or dry chemical.

Flash Point: Not available.

Autoignition Temperature: Not available.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 1; Flammability: 1; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation. Do not let this chemical enter the environment.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage: Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

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

Exposure Limits

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

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

Personal Protective Equipment

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

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

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

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance: brown

Odor: none reported

pH: Not available.

Vapor Pressure: 1 mm Hg @116c

Vapor Density: Not available.

Evaporation Rate:Not available.

Viscosity: Not available.

Boiling Point: 340 deg C

Freezing/Melting Point:101 deg C

Decomposition Temperature:Not available.

Solubility: insoluble

Specific Gravity/Density:1.0630g/cm³

Molecular Formula: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 (as benzene soluble aerosol) (listed as 'Coal tar pitches').
- **California:** Not listed.
- **NTP:** Known carcinogen (listed as Coal tar pitches).
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No data available.

Teratogenicity: No data available.

Reproductive Effects: No data available.

Mutagenicity: No data available.

Neurotoxicity: No data available.

Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

Section 14 - Transport Information

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

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 85-01-8 is listed on the TSCA inventory.

Health & Safety Reporting List

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

Chemical Test Rules

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

Section 12b

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

TSCA Significant New Use Rule

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

CERCLA Hazardous Substances and corresponding RQs

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

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 85-01-8: immediate.

Section 313

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

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 85-01-8 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

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

STATE

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

California Prop 65

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

European/International Regulations**European Labeling in Accordance with EC Directives****Hazard Symbols:**

T

Risk Phrases:

R 45 May cause cancer.

Safety Phrases:

S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)

CAS# 85-01-8: No information available.

Canada - DSL/NDSL

CAS# 85-01-8 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2B.

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

Canadian Ingredient Disclosure List

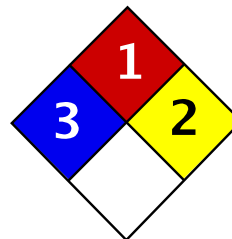
CAS# 85-01-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 7/14/1998

Revision #3 Date: 10/03/2005

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Health	3
Fire	1
Reactivity	2
Personal Protection	E

Material Safety Data Sheet

Arsenic MSDS

Section 1: Chemical Product and Company Identification

Product Name: Arsenic

Catalog Codes: SLA1006

CAS#: 7440-38-2

RTECS: CG0525000

TSCA: TSCA 8(b) inventory: Arsenic

CI#: Not applicable.

Synonym:

Chemical Name: Arsenic

Chemical Formula: As

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

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

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Arsenic	7440-38-2	100

Toxicological Data on Ingredients: Arsenic: ORAL (LD50): Acute: 763 mg/kg [Rat]. 145 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to kidneys, lungs, the nervous system, mucous membranes.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:

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

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:

Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits highly toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not

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

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.01 from ACGIH (TLV) [United States] [1995]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 74.92 g/mole

Color: Silvery.

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

Boiling Point: Not available.

Melting Point: Sublimation temperature: 615°C (1139°F)

Critical Temperature: Not available.

Specific Gravity: 5.72 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 145 mg/kg [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH.

Causes damage to the following organs: kidneys, lungs, the nervous system, mucous membranes.

Other Toxic Effects on Humans:

Very hazardous in case of ingestion, of inhalation.

Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Arsenic UNNA: UN1558 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Arsenic
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Arsenic

Pennsylvania RTK: Arsenic

Massachusetts RTK: Arsenic

TSCA 8(b) inventory: Arsenic

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

Other Classifications:

WHMIS (Canada):

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).

CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R22- Harmful if swallowed.

R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 2

Personal Protection: E

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

Health: 3

Flammability: 1

Reactivity: 2

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Safety glasses.

Section 16: Other Information**References:**

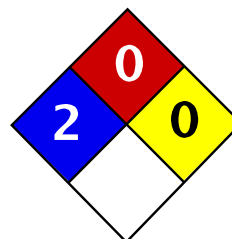
- Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
- Liste des produits purs tératogènes, mutagènes, cancérigènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec.
- Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec.
- SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
- The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
- Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

Other Special Considerations: Not available.

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Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Nickel metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nickel metal

Catalog Codes: SLN2296, SLN1342, SLN1954

CAS#: 7440-02-0

RTECS: QR5950000

TSCA: TSCA 8(b) inventory: Nickel metal

CI#: Not applicable.

Synonym: Nickel Metal shot; Nickel metal foil.

Chemical Name: Nickel

Chemical Formula: Ni

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Nickel metal	7440-02-0	100

Toxicological Data on Ingredients: Nickel metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer).

CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to skin.

The substance may be toxic to kidneys, lungs, liver, upper respiratory tract.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

Special Remarks on Explosion Hazards:

Material in powder form, capable of creating a dust explosion.

Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode.

Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion.

Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 1 (mg/m3) from ACGIH (TLV) [United States] Inhalation Respirable.

TWA: 0.5 (mg/m3) [United Kingdom (UK)]

TWA: 1 (mg/m3) from OSHA (PEL) [United States] Inhalation Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid. Lustrous solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 58.71 g/mole

Color: Silvery.

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

Boiling Point: 2730°C (4946°F)

Melting Point: 1455°C (2651°F)

Critical Temperature: Not available.

Specific Gravity: Density: 8.908 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Insoluble in cold water, hot water.

Insoluble in Ammonia.

Soluble in dilute Nitric Acid.

Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, combustible materials, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + industrial earth.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.

Causes damage to the following organs: skin.

May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:

Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Dose/Conc:

LDL [Rat] - Route: Oral; Dose: 5000 mg/kg

LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

Special Remarks on Chronic Effects on Humans: May cause cancer based on animal test data

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects:

Skin: Nickel dust and fume can irritate skin.

Eyes: Nickel dust and fume can irritate eyes.

Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.

Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased coronary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).

Chronic Potential Health Effects:

Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.

Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).

Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy. Chronic ingestion of Nickel may also affect respiration and cause pneumoconiosis or fibrosis.

Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Nickel metal

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Nickel metal

Connecticut hazardous material survey.: Nickel metal

Illinois toxic substances disclosure to employee act: Nickel metal

Illinois chemical safety act: Nickel metal

New York release reporting list: Nickel metal

Rhode Island RTK hazardous substances: Nickel metal

Pennsylvania RTK: Nickel metal

Michigan critical material: Nickel metal

Massachusetts RTK: Nickel metal

Massachusetts spill list: Nickel metal

New Jersey: Nickel metal

New Jersey spill list: Nickel metal

Louisiana spill reporting: Nickel metal

California Director's List of Hazardous Substances: Nickel metal

TSCA 8(b) inventory: Nickel metal

Other Regulations:

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

EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R40- Possible risks of irreversible effects.

R43- May cause sensitization by skin contact.

S22- Do not breathe dust.

S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

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

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

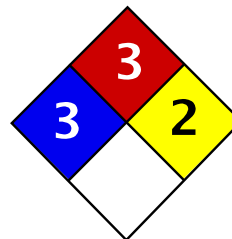
References: Not available.

Other Special Considerations: Not available.

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Health	3
Fire	3
Reactivity	2
Personal Protection	J

Material Safety Data Sheet

Calcium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Calcium

Catalog Codes: SLC2782

CAS#: 7440-70-2

RTECS: EV8040000

TSCA: TSCA 8(b) inventory: Calcium

CI#: Not available.

Synonym:

Chemical Formula: Ca

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Calcium	7440-70-2	100

Toxicological Data on Ingredients: Calcium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Corrosive to eyes and skin. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to lungs, mucous membranes.

Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

Section 4: First Aid Measures

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

Skin Contact:

If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands : Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

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

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

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Corrosive solid. Flammable solid that, in contact with water, emits flammable gases. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage**Precautions:**

Keep under inert atmosphere. Keep container dry. Do not breathe dust. Never add water to this product. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes. Keep away from incompatibles such as acids, moisture.

Storage:

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

Section 8: Exposure Controls/Personal Protection**Engineering Controls:**

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

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

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 40.08 g/mole

Color: Not available.

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

Boiling Point: 1484°C (2703.2°F)

Melting Point: 839°C (1542.2°F)

Critical Temperature: Not available.

Specific Gravity: 1.54 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Not available.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances:

Highly reactive with acids.

Reactive with moisture.

The product reacts violently with water to emit flammable but non toxic gases.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans: The substance is toxic to lungs, mucous membranes.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 4.3: Material that emits flammable gases on contact with water.

Identification: : Calcium : UN1401 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Calcium

Massachusetts RTK: Calcium

TSCA 8(b) inventory: Calcium

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

Other Classifications:

WHMIS (Canada):

CLASS B-6: Reactive and very flammable material.

CLASS E: Corrosive solid.

DSCL (EEC): R36/38- Irritating to eyes and skin.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 3

Reactivity: 2

Personal Protection: j

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

Health: 3

Flammability: 3

Reactivity: 2

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Splash goggles.

Section 16: Other Information

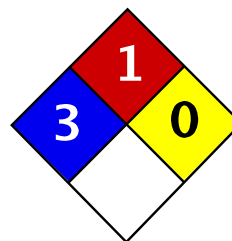
References: Not available.

Other Special Considerations: Not available.

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Health	3
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Cadmium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Cadmium

Catalog Codes: SLC3484, SLC5272, SLC2482

CAS#: 7440-43-9

RTECS: EU9800000

TSCA: TSCA 8(b) inventory: Cadmium

CI#: Not applicable.

Synonym:

Chemical Name: Cadmium

Chemical Formula: Cd

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Cadmium	7440-43-9	100

Toxicological Data on Ingredients: Cadmium: ORAL (LD50): Acute: 2330 mg/kg [Rat.]. 890 mg/kg [Mouse]. DUST (LC50): Acute: 50 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant). Severe over-exposure can result in death.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to kidneys, lungs, liver.

Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact: No known effect on eye contact, rinse with water for a few minutes.

Skin Contact:

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

Serious Skin Contact: Not available.

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

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 570°C (1058°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:

Non-flammable in presence of open flames and sparks, of heat, of oxidizing materials, of reducing materials, of combustible materials, of moisture.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:

Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.01 (ppm)

Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 112.4 g/mole

Color: Silvery.

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

Boiling Point: 765°C (1409°F)

Melting Point: 320.9°C (609.6°F)

Critical Temperature: Not available.

Specific Gravity: 8.64 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity: Reacts violently with potassium.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.

Acute oral toxicity (LD50): 890 mg/kg [Mouse].

Acute toxicity of the dust (LC50): 229.9 mg/m³ 4 hour(s) [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP.

The substance is toxic to kidneys, lungs, liver.

Other Toxic Effects on Humans:

Hazardous in case of ingestion, of inhalation.

Slightly hazardous in case of skin contact (irritant, sensitizer).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: An allergen. 0047 Animal: embryotoxic, passes through the placental barrier.

Special Remarks on other Toxic Effects on Humans: May cause allergic reactions, exzema and/or dehydration of the skin.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:

Identification:

Special Provisions for Transport:

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute:

Cadmium

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Cadmium

Pennsylvania RTK: Cadmium

Massachusetts RTK: Cadmium

TSCA 8(b) inventory: Cadmium

SARA 313 toxic chemical notification and release reporting: Cadmium

CERCLA: Hazardous substances.: Cadmium

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

Other Classifications:

WHMIS (Canada):

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).

CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R26- Very toxic by inhalation.

R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

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

Health: 3

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Safety glasses.

Section 16: Other Information

References:

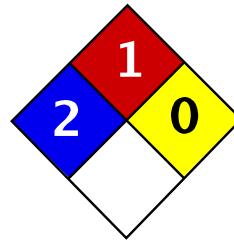
- Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
- Liste des produits purs tératogènes, mutagènes, cancérigènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec.
- Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec.
- SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
- The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
- Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

Other Special Considerations: Not available.

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Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Copper MSDS

Section 1: Chemical Product and Company Identification

Product Name: Copper

Catalog Codes: SLC4939, SLC2152, SLC3943, SLC1150, SLC2941, SLC4729, SLC1936, SLC3727, SLC5515

CAS#: 7440-50-8

RTECS: GL5325000

TSCA: TSCA 8(b) inventory: Copper

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: Cu

Contact Information:

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

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

Order Online: ScienceLab.com

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

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Copper	7440-50-8	100

Toxicological Data on Ingredients: Copper LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of ingestion. Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to lungs, mucous membranes.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

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

Skin Contact:

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

Serious Skin Contact: Not available.

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

Serious Inhalation: Not available.

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible.

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 1 (mg/m³) from ACGIH [1990]

Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 63.54 g/mole

Color: Not available.

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

Boiling Point: 2595°C (4703°F)

Melting Point: 1083°C (1981.4°F)

Critical Temperature: Not available.

Specific Gravity: 8.94 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans: The substance is toxic to lungs, mucous membranes.

Other Toxic Effects on Humans:

Very hazardous in case of ingestion.

Hazardous in case of inhalation.

Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Human: passes through the placenta, excreted in maternal milk.

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Copper

Massachusetts RTK: Copper

TSCA 8(b) inventory: Copper

CERCLA: Hazardous substances.: Copper

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

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC): R36- Irritating to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

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

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator

when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

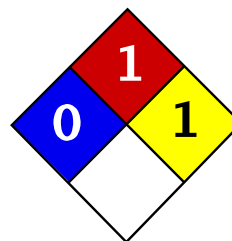
References: Not available.

Other Special Considerations: Not available.

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Last Updated: 11/06/2008 12:00 PM

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Health	1
Fire	3
Reactivity	2
Personal Protection	E

Material Safety Data Sheet

Magnesium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Magnesium

Catalog Codes: SLM4408, SLM2263, SLM3637

CAS#: 7439-95-4

RTECS: OM2100000

TSCA: TSCA 8(b) inventory: Magnesium

CI#: Not applicable.

Synonym: Magnesium ribbons, turnings or sticks

Chemical Name: Magnesium

Chemical Formula: Mg

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Magnesium	7439-95-4	100

Toxicological Data on Ingredients: Magnesium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

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

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at

least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:

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

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:

Highly flammable in presence of open flames and sparks, of heat.

Flammable in presence of acids, of moisture.

Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Explosive in presence of acids, of moisture.

Fire Fighting Media and Instructions:

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:

Magnesium turnings, chips or granules, ribbons, are flammable. They can be easily ignited. They may reignite after fire is extinguished. Produces flammable gases on contact with water and acid. May ignite on contact with water or moist air.

Magnesium fires do not flare up violently unless moisture is present.

Special Remarks on Explosion Hazards: Reacts with acids and water to form hydrogen gas which is highly flammable and explosive

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Flammable solid.

Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage:

Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Moisture sensitive. Dangerous when wet.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 24.31 g/mole

Color: Silver-white

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

Boiling Point: 1100°C (2012°F)

Melting Point: 651°C (1203.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.74 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Very slightly soluble in hot water.

Insoluble in cold water.

Insoluble in chromium trioxides, and mineral acids, alkalies.

Slightly soluble with decomposition in hot water.

Soluble in concentrated hydrogen fluoride, and ammonium salts.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, incompatible materials, water or moisture, moist air.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Violent chemical reaction with oxidizing agents.

Reacts with water to create hydrogen gas and heat. Must be kept dry.

Reacts with acids to form hydrogen gas which is highly flammable and explosive.

Magnesium forms hazardous or explosive mixtures with aluminum and potassium perchlorate; ammonium nitrate; barium nitrate, barium dioxide and zinc; beryllium oxide; boron phosphodiiodide; bromobenzyl trifluoride; cadmium cyanide; cadmium oxide; calcium carbide; carbonates; carbon tetrachloride; chlorine; chlorine trifluoride; chloroform; cobalt cyanide; copper cyanide; copper sulfate(anhydrous), ammonium nitrate, potassium chlorate and water; cupric oxide; cupric sulfate; fluorine; gold cyanide; hydrogen and calcium carbonate; hydrogen iodide; hydrogen peroxide; iodine; lead cyanide; mercuric oxide; mercury cyanide; methyl chloride; molybdenum trioxide; nickel cyanide; nitric acid; nitrogen dioxide; oxygen (liquid); performic acid; phosphates; potassium chlorate; potassium perchlorate; silver nitrate; silver oxide; sodium perchlorate; sodium peroxide; sodium peroxide and carbon dioxide; stannic oxide; sulfates; trichloroethylene; zinc cyanide; zinc oxide.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans: Not available.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects:

Skin: May cause skin irritation by mechanical action. May get mechanical injury or embedding of chips/particles in skin. The particles that are embedded in the wounds may retard healing.

Eyes: May cause eye irritation by mechanical action. Mechanical injury may occur. Particles or chips may embed in eye and retard healing.

Inhalation: Low hazard for usual industrial handling. It may cause respiratory tract irritation. However, it is unlikely due to physical form. When Magnesium metal is heated during welding or smelting process, Metal Fume Fever may result from inhalation of magnesium fumes. Metal Fume Fever is a flu-like condition consisting of fever, chills, sweating, aches, pains, cough, weakness, headache, nausea, vomiting, and breathing difficulty.

Other symptoms may include metallic taste, increased white blood cell count. There is no permanent ill-effect.

Ingestion: Low hazard for usual industrial handling. There are no known reports of serious industrial poisonings with Magnesium. Ingestion of large amounts of chips, turnings or ribbons may cause gastrointestinal tract irritation with nausea, vomiting, and diarrhea. Acute ingestion may also result in Hypermagnesia.

Hypermagnesia may cause hypotension, bradycardia, CNS depression, respiratory depression, and impairment of neuromuscular transmission (hyporeflexia, paralysis).

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Magnesium UNNA: 1869 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Connecticut hazardous material survey.: Magnesium

Rhode Island RTK hazardous substances: Magnesium

Pennsylvania RTK: Magnesium

Massachusetts RTK: Magnesium
Massachusetts spill list: Magnesium
New Jersey: Magnesium
TSCA 8(b) inventory: Magnesium

Other Regulations:

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

Other Classifications:

WHMIS (Canada):

CLASS B-4: Flammable solid.
CLASS B-6: Reactive and very flammable material.

DSCL (EEC):

R11- Highly flammable.
R15- Contact with water liberates extremely flammable gases.
S7/8- Keep container tightly closed and dry.
S43- In case of fire, use dry chemical. Never use water.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 3

Reactivity: 2

Personal Protection: E

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

Health: 0

Flammability: 1

Reactivity: 1

Specific hazard:

Protective Equipment:

Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

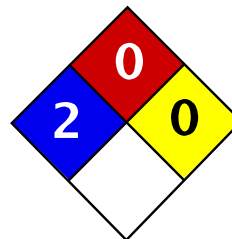
References: Not available.

Other Special Considerations: Not available.

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Last Updated: 11/06/2008 12:00 PM

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Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Nickel metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nickel metal

Catalog Codes: SLN2296, SLN1342, SLN1954

CAS#: 7440-02-0

RTECS: QR5950000

TSCA: TSCA 8(b) inventory: Nickel metal

CI#: Not applicable.

Synonym: Nickel Metal shot; Nickel metal foil.

Chemical Name: Nickel

Chemical Formula: Ni

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

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

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Nickel metal	7440-02-0	100

Toxicological Data on Ingredients: Nickel metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer).

CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to skin.

The substance may be toxic to kidneys, lungs, liver, upper respiratory tract.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

Special Remarks on Explosion Hazards:

Material in powder form, capable of creating a dust explosion.

Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode.

Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion.

Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 1 (mg/m3) from ACGIH (TLV) [United States] Inhalation Respirable.

TWA: 0.5 (mg/m3) [United Kingdom (UK)]

TWA: 1 (mg/m3) from OSHA (PEL) [United States] Inhalation Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid. Lustrous solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 58.71 g/mole

Color: Silvery.

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

Boiling Point: 2730°C (4946°F)

Melting Point: 1455°C (2651°F)

Critical Temperature: Not available.

Specific Gravity: Density: 8.908 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Insoluble in cold water, hot water.

Insoluble in Ammonia.

Soluble in dilute Nitric Acid.

Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, combustible materials, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + industrial earth.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.

Causes damage to the following organs: skin.

May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:

Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Dose/Conc:

LDL [Rat] - Route: Oral; Dose: 5000 mg/kg

LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

Special Remarks on Chronic Effects on Humans: May cause cancer based on animal test data

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects:

Skin: Nickel dust and fume can irritate skin.

Eyes: Nickel dust and fume can irritate eyes.

Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.

Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased coronary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).

Chronic Potential Health Effects:

Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.

Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).

Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy. Chronic ingestion of Nickel may also affect respiration and cause pneumoconiosis or fibrosis.

Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Nickel metal

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Nickel metal

Connecticut hazardous material survey.: Nickel metal

Illinois toxic substances disclosure to employee act: Nickel metal

Illinois chemical safety act: Nickel metal

New York release reporting list: Nickel metal

Rhode Island RTK hazardous substances: Nickel metal

Pennsylvania RTK: Nickel metal

Michigan critical material: Nickel metal

Massachusetts RTK: Nickel metal

Massachusetts spill list: Nickel metal

New Jersey: Nickel metal

New Jersey spill list: Nickel metal

Louisiana spill reporting: Nickel metal

California Director's List of Hazardous Substances: Nickel metal

TSCA 8(b) inventory: Nickel metal

Other Regulations:

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

EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R40- Possible risks of irreversible effects.

R43- May cause sensitization by skin contact.

S22- Do not breathe dust.

S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

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

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Safety glasses.

Section 16: Other Information

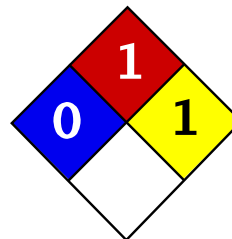
References: Not available.

Other Special Considerations: Not available.

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Last Updated: 11/06/2008 12:00 PM

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Health	1
Fire	1
Reactivity	1
Personal Protection	E

Material Safety Data Sheet

Zinc Metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Zinc Metal

Catalog Codes: SLZ1054, SLZ1159, SLZ1267, SLZ1099, SLZ1204

CAS#: 7440-66-6

RTECS: ZG8600000

TSCA: TSCA 8(b) inventory: Zinc Metal

CI#: Not applicable.

Synonym: Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips

Chemical Name: Zinc Metal

Chemical Formula: Zn

Contact Information:

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

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

Order Online: ScienceLab.com

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

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Zinc Metal	7440-66-6	100

Toxicological Data on Ingredients: Zinc Metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

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

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances:

Slightly flammable to flammable in presence of open flames and sparks, of heat, of oxidizing materials, of acids, of alkalis, of moisture.

Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:

Zinc + NaOH causes ignition.

Oxidation of zinc by potassium proceeds with incandescence.

Residues from zinc dust /acetic acid reduction operations may ignite after long delay if discarded into waste bins with paper.

Incandescent reaction when Zinc and Arsenic or Tellurium, or Selenium are combined.

When hydrazine mononitrate is heated in contact with zinc, a flaming decomposition occurs at temperatures a little above its melting point.

Contact with acids and alkali hydroxides (sodium hydroxide, potassium hydroxide, calcium hydroxide, etc.) results in evolution of hydrogen with sufficient heat of reaction to ignite the hydrogen gas.

Zinc foil ignites if traces of moisture are present.

It is water reactive and produces flammable gases on contact with water. It may ignite on contact with water or

moist air.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Flammable solid that, in contact with water, emits flammable gases.

Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.

Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area. Keep from any possible contact with water. Do not allow water to get into container because of violent reaction.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid. Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 65.39 g/mole

Color: Bluish-grey

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

Boiling Point: 907°C (1664.6°F)

Melting Point: 419°C (786.2°F)

Critical Temperature: Not available.

Specific Gravity: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials, moisture

Incompatibility with various substances:

Reactive with oxidizing agents, acids, alkalis.

Slightly reactive to reactive with moisture.

The product may react violently with water to emit flammable but non toxic gases.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with acids, halogenated hydrocarbons, NH_4NO_3 , barium oxide, $\text{Ba}(\text{NO}_3)_2$, Cadmium, CS_2 , chlorates, Cl_2 , CrO_3 , F_2 , Hydroxylamine, $\text{Pb}(\text{N}_3)_2$, MnCl_2 , HNO_3 , performic acid, KClO_3 , KNO_3 , N_2O_2 , Selenium, NaClO_3 , Na_2O_2 , Sulfur, Te, water, $(\text{NH}_4)_2\text{S}$, As_2O_3 , CS_2 , CaCl_2 , chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide, HCl , H_2SO_4 , $(\text{Mg} + \text{Ba}(\text{NO}_3)_2 + \text{BaO}_2)$, (ethyl acetoacetate +tribromoneopentyl alcohol.

Contact with Alkali Hydroxides(Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide, etc) results in evolution of hydrogen.

Ammonium nitrate + zinc + water causes a violent reaction with evolution of steam and zinc oxide.

May react with water.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans: Not available.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects:

Skin: May cause skin irritation. Dermal exposure to zinc may produce leg pains, fatigue, anorexia and weight loss.

Eyes: May cause eye irritation.

Ingestion: May be harmful if swallowed. May cause digestive tract irritation with tightness in throat, nausea, vomiting, diarrhea, loss of appetite, malaise, abdominal pain, fever, and chills. May affect behavior/central nervous system and autonomic nervous system with ataxia, lethargy, staggering gait, mild derangement in cerebellar function, lightheadness, dizziness, irritability, muscular stiffness, and pain. May also affect blood.

Inhalation: Inhalation of zinc dust or fumes may cause respiratory tract and mucous membrane irritation with cough and chest pain. It can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headachefever, malaise, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis.

The toxicological properties of this substance have not been fully investigated.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: Not available.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

New York release reporting list: Zinc Metal
Rhode Island RTK hazardous substances: Zinc Metal
Pennsylvania RTK: Zinc Metal
Florida: Zinc Metal
Michigan critical material: Zinc Metal
Massachusetts RTK: Zinc Metal
New Jersey: Zinc Metal
California Director's List of Hazardous Substances: Zinc Metal
TSCA 8(b) inventory: Zinc Metal
TSCA 12(b) one time export: Zinc Metal
SARA 313 toxic chemical notification and release reporting: Zinc Metal
CERCLA: Hazardous substances.: Zinc Metal: 1000 lbs. (453.6 kg)

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not Available

DSCL (EEC):

R15- Contact with water liberates extremely flammable gases.
R17- Spontaneously flammable in air.
S7/8- Keep container tightly closed and dry.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 1

Personal Protection: E

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

Health: 0

Flammability: 1

Reactivity: 1

Specific hazard:

Protective Equipment:

Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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ToxFAQs™: Chemical Agent Briefing Sheets (CABS)

Lead

January 2006

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- [What are the most important or common mediating factors?](#)
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What is lead?

Lead is a heavy, bluish-gray metal that has a low melting point. It occurs naturally in the Earth's crust, but it is not a particularly abundant element. It is rarely found naturally as a metal, but rather in its divalent (2+) oxidative state in ore deposits widely distributed throughout the world. The most important lead containing ores are galena (PbS), anglesite (PbSO₄), and cerussite (PbCO₃). Natural lead is a mixture of four stable isotopes: ²⁰⁸Pb (51%–53%), ²⁰⁶Pb (23.5%–27%), ²⁰⁷Pb (20.5%–23%), and ²⁰⁴Pb (1.35%–1.5%).

What are the forms of lead?

- Metallic lead
- Inorganic lead and lead compounds (or lead salts)
- Organic lead (containing carbon)

What are the common uses of lead?

The largest use for lead is in storage batteries in cars and other vehicles. Lead may be used as a pure metal, alloyed with other metals, or as chemical compounds.

Lead used by industry comes from mined ores ("primary") or from recycled scrap metal or batteries ("secondary"). However, most lead today is obtained from recovery of recycled scrap, mostly lead-acid batteries.

Human activities, such as lead mining and smelting operations and manufacturing and use of lead products (e.g., leaded gasoline, lead-based paint), have resulted in the contamination of many industrial and residential areas with lead.

Form	Uses
Metallic lead Lead and lead compounds (or lead salts), such as <ul style="list-style-type: none"> • lead acetate • lead chloride • lead nitrate • lead oxide • lead phosphate • lead acetate 	<p>Certain uses of lead, such as leaded gasoline, lead-based paints for domestic use, lead-based solder in food cans and water pipes, lead sinkers, and ammunition, have been reduced or banned to minimize lead's harmful effects on people and animals.</p> <ul style="list-style-type: none"> • Cosmetics and hair dye - Some hair dyes and some non-Western cosmetics, such as kohl and surma, contain lead. • Fishing equipment - Most fishing weights and sinkers are made from lead. • Folk remedies - Many non-Western folk remedies used to treat diarrhea or other ailments may contain substantial amounts of lead. Examples of these include alarcon, ghasard, alcoh, greta, azarcon,

- **lead sulfate**
- **lead sulfide**

liga, bali goli, pay-loo-ah, coral, and rueda.

- **Glazing** - Applied to some ceramicware can contain lead.
- **Lead based paint** - Although the sale of residential lead-based paint was banned in the United States in 1978, it remains a major source of lead exposure for young children residing in older houses.
- **Lead batteries** - Production of lead-acid batteries is the major use of lead.
- **Lead-based solder** - Has been banned for use in water distribution systems, but many buildings and homes contain lead pipes or lead-based solder. Lead-based solder also is used for electrical circuitry applications.
- **Lead-shot and ammunition** - It is the second highest production use of lead.
- Other uses of lead include the production of lead alloys, soldering materials, shielding for x-ray machines, and manufacturing of corrosion- and acid-resistant materials used in the building industry.

Organic

- **tetraethyl lead**
- **tetramethyl lead**

The use of lead in gasoline was phased out in the 1980s, and has been banned since January 1, 1996. The use of lead in gasoline has contributed to its dispersion throughout the environment. During the combustion of gasoline containing these alkyllead compounds, significant amounts of inorganic lead can be released to the surrounding areas.

Current Uses

- Gasoline for off-road vehicles, farm equipment, and airplanes

Past Uses

- Gasoline additives (to increase octane rating)

What are the routes of exposure for lead?

People are most likely to be exposed to lead by consuming contaminated food and drinking water. Exposure can also occur by inadvertently ingesting contaminated soil, dust, or lead-based paint.

Form	Routes of Exposure
Metallic lead Lead and lead compounds (or lead salts), such as <ul style="list-style-type: none"> • lead acetate • lead chloride • lead nitrate • lead oxide • lead phosphate • lead subacetate • lead sulfate • lead sulfide 	<ul style="list-style-type: none"> • Ingestion is the primary source of exposure to the general population. • Lead paint is a major source of environmental exposure for children who ingest flaking paint, paint chips, and weathered powdered paint (mostly from deteriorated housing units in urban areas). Lead paint can also contribute to soil/dust lead which can be inadvertently ingested via hand-to-mouth activity of young children. • Lead can leach into drinking water from lead-based solder used in water pipes. • Lead can leach into foods or liquids stored in ceramic containers made with lead glazing. • Engaging in hobbies such as casting ammunition, making fishing weights, and stained glass can result in exposure to lead. • Exposure by inhalation can result during activities such as soldering with lead solder or sanding or sandblasting lead-based paint.
Organic <ul style="list-style-type: none"> • tetraethyl lead • tetramethyl lead 	<ul style="list-style-type: none"> • Inhalation • Dermal studies in animals have shown that organic lead is well absorbed through the skin

Who are the populations most at risk and how are they usually exposed?

People living near hazardous waste sites, lead smelters or refineries, battery recycling or crushing centers, or other industrial lead sources may be exposed to lead and chemicals that contain lead. Workers in occupations that have sources of lead exposure (e.g., plumbers, miners, mechanics, and lead smelter or refinery workers).

Certain hobbies, folk remedies, home activities, and car repairs (e.g., radiator repair) can contribute to lead exposure. Smoking cigarettes or breathing second-hand smoke increases exposure because tobacco smoke contains small amounts of lead.

Pregnant women, the developing fetuses, and young children are particularly vulnerable to the effects of lead. Young children are more likely to play in dirt and to place their hands and other objects in their

mouths, thereby increasing the opportunity for exposure via ingestion of lead-contaminated soil and dust.

What are the possible toxic effects of lead?

The most sensitive targets for lead toxicity are the developing nervous system, the hematological and cardiovascular systems, and the kidney. However, because of lead's many modes of action in biological systems, lead could potentially affect any system or organs in the body. The effects are the same whether it is breathed or swallowed.

Blood Lead Concentrations Corresponding to Adverse Health Effects

Life Stage	Effect	Blood lead (µg/dL)
Children	Depressed ALAD* activity	<5
	Neurodevelopmental effects	<10
	Sexual maturation	<10
	Depressed vitamin D	>15
	Elevated EP**	>15
	Depressed NCV***	>30
	Depressed hemoglobin	>40
	Colic	>60
Adults	Depressed GFR****	<10
	Elevated blood pressure	<10
	Elevated EP (females)	>20
	Enzymuria/proteinuria	>30
	Peripheral neuropathy	>40
	Neurobehavioral effects	>40
	Altered thyroid hormone	>40
	Reduced fertility	>40
	Depressed hemoglobin	>50
Elderly adults	Depressed ALAD*	<5
	Neurobehavioral effects	>4

*aminolevulinic acid dehydratase (ALAD)

**erythrocyte porphyrin (EP)

***nerve conduction velocity (NCV)

****glomerular filtration rate (GFR)

Source: ATSDR Toxicological Profile for Lead (Draft for Public Comment), 2005.

How can I reduce the risk of exposure to lead?

- Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint (homes built before 1978).
- If you have a water lead problem, the U.S. Environmental Protection Agency (EPA) recommends that you flush your cold water pipes if they have not been used in over 6 hours by running water until it is cold (5 seconds to 2 minutes) before drinking or cooking with it.
- Avoid some types of paints and pigments that contain lead and are used as make-up or hair coloring; keep these kinds of products away from children.
- Hire a professional contractor, who is required to follow certain health safety requirements for remediation or renovation involving lead-based paint, (www.epa.gov/lead/pubs/leadinfo.htm#remodeling).
- Wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

What are the safety guidelines for lead exposure?

Air

- [National Institute for Occupational Safety and Health](http://www.cdc.gov/niosh) (NIOSH)

Recommended exposure limit (REL) time-weighted average (TWA) - 0.05 mg/m³
Immediately dangerous to life or health (IDLH) - 100 mg/m³

- [Occupational Safety and Health Administration](http://www.osha-slc.org) (OSHA)

Air - workplace 50 µg/m³
Action level - 40 µg/100 g of whole blood

- The [American Conference of Governmental Industrial Hygienists](http://www.acgi.org) (ACGIH)

Threshold limit values (TLV)/(TWA) - 0.05 mg/m³
 TLV/TWA guideline for lead arsenate - 150 µg/m³
 TLV/TWA guideline for other forms of lead - 50 µg lead/m³

- [U.S. Environmental Protection Agency](#) (EPA)

National Primary and Secondary Ambient Air Quality Standards - 1.5 µg/m³

- [World Health Organization](#) (WHO)

Air quality guidelines -- 0.5 µg/m³

Water

- EPA

Maximum contaminant level (MCL) - action level 0.015 mg/L
 Action level for public supplies - 15 µg/L

- WHO

Drinking Water Quality Guidelines - 0.01 mg/L

Blood

- [Centers for Disease Control and Prevention](#) (CDC)

Level of concern for children - 10 µg/dL

- OSHA

Cause for written notification and medical exam - 40 µg/dL
 Cause for medical removal from exposure - 50 µg/dL

- ACGIH

Advisory; biological exposure index - 30 µg/dL

Food

- [Food and Drug Administration](#) (FDA)

Bottled drinking water - 0.005 mg/L

Other

- ACGIH

Biological exposure indices (lead in blood) - 30 µg/100 mL

- [Consumer Product Safety Commission](#)

Paint - 600 ppm

- FDA

Ceramicware (µg/mL leaching solution) - 0.5-3.0 µg/mL

µg/m³: micrograms per cubic meter
 µg/dL: micrograms per deciliter
 µg/L: micrograms per liter
 g: gram

mg/L: milligrams per liter
 mL: milliliter
 ppm: parts per million

What are the most important or common mediating factors?

Factors that determine the severity of the health effects from lead exposure include

- Dose
- Age of the person exposed
 - the developing nervous system is the most sensitive system to the effects of lead
 - the efficiency of lead absorption from the gastrointestinal tract is greater in children than in adults
- Life stages of women (childbirth, lactating, menopause)
- Occupational exposures
- Duration of exposure
- Health and lifestyle of the person exposed
- Nutritional status of the person exposed
 - a diet adequate in calcium and iron may decrease lead absorption

The toxic effects of lead exposure may be worse in individuals with inherited genetic diseases or gene polymorphisms such as thalassemia, individuals with glucose-6-phosphate dehydrogenase (G6PD) deficiency, and carriers of certain gene polymorphic forms (e.g., ALAD and vitamin D receptor). Research continues about this topic.

Is there a test to see if my child or I have been exposed to lead?

- | | |
|-----------------------|---|
| Blood | <ul style="list-style-type: none"> • The screening test of choice is blood lead levels. • Blood tests are commonly used to screen children for lead poisoning. • Analysis of lead in whole blood is the most common and accurate method of assessing lead exposure. • Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (µg/dL). |
| Bone and Teeth | <ul style="list-style-type: none"> • X-ray fluorescence techniques have been used to determine lead concentration in bones and teeth. It is not widely available and is used mostly in research. • Lead partitions to bone over a lifetime of exposure; therefore, bone lead measurements may be a better indicator of cumulative exposure than blood lead. |
| Urine | <ul style="list-style-type: none"> • Measurements of urinary lead levels have been used to assess lead exposure. • The measurement of lead excreted in urine following chelation with calcium disodium EDTA (EDTA provocation) has been used to detect elevated body burden of lead in adults and children. |
| Hair and Nails | <ul style="list-style-type: none"> • These are not reliable for testing due to errors external contamination. They are relatively poor predictors of blood lead, particularly at low concentrations. |

Future Research Needs

To close current gaps in the scientific database on the health effects of lead, a long-term research program is needed that might include the following:

- Further short-term studies or studies in vitro designed to clarify mechanisms of action for the various toxicities might be useful.
- Studies identifying exposures during different developmental periods can help identify critical periods of vulnerability for immunocompetence, development of sex organs, or neurobehavioral parameters.
- Chronic-duration exposure studies in animals would expand information on the toxicity of lead. Special studies that examine biochemical and morphological effects of lead may provide new information on mechanisms of action of lead, particularly for the effects of greatest concern such as neurobehavioral changes in children.
- Development of new and more sensitive tests of specific neuropsychological functions.
- Further investigation of links between lead and amyotrophic lateral sclerosis, essential tremor, schizophrenia, and Parkinson's disease.
- Epidemiological studies designed in a manner that permits more rigorous assessments of effect modification.
- Studies about the long-term consequences of lead-related neurobehavioral deficits detected in infants and children and the manifestation of chronic neurobehavioral problems in adolescence and adulthood.
- Further characterization of bone lead concentration as a biomarker of exposure for various effect end points (e.g., blood pressure and renal effects).
- Studies of the potential prevalence of elevated bone lead stores in women of reproductive age and the associated risk that this poses to fetal development by mobilization of maternal bone stores during pregnancy.
- Further clarification of the role of some genetic polymorphisms.
- Evaluation of cohorts from prospective studies into adulthood for potential late-appearing effects including cancer.

For more information

- Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Lead
<http://www.atsdr.cdc.gov/toxprofiles/tp13.html>
- ATSDR ToxFAQs™ for Lead
<http://www.atsdr.cdc.gov/tfacts13.html>
- ATSDR Case Studies in Environmental Medicine Lead Toxicity
<http://www.atsdr.cdc.gov/csem/lead/>
- ATSDR Interaction Profile for Chemical Mixtures for Arsenic, Cadmium, Chromium, and Lead
<http://www.atsdr.cdc.gov/interactionprofiles/ip04.html>

- ATSDR Interaction Profile for Chemical Mixtures for Lead, Manganese, Zinc, and Copper
<http://www.atsdr.cdc.gov/interactionprofiles/ip06.html>
- ATSDR Interaction Profile for Chemical Mixtures for Chlorpyrifos, Lead, Mercury, and Methylmercury
<http://www.atsdr.cdc.gov/interactionprofiles/ip11.html>
- Centers for Disease Control and Prevention Lead Web Page
<http://www.cdc.gov/lead/>
- U.S. Environmental Protection Agency Lead Web Page
<http://www.epa.gov/lead/>
- U.S. Department of Labor, Occupational Safety & Health Administration
<http://www.osha.gov/SLTC/lead/>

For more information, contact:

*Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333
Phone: 1-800-CDC-INFO (800-232-4636)
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Email: CDCINFO@cdc.gov*

This page was updated on 01/04/2008



Mercury

Mercury is a naturally occurring metal found in air, water, and soil. It exists in several forms, including elemental (or metallic) mercury, inorganic mercury compounds, and organic mercury compounds:

- **Elemental mercury** is liquid at room temperature and is used in thermometers, fluorescent light bulbs, some electrical switches, and some industrial processes.
- **Inorganic mercury** compounds are formed when mercury combines with other elements to form salts, which are usually powders or crystals. Inorganic mercury compounds are found naturally in the environment. Some forms of inorganic mercury have been used in antiseptic creams, ointments, and preservatives.
- **Organic mercury** compounds are formed when mercury combines with carbon. Microscopic organisms can produce organic mercury compounds (methylmercury) in contaminated water and soil, which can accumulate in the food chain. Other special types of organomercurials have been used as medical preservatives and medicines.

How People Are Exposed to Mercury

- Eating fish or shellfish that is contaminated with methylmercury, which is the main source of general human exposures to mercury;
- Breathing air contaminated with elemental mercury vapors (e.g., in workplaces such as dental offices and industries that use mercury or in locations where a mercury spill or release has occurred);
- Having dental fillings that contain mercury; and
- Practicing cultural or religious rituals that use mercury.

How Mercury Affects People's Health

- Short-term exposure to extremely high levels of elemental mercury vapors can result in lung damage, nausea, diarrhea, increases in blood pressure or heart rate, skin rashes, eye irritation, and injury to the nervous system.
- Prolonged exposure to lower levels of elemental mercury can permanently damage the brain and kidneys.
- The developing brain of a fetus can be injured if the mother is exposed to methylmercury.

Levels of Mercury in U.S. Population

Scientists tested levels of mercury in the blood of 16,780 participants who took part in CDC's national study known as the National Health and Nutrition Examination Survey (NHANES). These findings are based on total blood mercury levels in the U.S. general

population for persons aged 1 year and older who participated in NHANES during 2003–2006, as well as trends in the total mercury of children aged 1–5 and females aged 16–49 during 1999–2006.

- In the total population during 2003–2006, the total blood mercury levels for non-Hispanic blacks and non-Hispanic whites were higher than those for Mexican Americans.
- Across the age groups in the total population during 2003–2006, total blood mercury levels increased with age, peaked at the fifth or sixth decade, depending on race/ethnicity, and then declined.
- In the most recent survey period of 2005–2006, the 95th percentile levels for total blood mercury in children aged 1–5 years and females aged 16–49 years were 1.43 µg/L and 4.48 µg/L, respectively. The 95th percentile means that 95 percent of the U.S. population's exposure is below this estimated level. Conversely, only 5 percent of the population will have values at this level or higher.
- Over the four survey periods from 1999–2006, blood mercury levels increased slightly for non-Hispanic white children and decreased slightly for non-Hispanic black and Mexican American children. Female children had slightly higher blood mercury levels than male children.

For More Information

- Agency for Toxic Substances and Disease Registry
Detailed information about mercury and public health is available at <http://www.atsdr.cdc.gov/alerts/970626.html> and <http://www.atsdr.cdc.gov/cabs/mercury/index.html>
- CDC Emergency Preparedness and Response
Case definitions of mercury, toxicology FAQs, and toxicological profile at <http://emergency.cdc.gov/agent/mercury/>

May 2009

The Centers for Disease Control and Prevention (CDC) protects people's health and safety by preventing and controlling diseases and injuries; enhances health decisions by providing credible information on critical health issues; and promotes healthy living through strong partnerships with local, national, and international organizations.



[ATSDR Home](#) > [ToxFAQs™](#) Arsenic

ToxFAQs™

ToxFAQs™
for
Arsenic
(*Arsénico*)
August 2007



[PDF Version, 92 KB](#)

CAS#: 7440-38-2

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

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- [What is arsenic?](#)
- [What happens to arsenic when it enters the environment?](#)
- [How might I be exposed to arsenic?](#)
- [How can arsenic affect my health?](#)
- [How likely is arsenic to cause cancer?](#)
- [How does arsenic affect children?](#)
- [How can families reduce their risk for exposure to arsenic?](#)
- [Is there a medical test to show whether I've been exposed to arsenic?](#)
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Highlights

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

What is arsenic?

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

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

What happens to arsenic when it enters the environment?

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

How might I be exposed to arsenic?

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

How can arsenic affect my health?

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

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

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

Skin contact with inorganic arsenic may cause redness and swelling.

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

How likely is arsenic to cause cancer?

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

How does arsenic affect children?

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

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

How can families reduce their risk for exposure to arsenic?

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

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

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

Has the federal government made recommendations to protect human health?

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

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

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. [Toxicological Profile for Arsenic \(Update\)](#). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE, Mailstop F-62
Atlanta, GA 30333
Phone: 1-800-CDC-INFO • 888-232-6348 (TTY)
FAX: 770-488-4178
Email: cdcinfo@cdc.gov

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

This page was updated on 10/05/2007



U.S. Environmental Protection Agency

Pesticides: Topical & Chemical Fact Sheets

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Health & Safety

Specific Chemicals

Regulatory Actions

Assessing Health Risks from Pesticides

January 1999
735-F-99-002

The Federal Government, in cooperation with the States, carefully regulates pesticides to ensure that they do not pose unreasonable risks to human health or the environment. As part of that effort, the Environmental Protection Agency (EPA) requires extensive test data from pesticide producers that demonstrate pesticide products can be used without posing harm to human health and the environment. EPA scientists and analysts carefully review these data to determine whether to register (license) a pesticide product or a use and whether specific restrictions are necessary. This fact sheet is a brief overview of EPA's process for assessing potential risks to human health when evaluating pesticide products.

Background

There are more than 865 active ingredients registered as pesticides, which are formulated into thousands of pesticide products that are available in the marketplace. About 350 pesticides are used on the foods we eat, and to protect our homes and pets.

EPA plays a critical role in evaluating these chemicals prior to registration, and in reevaluating older pesticides already on the market, to ensure that they can be used with a reasonable certainty of no harm. The process EPA uses for evaluating the health impacts of a pesticide is called risk assessment.

EPA uses the National Research Council's four-step process for human health risk assessment:

Step One: Hazard Identification

Step Two: Dose-Response Assessment

Step Three: Exposure Assessment

Step Four: Risk Characterization

Step One: Hazard Identification (Toxicology)

The first step in the risk assessment process is to identify potential health effects that may occur from different types of pesticide exposure. EPA considers the full spectrum of a pesticide's potential health effects.

Generally, for human health risk assessments, many toxicity studies are conducted on animals by pesticide companies in independent laboratories and evaluated for acceptability by EPA scientists. EPA evaluates pesticides for a wide range of adverse effects, from eye and skin irritation to cancer and birth defects in laboratory animals. EPA may also consult the public literature or other sources of supporting information on any aspect of the chemical.

Step Two: Dose-Response Assessment

Paracelsus, the Swiss physician and alchemist, the "father" of modern toxicology (1493-1541) said,

"The dose makes the poison."

In other words, **the amount of a substance a person is exposed to** is as important as **how toxic the chemical might be**. For example, small doses of aspirin can be beneficial to people, but at very high doses, this common medicine can be deadly. In some individuals, even at very low doses, aspirin may be deadly.

Dose-response assessment involves considering the dose levels at which adverse effects were observed in test animals, and using these dose levels to calculate an equal dose in humans.

Step Three: Exposure Assessment

People can be exposed to pesticides in three ways:

1. Inhaling pesticides (inhalation exposure),
2. Absorbing pesticides through the skin (dermal exposure), and
3. Getting pesticides in their mouth or digestive tract (oral exposure).

Depending on the situation, pesticides could enter the body by any one or all of these routes. Typical sources of pesticide exposure include:

- **Food**

Most of the foods we eat have been grown with the use of pesticides. Therefore, pesticide residues may be present inside or on the surfaces of these foods.

- **Home and Personal Use Pesticides**

You might use pesticides in and around your home to control insects, weeds, mold, mildew, bacteria, lawn and garden pests and to protect your pets from pests such as fleas. Pesticides may also be used as insect repellants which are directly applied to the skin or clothing.

- **Pesticides in Drinking Water**

Some pesticides that are applied to farmland or other land structures can make their way in small amounts to the ground water or surface water systems that feed drinking water supplies.

- **Worker Exposure to Pesticides**

Pesticide applicators, vegetable and fruit pickers and others who work around pesticides can be exposed due to the nature of their jobs. To address the unique risks workers face from occupational exposure, EPA evaluates occupational exposure through a separate program. All pesticides registered by EPA have been shown to be safe when used properly.

Step Four: Risk Characterization

Risk characterization is the final step in assessing human health risks from pesticides. It is the process of combining the hazard, dose-response and exposure assessments to describe the overall risk from a pesticide. It explains the assumptions used in assessing exposure as well as the uncertainties that are built into the dose-response assessment. The strength of the overall database is considered, and broad

conclusions are made. EPA's role is to evaluate both toxicity and exposure and to determine the risk associated with use of the pesticide.

Simply put,

$$\text{RISK} = \text{TOXICITY} \times \text{EXPOSURE}.$$

This means that the risk to human health from pesticide exposure depends on both the toxicity of the pesticide and the likelihood of people coming into contact with it. At least *some* exposure and *some* toxicity are required to result in a risk. For example, if the pesticide is very poisonous, but no people are exposed, there is no risk. Likewise, if there is ample exposure but the chemical is non-toxic, there is no risk. However, usually when pesticides are used, there is some toxicity and exposure, which results in a potential risk.

EPA recognizes that effects vary between animals of different species and from person to person. To account for this variability, *uncertainty factors* are built into the risk assessment. These uncertainty factors create an additional margin of safety for protecting people who may be exposed to the pesticides. FQPA requires EPA to use an extra 10-fold safety factor, if necessary, to protect infants and children from effects of the pesticide.

Types of Toxicity Tests EPA Requires for Human Health Risk Assessments

EPA evaluates studies conducted over different periods of time and that measure specific types of effects. These tests are evaluated to screen for potential health effects in infants, children and adults.

Acute Testing: Short-term exposure; a single exposure (dose).

- Oral, dermal (skin), and inhalation exposure
- Eye irritation
- Skin irritation
- Skin sensitization
- Neurotoxicity

Sub-chronic Testing: Intermediate exposure; repeated exposure over a longer period of time (i.e., 30-90 days).

- Oral, dermal (skin), and inhalation
- Neurotoxicity (nerve system damage)

Chronic Toxicity Testing: Long-term exposure; repeated exposure lasting for most of the test animal's life span. Intended to determine the effects of a pesticide after prolonged and repeated exposures.

- Chronic effects (non-cancer)
- Carcinogenicity (cancer)

Developmental and Reproductive Testing: Identify effects in the fetus of an exposed pregnant female (birth defects) and how pesticide exposure affects the ability of a test animal to successfully reproduce.

Mutagenicity Testing: Assess a pesticide's potential to affect the cell's genetic components.

Hormone Disruption: Measure effects for their potential to disrupt the endocrine system. The endocrine system consists of a set of glands and the hormones they produce that help guide the development, growth, reproduction, and behavior of animals including humans.

Risk Management

Once EPA completes the risk assessment process for a pesticide, we use this information to determine if (when used according to label directions), there is a reasonable certainty that the pesticide will not harm a person's health.

Using the conclusions of a risk assessment, EPA can then make a more informed decision regarding whether to approve a pesticide chemical or use, as proposed, or whether additional protective measures are necessary to limit occupational or non-occupational exposure to a pesticide. For example, EPA may prohibit a pesticide from being used on certain crops because consuming too much food treated with the pesticide may result in an unacceptable risk to consumers. Another example of protective measures is requiring workers to wear personal protective equipment (PPE) such as a respirator or chemical resistant gloves, or not allowing workers to enter treated crop fields until a specific period of time has passed.

If, after considering all appropriate risk reduction measures, the pesticide still does not meet EPA's safety standard, the Agency will not allow the proposed chemical or use. Regardless of the specific measures enforced, EPA's primary goal is to ensure that legal uses of the pesticide are protective of human health, especially the health of children, and the environment.

Human Health Risk Assessment and the Law

Federal law requires detailed evaluation of pesticides to protect human health and the environment. In 1996, Congress made significant changes to strengthen pesticide laws through the Food Quality Protection Act (FQPA). Many of these changes are key elements of the current risk assessment process. FQPA required that EPA consider:

- **A New Safety Standard:** FQPA strengthened the safety standard that pesticides must meet before being approved for use. EPA must ensure with a reasonable certainty that no harm will result from the legal uses of the pesticide.
- **Exposure from All Sources:** In evaluating a pesticide, EPA must estimate the combined risk from that pesticide from all non-occupational sources, such as:
 - Food Sources
 - Drinking Water Sources
 - Residential Sources
- **Cumulative Risk:** EPA is required to evaluate pesticides in light of similar toxic effects that different pesticides may share, or "a common mechanism of toxicity." At this time, EPA is developing a methodology for this type of assessment.
- **Special Sensitivity of Children to Pesticides:** EPA must ascertain whether there is an increased susceptibility from exposure to the pesticide to infants and children. EPA must build an additional 10-fold safety factor into risk assessments to ensure the protection of infants and children, unless it is determined that a lesser margin of safety will be safe for infants and children.

For More Information

If you would like more information about EPA's pesticide programs, contact the Communication Service Branch at (703) 305-5017 or visit the [Pesticides Web site](#).

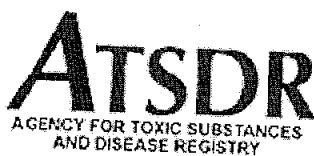
For more information on specific pesticides, or to inquire about the symptoms of pesticide poisoning, call the National Pesticide Information Center (NPIC), a toll-free hotline information at: 1-800-858-7378, or visit their [Web site](#) [\[Exit Disclaimer\]](#).

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ToxFAQs™

for

Polychlorinated Biphenyls (PCBs)

(Bifenilos Policlorados (BPCs))

February 2001






This fact sheet answers the most frequently asked health questions about polychlorinated biphenyls (PCBs). For more information, you may call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls (PCBs)?

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors,

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and old microscope and hydraulic oils.

[back to top](#)**What happens to polychlorinated biphenyls (PCBs) when they enter the environment?**

- PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.
- PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.
- PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.
- PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

[back to top](#)**How might I be exposed to polychlorinated biphenyls (PCBs)?**

- Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.
- Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.
- Breathing air near hazardous waste sites and drinking contaminated well water.
- In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

[back to top](#)**How can polychlorinated biphenyls (PCBs) affect my health?**

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

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How likely are polychlorinated biphenyls (PCBs) to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The EPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

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How do polychlorinated biphenyls (PCBs) affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported. In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

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How can families reduce the risk of exposure to polychlorinated biphenyls (PCBs)?

- You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.
- Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.
- Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.
- If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

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Is there a medical test to show whether I've been exposed to polychlorinated biphenyls (PCBs)?

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

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Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

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References

Agency for Toxic Substances and Disease Registry (ATSDR).
2000. Toxicological Profile for polychlorinated biphenyls (PCBs).
Atlanta, GA: U.S. Department of Health and Human Services,
Public Health Service.

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Where can I get more information?

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

For more information, contact:

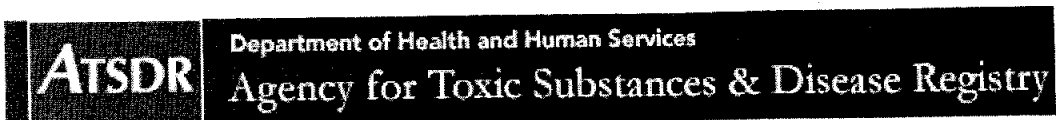
Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333
Phone: 1-888-42-ATSDR (1-888-422-8737)
FAX: (770)-488-4178
Email: ATSDRIC@cdc.gov

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2007 CERCLA Priority List of Hazardous Substances

2007 RANK	SUBSTANCE NAME	TOTAL POINTS	2005 RANK	CAS #
1	ARSENIC	1672.58	1	007440-38-2
2	LEAD	1534.07	2	007439-92-1
3	MERCURY	1504.69	3	007439-97-6
4	VINYL CHLORIDE	1387.75	4	000075-01-4
5	POLYCHLORINATED BIPHENYLS	1365.78	5	001336-36-3
6	BENZENE	1355.96	6	000071-43-2
7	CADMIUM	1324.22	8	007440-43-9
8	POLYCYCLIC AROMATIC HYDROCARBONS	1316.98	7	130498-29-2
9	BENZO(A)PYRENE	1312.45	9	000050-32-8
10	BENZO(B)FLUORANTHENE	1266.55	10	000205-99-2
11	CHLOROFORM	1223.03	11	000067-66-3
12	DDT, P,P'-	1193.36	12	000050-29-3
13	AROCLOR 1254	1182.63	13	011097-69-1
14	AROCLOR 1260	1177.77	14	011096-82-5
15	DIBENZO(A,H)ANTHRACENE	1165.88	15	000053-70-3
16	TRICHLOROETHYLENE	1154.73	16	000079-01-6
17	DIELDRIN	1150.91	17	000060-57-1
18	CHROMIUM, HEXAVALENT	1149.98	18	018540-29-9
19	PHOSPHORUS, WHITE	1144.77	19	007723-14-0
20	CHLORDANE	1133.21	21	000057-74-9
21	DDE, P,P'-	1132.49	20	000072-55-9
22	HEXACHLOROBUTADIENE	1129.63	22	000087-68-3
23	COAL TAR CREOSOTE	1124.32	23	008001-58-9
24	ALDRIN	1117.22	25	000309-00-2
25	DDD, P,P'-	1114.83	24	000072-54-8
26	BENZIDINE	1114.24	26	000092-87-5
27	AROCLOR 1248	1112.20	27	012672-29-6
28	CYANIDE	1099.48	28	000057-12-5
29	AROCLOR 1242	1093.14	29	053469-21-9
30	AROCLOR	1091.52	62	012767-79-2
31	TOXAPHENE	1086.65	30	008001-35-2
32	HEXACHLOROCYCLOHEXANE, GAMMA-	1081.63	32	000058-89-9
33	TETRACHLOROETHYLENE	1080.43	31	000127-18-4
34	HEPTACHLOR	1072.67	33	000076-44-8
35	1,2-DIBROMOETHANE	1064.06	34	000106-93-4
36	HEXACHLOROCYCLOHEXANE, BETA-	1060.22	37	000319-85-7
37	ACROLEIN	1059.07	36	000107-02-8
38	DISULFOTON	1058.85	35	000298-04-4
39	BENZO(A)ANTHRACENE	1057.96	38	000056-55-3
40	3,3'-DICHLOROBENZIDINE	1051.61	39	000091-94-1

41	ENDRIN	1048.57	41	000072-20-8
42	BERYLLIUM	1046.12	40	007440-41-7
43	HEXACHLOROCYCLOHEXANE, DELTA-	1038.27	42	000319-86-8
44	1,2-DIBROMO-3-CHLOROPROPANE	1035.55	43	000096-12-8
45	PENTACHLOROPHENOL	1028.01	45	000087-86-5
46	HEPTACHLOR EPOXIDE	1027.12	44	001024-57-3
47	CARBON TETRACHLORIDE	1023.32	46	000056-23-5
48	AROCLOR 1221	1018.41	47	011104-28-2
49	COBALT	1015.57	50	007440-48-4
50	DDT, O,P'-	1014.71	49	000789-02-6
51	AROCLOR 1016	1014.33	48	012674-11-2
52	DI-N-BUTYL PHTHALATE	1007.49	52	000084-74-2
53	NICKEL	1005.40	55	007440-02-0
54	ENDOSULFAN	1004.65	54	000115-29-7
55	ENDOSULFAN SULFATE	1003.56	53	001031-07-8
56	DIAZINON	1002.08	57	000333-41-5
57	ENDOSULFAN, ALPHA	1001.30	58	000959-98-8
58	XYLENES, TOTAL	996.07	59	001330-20-7
59	CIS-CHLORDANE	995.08	51	005103-71-9
60	DIBROMOCHLOROPROPANE	994.87	60	067708-83-2
61	METHOXYCHLOR	994.47	61	000072-43-5
62	BENZO(K)FLUORANTHENE	981.26	63	000207-08-9
63	ENDRIN KETONE	978.99	64	053494-70-5
64	TRANS-CHLORDANE	973.99	56	005103-74-2
65	CHROMIUM(VI) OXIDE	969.58	66	001333-82-0
66	METHANE	959.78	67	000074-82-8
67	ENDOSULFAN, BETA	959.19	65	033213-65-9
68	AROCLOR 1232	955.64	68	011141-16-5
69	ENDRIN ALDEHYDE	954.86	69	007421-93-4
70	BENZOFLUORANTHENE	951.48	70	056832-73-6
71	TOLUENE	947.50	71	000108-88-3
72	2-HEXANONE	942.02	72	000591-78-6
73	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	938.11	73	001746-01-6
74	ZINC	932.89	74	007440-66-6
75	DIMETHYLARSINIC ACID	922.06	75	000075-60-5
76	DI(2-ETHYLHEXYL)PHTHALATE	919.02	76	000117-81-7
77	CHROMIUM	908.52	77	007440-47-3
78	NAPHTHALENE	896.67	78	000091-20-3
79	1,1-DICHLOROETHENE	891.19	79	000075-35-4
80	METHYLENE CHLORIDE	888.96	81	000075-09-2
81	AROCLOR 1240	888.11	80	071328-89-7
82	2,4,6-TRINITROTOLUENE	883.59	82	000118-96-7
83	BROMODICHLOROETHANE	870.00	83	000683-53-4
84	HYDRAZINE	864.41	85	000302-01-2
85	1,2-DICHLOROETHANE	863.99	84	000107-06-2
86	2,4,6-TRICHLOROPHENOL	863.71	86	000088-06-2
87	2,4-DINITROPHENOL	860.45	87	000051-28-5
88	BIS(2-CHLOROETHYL) ETHER	859.88	88	000111-44-4
89	THIOCYANATE	849.21	89	000302-04-5
90	ASBESTOS	841.54	90	001332-21-4
91	CHLORINE	840.37	92	007782-50-5
92	CYCLOTRIMETHYLENETRINITRAMINE (RDX)	840.28	91	000121-82-4
93	HEXACHLOROBENZENE	838.34	93	000118-74-1

94	2,4-DINITROTOLUENE	837.88	96	000121-14-2
95	RADIUM-226	835.93	94	013982-63-3
96	ETHION	834.03	97	000563-12-2
97	1,1,1-TRICHLOROETHANE	833.81	95	000071-55-6
98	URANIUM	833.41	98	007440-61-1
99	ETHYLBENZENE	832.13	99	000100-41-4
100	RADIUM	828.07	100	007440-14-4
101	THORIUM	825.17	101	007440-29-1
102	4,6-DINITRO-O-CRESOL	822.78	102	000534-52-1
103	1,3,5-TRINITROBENZENE	820.17	103	000099-35-4
104	CHLOROBENZENE	819.69	105	000108-90-7
105	RADON	817.89	104	010043-92-2
106	RADIUM-228	816.76	106	015262-20-1
107	THORIUM-230	814.72	107	014269-63-7
107	URANIUM-235	814.72	107	015117-96-1
109	BARIUM	813.46	109	007440-39-3
110	FLUORANTHENE	812.40	113	000206-44-0
111	URANIUM-234	812.11	110	013966-29-5
112	N-NITROSODI-N-PROPYLAMINE	811.05	111	000621-64-7
113	THORIUM-228	810.36	112	014274-82-9
114	RADON-222	809.78	114	014859-67-7
115	HEXACHLOROCYCLOHEXANE, ALPHA-	809.56	116	000319-84-6
116	1,2,3-TRICHLOROBENZENE	808.41	143	000087-61-6
117	MANGANESE	807.90	115	007439-96-5
118	COAL TARS	807.07	117	008007-45-2
119	CHRYSTILE ASBESTOS	806.68	119	012001-29-5
119	STRONTIUM-90	806.68	119	010098-97-2
121	PLUTONIUM-239	806.67	118	015117-48-3
122	POLONIUM-210	806.39	122	013981-52-7
123	METHYLMERCURY	806.39	121	022967-92-6
124	PLUTONIUM-238	806.01	123	013981-16-3
125	LEAD-210	805.90	124	014255-04-0
126	PLUTONIUM	805.23	125	007440-07-5
127	CHLORPYRIFOS	804.93	125	002921-88-2
128	COPPER	804.86	133	007440-50-8
129	AMERICIUM-241	804.55	128	086954-36-1
130	RADON-220	804.54	127	022481-48-7
131	AMOSITE ASBESTOS	804.07	129	012172-73-5
132	IODINE-131	803.48	130	010043-66-0
133	HYDROGEN CYANIDE	803.08	132	000074-90-8
134	TRIBUTYL TIN	802.61	131	000688-73-3
135	GUTHION	802.32	134	000086-50-0
136	NEPTUNIUM-237	802.13	135	013994-20-2
137	CHRYSENE	802.10	139	000218-01-9
138	CHLORDECONE	801.64	136	000143-50-0
138	IODINE-129	801.64	136	015046-84-1
138	PLUTONIUM-240	801.64	136	014119-33-6
141	S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	797.88	140	000078-48-8
142	BROMINE	789.15	142	007726-95-6
143	POLYBROMINATED BIPHENYLS	789.11	141	067774-32-7
144	DICOFOL	787.56	144	000115-32-2
145	PARATHION	784.14	145	000056-38-2
146	1,1,2,2-TETRACHLOROETHANE	782.15	146	000079-34-5

147	SELENIUM	778.98	147	007782-49-2
148	HEXACHLOROCYCLOHEXANE, TECHNICAL GRADE	774.91	148	000608-73-1
149	TRICHLOROFLUOROETHANE	770.74	149	027154-33-2
150	TRIFLURALIN	770.12	150	001582-09-8
151	DDD, O,P'-	768.73	151	000053-19-0
152	4,4'-METHYLENEBIS(2-CHLOROANILINE)	766.66	152	000101-14-4
153	HEXACHLORODIBENZO-P-DIOXIN	760.42	153	034465-46-8
154	HEPTACHLORODIBENZO-P-DIOXIN	754.47	154	037871-00-4
155	PENTACHLOROBENZENE	753.58	155	000608-93-5
156	1,3-BUTADIENE	747.31	201	000106-99-0
157	AMMONIA	745.55	156	007664-41-7
158	2-METHYLNAPHTHALENE	743.24	157	000091-57-6
159	1,4-DICHLOROBENZENE	737.32	159	000106-46-7
160	1,1-DICHLOROETHANE	736.23	158	000075-34-3
161	ACENAPHTHENE	731.25	160	000083-32-9
162	1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN	726.14	161	039001-02-0
163	1,1,2-TRICHLOROETHANE	724.96	162	000079-00-5
164	TRICHLOROETHANE	723.32	163	025323-89-1
165	HEXACHLOROCYCLOPENTADIENE	719.01	164	000077-47-4
166	HEPTACHLORODIBENZOFURAN	718.58	165	038998-75-3
167	1,2-DIPHENYLHYDRAZINE	713.90	166	000122-66-7
168	2,3,4,7,8-PENTACHLORODIBENZOFURAN	710.71	167	057117-31-4
169	TETRACHLOROBIPHENYL	709.21	168	026914-33-0
170	CRESOL, PARA-	707.83	169	000106-44-5
171	OXYCHLORDANE	706.32	170	027304-13-8
172	1,2-DICHLOROBENZENE	704.91	171	000095-50-1
173	1,2-DICHLOROETHENE, TRANS-	704.04	178	000156-60-5
174	INDENO(1,2,3-CD)PYRENE	703.30	180	000193-39-5
175	GAMMA-CHLORDENE	702.59	172	056641-38-4
176	CARBON DISULFIDE	702.55	174	000075-15-0
177	TETRACHLOROPHENOL	702.54	173	025167-83-3
178	AMERICIUM	701.62	175	007440-35-9
178	URANIUM-233	701.62	175	013968-55-3
180	PALLADIUM	700.66	177	007440-05-3
181	HEXACHLORODIBENZOFURAN	700.56	179	055684-94-1
182	PHENOL	696.96	183	000108-95-2
183	CHLOROETHANE	693.90	182	000075-00-3
184	ACETONE	693.31	181	000067-64-1
185	P-XYLENE	690.20	185	000106-42-3
186	DIBENZOFURAN	689.19	187	000132-64-9
187	ALUMINUM	688.13	186	007429-90-5
188	2,4-DIMETHYLPHENOL	685.76	189	000105-67-9
189	CARBON MONOXIDE	684.49	188	000630-08-0
190	TETRACHLOROETHANE	677.97	190	025322-20-7
191	HYDROGEN SULFIDE	676.51	193	007783-06-4
192	PENTACHLORODIBENZOFURAN	673.21	192	030402-15-4
193	CHLOROMETHANE	670.19	191	000074-87-3
194	BIS(2-METHOXYETHYL) PHTHALATE	666.08	194	034006-76-3
195	BUTYL BENZYL PHTHALATE	659.38	195	000085-68-7
196	CRESOL, ORTHO-	658.66	196	000095-48-7
197	HEXACHLOROETHANE	653.10	199	000067-72-1
198	VANADIUM	651.70	198	007440-62-2

199	N-NITROSODIMETHYLAMINE	650.71	200	000062-75-9
200	1,2,4-TRICHLOROBENZENE	647.30	203	000120-82-1
201	BROMOFORM	643.53	202	000075-25-2
202	TETRACHLORODIBENZO-P-DIOXIN	635.74	204	041903-57-5
203	1,3-DICHLOROBENZENE	631.41	205	000541-73-1
204	PENTACHLORODIBENZO-P-DIOXIN	625.12	207	036088-22-9
205	N-NITROSODIPHENYLAMINE	624.79	208	000086-30-6
206	1,2-DICHLOROETHYLENE	622.49	206	000540-59-0
207	2,3,7,8-TETRACHLORODIBENZOFURAN	622.15	210	051207-31-9
208	2-BUTANONE	620.01	209	000078-93-3
209	2,4-DICHLOROPHENOL	616.45	212	000120-83-2
210	1,4-DIOXANE	616.29	215	000123-91-1
211	FLUORINE	613.28	214	007782-41-4
212	NITRITE	612.64	216	014797-65-0
213	CESIUM-137	612.50	217	010045-97-3
214	SILVER	612.19	213	007440-22-4
215	CHROMIUM TRIOXIDE	610.85	218	007738-94-5
216	NITRATE	610.66	219	014797-55-8
217	POTASSIUM-40	608.91	220	013966-00-2
218	DINITROTOLUENE	607.65	221	025321-14-6
219	ANTIMONY	605.37	222	007440-36-0
220	COAL TAR PITCH	605.33	224	065996-93-2
221	THORIUM-227	605.32	223	015623-47-9
222	2,4,5-TRICHLOROPHENOL	604.83	225	000095-95-4
223	ARSENIC ACID	604.45	226	007778-39-4
224	ARSENIC TRIOXIDE	604.36	227	001327-53-3
225	PHORATE	603.10	228	000298-02-2
226	BENZOPYRENE	603.00	230	073467-76-2
227	CRESOLS	602.74	229	001319-77-3
228	CHLORDANE, TECHNICAL	602.62	231	012789-03-6
229	DIMETHOATE	602.61	232	000060-51-5
230	ACTINIUM-227	602.57	233	014952-40-0
230	STROBANE	602.57	233	008001-50-1
232	4-AMINOBIIPHENYL	602.51	235	000092-67-1
232	PYRETHRUM	602.51	235	008003-34-7
234	ARSINE	602.42	237	007784-42-1
235	NALED	602.32	238	000300-76-5
236	DIBENZOFURANS, CHLORINATED	602.13	239	042934-53-2
236	ETHOPROP	602.13	239	013194-48-4
238	ALPHA-CHLORDENE	601.94	241	056534-02-2
238	CARBOPHENOTHION	601.94	241	000786-19-6
240	DICHLORVOS	601.64	243	000062-73-7
241	CALCIUM ARSENATE	601.45	244	007778-44-1
241	MERCURIC CHLORIDE	601.45	244	007487-94-7
241	SODIUM ARSENITE	601.45	244	007784-46-5
244	FORMALDEHYDE	599.64	247	000050-00-0
245	2-CHLOROPHENOL	599.62	248	000095-57-8
246	PHENANTHRENE	597.68	249	000085-01-8
247	HYDROGEN FLUORIDE	588.03	250	007664-39-3
248	2,4-D ACID	584.47	251	000094-75-7
249	DIBROMOCHLOROMETHANE	580.59	252	000124-48-1
250	DIURON	579.16	253	000330-54-1
251	BUTYLATE	578.43	254	002008-41-5

252	DIMETHYL FORMAMIDE	578.23	255	000068-12-2
253	PYRENE	577.95	256	000129-00-0
254	DICHLOROBENZENE	577.70	211	025321-22-6
255	ETHYL ETHER	572.47	257	000060-29-7
256	DICHLOROETHANE	570.46	258	001300-21-6
257	4-NITROPHENOL	567.79	259	000100-02-7
258	1,3-DICHLOROPROPENE, CIS-	561.82	184	010061-01-5
259	PHOSPHINE	559.74	260	007803-51-2
260	TRICHLOROBENZENE	557.96	261	012002-48-1
261	2,6-DINITROTOLUENE	555.20	262	000606-20-2
262	FLUORIDE ION	549.64	263	016984-48-8
263	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	547.90	264	035822-46-9
264	METHYL PARATHION	545.83	265	000298-00-0
265	PENTAERYTHRITOL TETRANITRATE	545.59	266	000078-11-5
266	1,3-DICHLOROPROPENE, TRANS-	543.37	267	010061-02-6
267	BIS(2-ETHYLHEXYL)ADIPATE	540.20	268	000103-23-1
268	CARBAZOLE	534.52	269	000086-74-8
269	METHYL ISOBUTYL KETONE	533.24	271	000108-10-1
270	1,2-DICHLOROETHENE, CIS-	533.15	270	000156-59-2
271	STYRENE	532.70	272	000100-42-5
272	CARBARYL	530.98	273	000063-25-2
273	1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	529.45	274	067562-39-4
274	ACRYLONITRILE	528.28	275	000107-13-1
275	1-METHYLNAPHTHALENE	526.51	NEW	

Substances were assigned the same rank when two (or more) substances received equivalent total point scores.

CAS # = Chemical Abstracts Service Registry Number

This page was updated on 01/10/2008

APPENDIX 9
PERMITS REQUIRED

Permits Required

NYC DOB

New Building
Builders Pavement Plan
SD1 & SD2
Electrical Plumbing
Sprinkler
Sheeting and Shoring
Temp Electric

NYC DOT

Street Crossing
Container
Lane Closure

APPENDIX 10
ESTIMATED REMEDIAL COSTS

Track 1 – Estimated Remedial Cost

Tasks	Budget Cost/Range*
-Waste Characterization Sampling and Analysis	\$58,375
-Air Monitoring/Geologist on-site	\$75,600
-Sheeting and Shoring	\$434,480
-Engineering Supervision of excavation	\$60,000
-Soil disposal	\$1,009,300
-Post-excavation end point soil samples/DUSR	\$37,400
-Mobilization for excavation	\$89,600
-Installation of SVE System	\$125,000
-Operation and Maintenance Plan of SVE system	\$95,000
-Off-Site soil vapor Assessment	\$70,000
-Project management	\$25,000
-Groundwater treatment, monitoring and remediation	\$325,000
-FER	\$15,000
Total	\$2,419,755

*Subject to change based on field conditions

APPENDIX 11

GROUNDWATER REMEDIAL ACTION WORK PLAN

Groundwater Remedial Action Work Plan

**77-57 Vleigh Place, Queens, NY
Block 6630, Lot 1
NYSDEC BCP Number: C241168**

**PREPARED OCTOBER 18, 2017
REVISED DECEMBER 15, 2017**

INTRODUCTION

This Groundwater Remedial Action Work Plan (GRAWP) is intended to document the proposed remedial technology for the dissolved chlorinated volatile constituents (cVOCs) present beneath the southeastern upgradient portion of the property located at 77-57 Vleigh Place, Queens, New York. The property will hereafter be referred to as the "Site". The GRAWP has been proposed as part of the remedy outlined in the Remedial Action Work Plan (RAWP), to remediate the source and reduce the potential risk of chlorinated vapor emanating from the Site on-Site and into surrounding properties. Proposed remedy in this GRAWP consists of in-situ treatment of cVOCs in groundwater by a chemical oxidant identified as PersulfOx and a bioremedial agent identified as 3_D Microemulsion Factory Elumlsified (3DME) in accordance with manufacturer's specification and per the requirements of the New York State Department of Environmental Conservation (NYSDEC) in their correspondences dated November 17, 2017 and December 6, 2017. The GRAWP will be implemented independent of the schedule of the proposed Site development.

The Site has formally entered into to the New York State Department of Environmental Conservation (NYSDEC) Brownfields Cleanup Program (BCP) and given Site Number C241168. The applicant, Aldrich Management Co., LLC, has applied to this program as a Participant. The Site will be developed into a mixed use commercial and residential facility.

SITE BACKGROUND

The Site is located in the Flushing section in Queens, New York and is identified as Block 6630 and Lot 1 on the New York City Tax Map. The Site is 39,000-square feet and is bounded by Vleigh Place to the west, a 3-story multi-family building to the east, 78th Avenue to the south and 77th Road to north. The Site consisted of an approximately 11,500 square foot one-story commercial building housing thirteen (13) tenant spaces and an open yard covered by bare soil and utilized for parking by on-Site tenants. On December 30, 2016 the building was completely destroyed by a fire and was immediately condemned

by the NYCDOB and was then demolished and removed of during August 2017. The Site is currently vacant and is covered by a sub-grade concrete slab in poor condition and sub-grade stone foundation sidewalls in the area of the basement of the former building and a bare surface in the former parking area. **Figure 1** provides the specific locations of existing monitoring wells at the Site.

The subsurface environmental quality beneath the site was characterized in a Remedial Investigation Report (RIR) dated September 2017 as part of the Site remediation under the BCP. A total of thirteen (13) on-site and off-site monitoring wells including two (2) monitoring well nests designated MW-1 through MW-13 were previously installed as part of the RI. The groundwater beneath the Site was determined to flow toward the northwest. A plume of PCE and TCE was delineated beneath the southeast upgradient portion of the Site. The highest PCE concentrations of 2,200 µg/L and 11,000 µg/L are currently present in on-site monitoring wells MW-9 and MW-11 situated in the southeastern portion of the rear yard. PCE was also detected off-site at a concentration of 130 ug/L in upgradient monitoring well MW-12. Maximum TCE concentrations were detected at 75 ug/L in MW-9 and MW-11. This cVOCs plume extends off-site to both the east, west and north west as evidenced by off-site monitoring wells in those directions. **Figure 2** provides the groundwater contamination diagram.

PROPOSED REMEDIATION

Remediation of cVOCs present in groundwater will be accomplished in-situ through the application of chemical oxidant identified as PersulfOx. Since PersulfOx will create aerobic conditions in the subsurface, a bioremedial agent identified as 3_D Microemulsion Factory Elumlsified (3DME), which will create an anaerobic mechanism is recommended at least 3 months after the application of PersulfOx. The proposed area of injection will be confined to the source location in the hydraulic upgradient southeastern portion of the Site. Injections at this location will deliver the chemical oxidant and the bioremedial agent to the subsurface allowing them to flow with groundwater, treating residual contaminants in groundwater.

The remedial action covered in this groundwater remedial design will be conducted through the following activities.

1. Groundwater contamination will be treated first via PersulfOx followed by 3DME mixed with additives consisting of Bio-Dechlor Innoculum Plus (BDI Plus) and CRS Chemical Reducing Solution (CRS).
2. If the total cVOCs in groundwater were detected three months after the first round of PersulfOx injections at concentrations exceeding 7,000 µg/L, a second round of

PersulfOx injections will be performed as a contingency measure in this work plan before transitioning to anaerobic bioremediation via 3DME. The proposed injections of 3DME and its BDI Plus and CRS additives will be performed thereafter.

3. Implementation of a groundwater monitoring program.

1. Groundwater Remediation

Based upon communications with the manufacturer, it is recommended that PersulfOx is applied in a first application to reduce the cVOCs followed by a second application 3DME to promote anaerobic bioremediation to reduce the residual cVOC contamination. If the total concentration of cVOC contaminants detected in groundwater three months after the first PersulfOx injections exceeds 7,000 µg/L, a second round of PersulfOx injections will be performed before the injections of 3DME. In addition to the 3DME, manufacturer also proposed mixing 3DME with BDI and CRS as add-ons that will assist in the reductive dechlorination process.

The application of PersulfOx and 3DME will be performed via injections in the vicinity of the source area. Since remedial injection points for bioremedial agents and chemical oxidants are considered Class V UIC wells and are regulated through the USEPA UIC program, EPA will be notified of the construction of the injection well by filing form OMB No. 2040-0042 with the Region 1 USEPA office 30 days prior to performing any oxidant injection into oxidant injection wells.

During both applications, PersulfOx and 3DME will be mixed with water and injected as a solution in a semi-viscous form utilizing Geoprobe® GS1000 Grout Machine. The Grout Machine will inject PersulfOx and 3DME directly through a Pressure Activated Injection Probe.

The PersulfOx and 3DME solutions would be introduced into the saturated zone. PersulfOx will be introduced in an area that is approximately 990 square feet in the vicinity of MW-9, MW-11 and MW-12 via an anticipated 10 injection points evenly spaced 10 feet apart. If a second round of PersulfOx is required, the 10 injections points will be off-set at least 3 feet from the previous points. 3DME will be introduced in an area that is approximately 4,900 square feet in the southeastern portion of the Site via an anticipated 30 injection points evenly spaced 12.5 feet apart. The injection probes will be installed at 48 feet bgs. The solutions will be injected under pressure from that depth to the soil/groundwater interface at 32 feet bgs for a treatment zone of approximately 16-foot thick.

Approximately 4,133 pounds of PersulfOx mixed with 3,632 gallons of water will be applied during the first injection. During this injection, an anticipated 25.81 pounds of PersulfOx will be applied per foot in each injection point. If the first groundwater monitoring results obtained three months after the first remedial injections indicate CVOcs concentrations warrant a second round of PersulfOx application, these injections will be repeated using the same material quantity and solution.

Three months after completing PersulfOx injection, approximately 6,000 pounds of 3DME will be introduced in the ground along with 2,400 pounds of CRS and 30 liters of BDI additives. The solution will be created by mixing 3DME with 6,471 gallons of water for, mixing CRS with 274 gallons of water and mixing BDI with 300 gallons of water. During this injection, an anticipated 12.5 pounds of 3DME, 0.56 pounds of CRS and 0.06 liter of BDI will be applied per foot of the treatment zone.

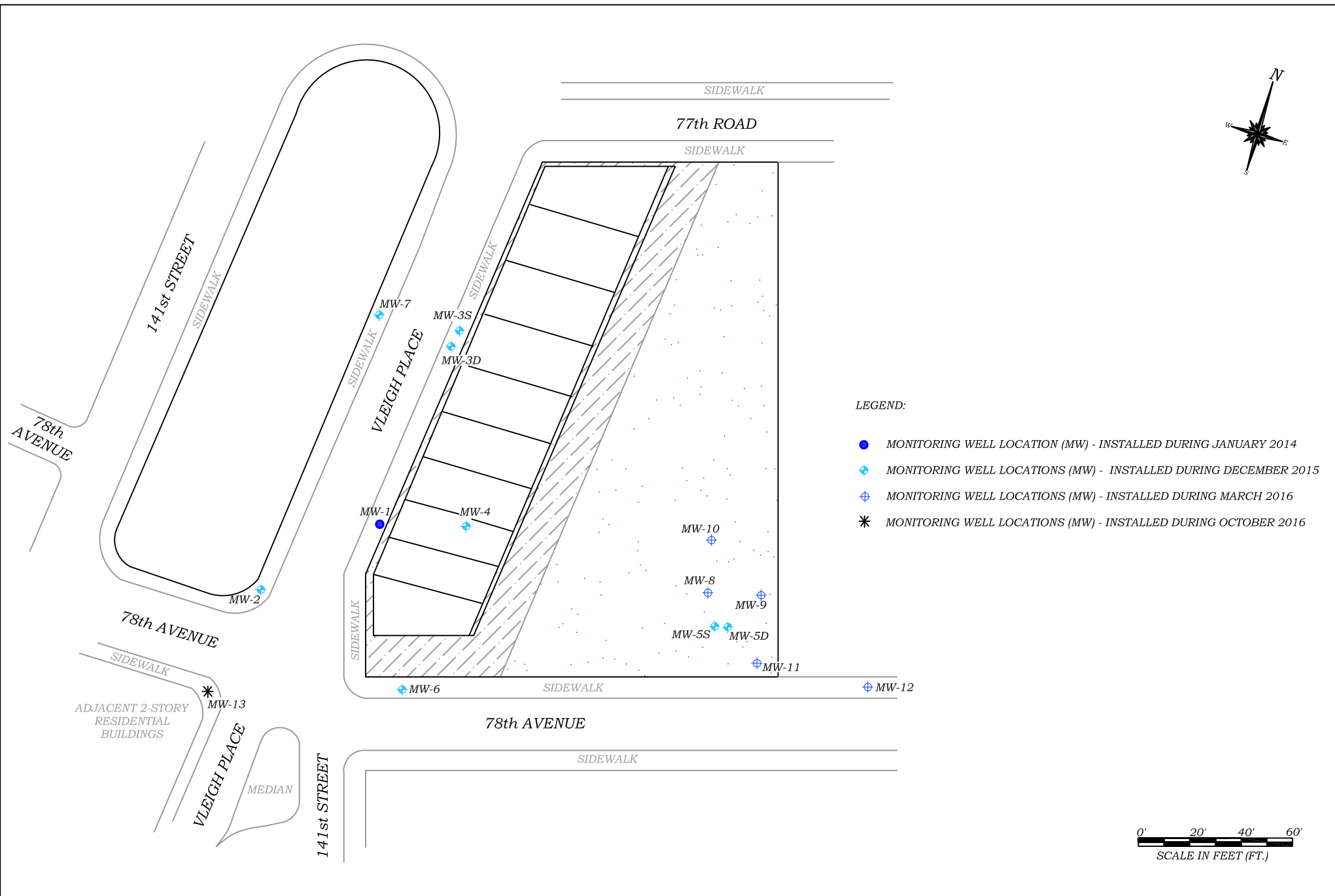
Figure 3 provides remedial injection points diagram. **Attachment #1** provides design summary of proposed applications of PersulfOx and 3DME and additives.

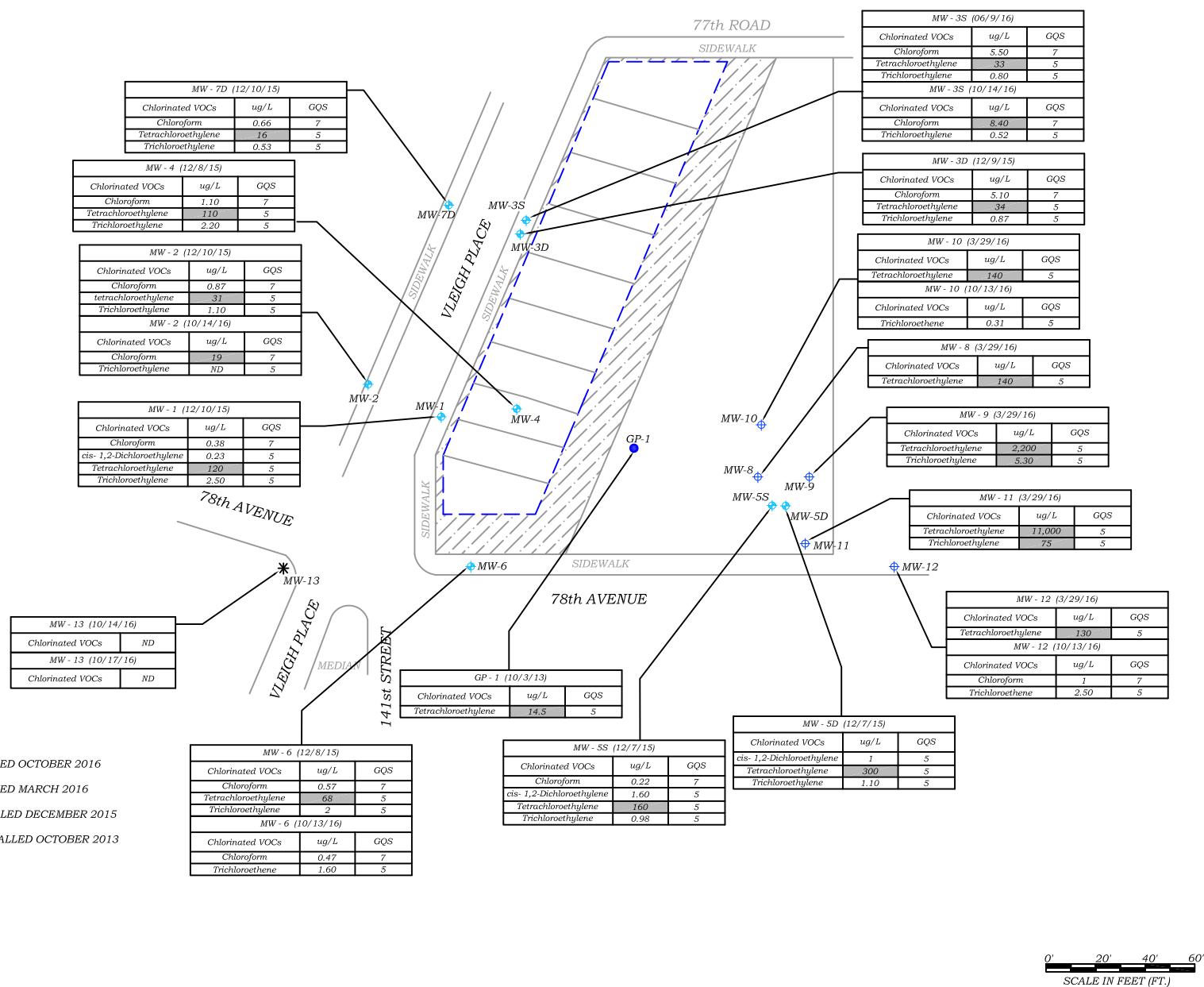
2. Implementation of a Sampling and Monitoring Program

Prior to commencement of injection activities, a round of sampling of groundwater will be conducted from all monitoring wells at the Site in order to establish background levels of CVOcs in the monitoring wells. Samples collected in the treatment area from monitoring wells MW-5S (Shallow), MW-8, MW-9, MW-10, MW-11, and MW-12 will also be analyzed for pH, DO, and ORP. The attenuation of pH, DO, and ORP will be monitored monthly in order to establish a 3-month trend showing a return to their baseline level as an indicator that PersulfOx has run its course and it is the appropriate time to inject 3DME and also to monitor the lifetime of 3DME.

Another round of sampling from all monitoring wells will be conducted three months after completing PersulfOx injections and quarterly for at least the next 24 months following the 3DME injections. The effectiveness of remedial action will be evaluated at 12 months following 3DME injections.

FIGURES





HYDRO TECH ENVIRONMENTAL CORP.

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77 ARKAY DRIVE, SUITE G
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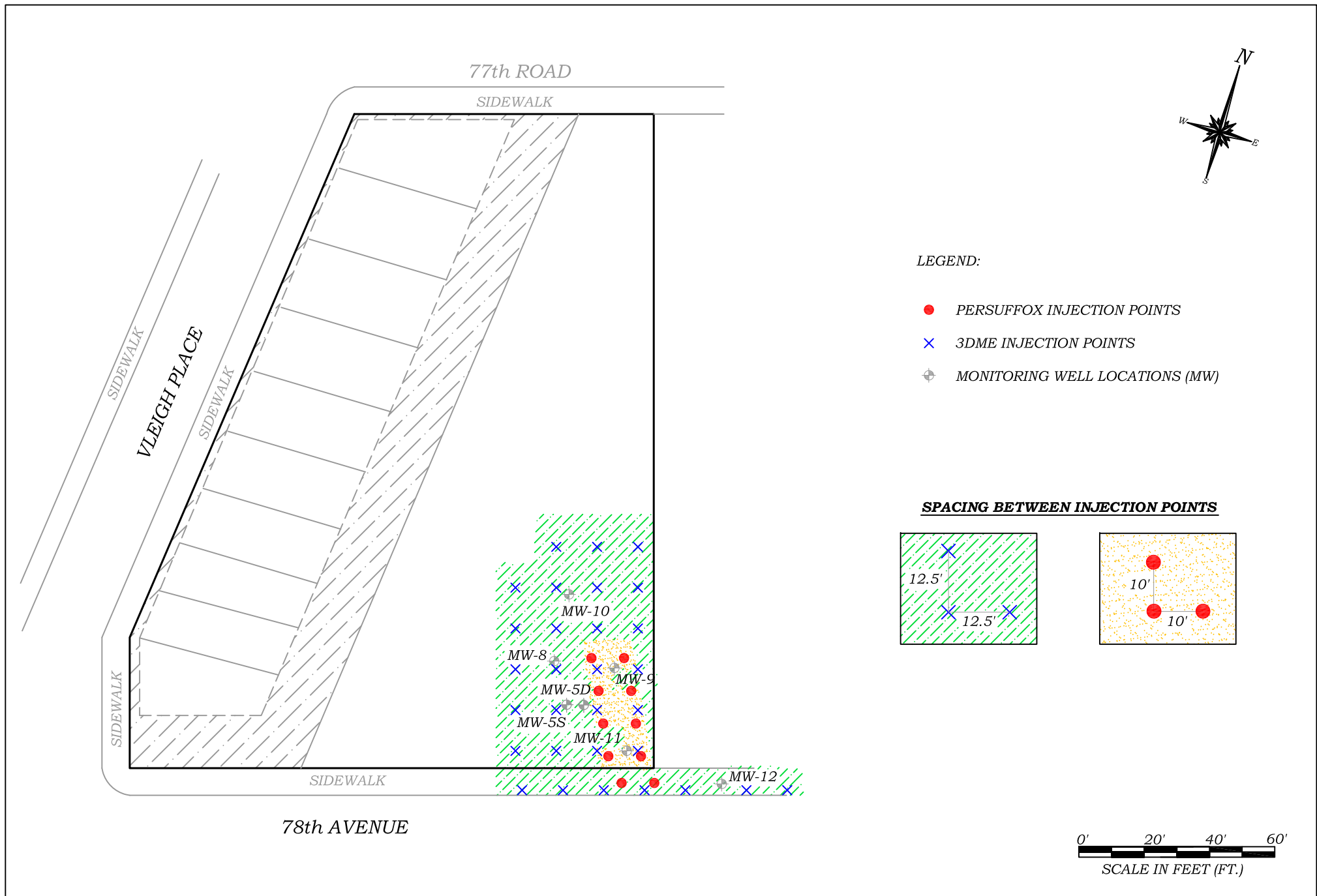
www.hydrotechenvironmental.com

77-57 Vleigh Pl
Flushing, NY
HTE Job# 170213

Drawn By: C.O.
Reviewed By: P.M.
Approved By: M.R.
Date: 10/11/17
Scale: AS NOTED

TITLE:

FIGURE 2: SPIDER MAP OF CVOCs IN EXCEEDANCE OF GA STANDARD IN GROUNDWATER



ATTACHMENT #1
DESIGN SUMMARY OF PROPOSED APPLICATIONS OF
PERSULFOX AND 3DME AND ADDITIVES



Project Information			PersulfOx® Application Design Summary		
77-57 Vleigh Place Queens, NY MW-9, MW-11, & 12 Hot Spot Prepared For: Paul Matli (Hydro Tech Environmental)			MW-9, MW-11, & 12 Hot Spot		Field App. Instructions
			Application Method	Direct Push	
			Spacing Within Rows (ft)	10	
			Spacing Between Rows (ft)	10	
Injection Points (per app.)	10				
Target Treatment Zone (TTZ) Info	Unit	Value	Number of Applications	2	Field Mixing Ratios
Treatment Area	ft²	990	Areal Extent (square ft)	990	
Top Treat Depth	ft	32.0	Top Application Depth (ft bgs)	32	Water per Pt per app (gals)
Bot Treat Depth	ft	48.0	Bottom Application Depth (ft bgs)	48	363
Vertical Treatment Interval	ft	16.0	PersulfOx to be Applied (lbs)	8,265	PersulfOx per Pt per app (lbs)
Treatment Zone Volume	ft³	15,840	PersulfOx Solution %	12%	413
Treatment Zone Volume	cy	587	Volume Water (gals)	7,263	Total Volume per Pt per app (gals)
Soil Type	---	sand	Total Volume (gals)	7,676	384
Porosity	cm³/cm³	0.33	Per Application Totals		
Effective Porosity	cm³/cm³	0.20	PersulfOx per app. (lbs)	4,133	Volume per vertical ft (gals)
Treatment Zone Pore Volume	gals	39,102	Volume Water per app. (gals)	3,632	24
Treatment Zone Effective Pore Volume	gals	23,698	Total Volume per app. (gals)	3,838	
Fraction Organic Carbon (foc)	g/g	0.002	Technical Notes/Discussion		
Soil Density	g/cm³	1.7	The second application of PersulfOx is a contingency event.		
Soil Density	lb/ft³	108			
Soil Weight	lbs	1.7E+06			
Hydraulic Conductivity	ft/day	25.0			
Hydraulic Conductivity	cm/sec	8.82E-03			
Hydraulic Gradient	ft/ft	0.003	Assumptions/Qualifications		
GW Velocity	ft/day	0.38			
GW Velocity	ft/yr	137	In generating this preliminary estimate, Regenesi relied upon professional judgment and site specific information provided by others. Using this information as input, we performed calculations based upon known chemical and geologic relationships to generate an estimate of the mass of product and subsurface placement required to affect remediation of the site. REGENESIS developed this Scope of Work in reliance upon the data and professional judgments provided by those whom completed the earlier environmental site assessment(s). The fees and charges associated with the Scope of Work were generated through REGENESIS' proprietary formulas and thus may not conform to billing guidelines, constraints or other limits on fees. REGENESIS does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the "Government"). In any circumstance where REGENESIS may serve as a supplier or subcontractor to an entity which seeks reimbursement from the Government for all or part of the services performed or products provided by REGENESIS, it is the sole responsibility of the entity seeking reimbursement to ensure the Scope of Work and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity which seeks reimbursement from the Government, REGENESIS does not knowingly present or cause to be presented any claim for payment to the Government. Prepared By: Andy Lowy - Design Specialist Date: 12/12/2017		
Sources of Oxidant Demand	Unit	Value			
Sorbed Phase Contaminant Mass	lbs	14			
Dissolved Phase Contaminant Mass	lbs	3.6			
Total Contaminant Mass	lbs	18			
Stoichiometric PersulfOx Demand	lbs	59			
Stoichiometric PersulfOx Required	lbs	294			
Additional Soil Oxidant Demand	g/kg	2.0			
SOD PersulfOx Required	lbs	3,801			
Total PersulfOx Required	lbs	4,095			
Application Dosing					
PersulfOx Required	lbs	8,265			

Paul Matli

From: Andy Lowy <ALowy@Regenesis.com>
Sent: Tuesday, December 12, 2017 12:29 PM
To: Paul Matli
Cc: Maureen Dooley; Tarek Khouri
Subject: RE: New NYSDEC BCP Project - Request for remediation of dissolved CVOCs - 77-57 Vleigh PL Queens NY
Attachments: 77-57 Vleigh Place December 2017 Revised Proposal.pdf

Hi Paul,

Attached is the revised proposal which now includes a second contingency application of PersulfOx. As for reductions following the first PersulfOx event, I think we would like to see the cVOC concentrations drop into the 5-7 ppm range before transitioning to the 3DMe. Please let me know if there are any further questions.

Thank you,

Andy Lowy
East Design Specialist
610-655-5259



For leading vapor intrusion mitigation, please visit www.landsciencetech.com, a division of **REGENESIS**



Confidentiality Note: This email may contain confidential and/or private information. If you received this email in error please delete and notify sender.

From: Paul Matli [mailto:pmatli@hydrotechenvironmental.com]
Sent: Wednesday, December 06, 2017 11:57 AM
To: Andy Lowy <ALowy@Regenesis.com>
Cc: Maureen Dooley <MDooley@Regenesis.com>; Tarek Khouri <tkhouri@hydrotechenvironmental.com>
Subject: RE: New NYSDEC BCP Project - Request for remediation of dissolved CVOCs - 77-57 Vleigh PL Queens NY

Andy - NYSDEC would like to set a conference call with you to discuss the reason you are proposing a single round of injections of PersulfOx in their response below.

“Comment #3 – We are not completely convinced that one injection of PersulfOx is sufficient to achieve the desired reduction in cVOCs in the groundwater. One additional comment that we would like addressed is what will be an acceptable reduction in cVOC contamination after the PersulfOx injection to make the cVOC concentrations more favorable for anaerobic bioremediation? If the reduction is not sufficient after three months, a second PersulfOx must be considered. Please add this contingency to the work plan. Samples will need to be collected and analyzed for cVOCs prior to the proposed 3DME injections. Property redevelopment will of course need to be factored into all future site remedial activities. “

Please advise if you have any objections to this request. If not, please advise on your availability by providing alternate dates and time.

Regards,



Project Information			3-D Microemulsion®, BDI® Plus, CRS® Application Design Summary			
77-57 Vleigh Place						
Queens, NY						
Dissolved Plume						
Prepared For:						
Paul Matli (Hydro Tech Environmental)						
Target Treatment Zone (TTZ) Info		Unit	Value	Dissolved Plume		Field App. Instructions
Treatment Area	ft ²	4,900	Application Method	Direct Push		
Top Treat Depth	ft	32.0	Spacing Within Rows (ft)	12.5		
Bot Treat Depth	ft	48.0	Spacing Between Rows (ft)	12.5		
Vertical Treatment Interval	ft	16.0	Application Points	30		
Treatment Zone Volume	ft ³	78,400	Areal Extent (square ft)	4,900		
Treatment Zone Volume	cy	2,904	Top Application Depth (ft bgs)	32		Field Mixing Ratios
Soil Type	---	sand	Bottom Application Depth (ft bgs)	48		
Porosity	cm ³ /cm ³	0.33	3DME to be Applied (lbs)	6,000		3DME Concentrate per Pt (lbs)
Effective Porosity	cm ³ /cm ³	0.20	3DME to be Applied (gals)	719		200
Treatment Zone Pore Volume	gals	193,536	3DME Mix %	10%		Mix Water per Pt (gals)
Treatment Zone Effective Pore Volume	gals	117,295	Volume Water (gals)	6,471		216
Fraction Organic Carbon (foc)	g/g	0.002	3DME Mix Volume (gals)	7,190		3DME Mix Volume per Pt (gals)
Soil Density	g/cm ³	1.7	CRS to be Applied (lbs)	2,400		240
Soil Density	lb/ft ³	108	CRS Volume (gals)	274		CRS Volume per Pt (gals)
Soil Weight	lbs	8.5E+06	BDI Plus to be Applied (L)	30		9
Hydraulic Conductivity	ft/day	25.0	BDI Mix Water Volume (gals)	300		BDI Volume per Pt (L)
Hydraulic Conductivity	cm/sec	8.82E-03	HRC Primer to be Applied (lbs)	0		1.0
Hydraulic Gradient	ft/ft	0.003	HRC Primer Volume (gals)	0		HRC Primer per Pt (lbs)
GW Velocity	ft/day	0.38	Total Application Volume (gals)	7,772		0
GW Velocity	ft/yr	137	Estimated Radius of Injection (ft)	3.7		Volume per pt (gals)
Sources of 3-D Microemulsion Demand			Prepared by: Andy Lowy - Design Specialist		Volume per vertical ft (gals)	
Dissolved Phase Mass	lbs	0	Date: 9/11/2017		16	
Sorbed Phase Contaminant Mass	lbs	1	Technical Notes/Discussion			
Competing Electron Acceptor Mass	lbs	145				
Stoichiometric 3DME Demand	lbs	152	Assumptions/Qualifications			
TTZ Groundwater Mass Flux	L/day	2,379	In generating this preliminary estimate, RegenesiS relied upon professional judgment and site specific information provided by others. Using this information as input, we performed calculations based upon known chemical and geologic relationships to generate an estimate of the mass of product and subsurface placement required to affect remediation of the site.			
CVOC Mass Flux through TTZ	lb/yr	1	REGENESIS developed this Scope of Work in reliance upon the data and professional judgments provided by those whom completed the earlier environmental site assessment(s). The fees and charges associated with the Scope of Work were generated through REGENESIS’ proprietary formulas and thus may not conform to billing guidelines, constraints or other limits on fees. REGENESIS does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the “Government”). In any circumstance where REGENESIS may serve as a supplier or subcontractor to an entity which seeks reimbursement from the Government for all or part of the services performed or products provided by REGENESIS, it is the sole responsibility of the entity seeking reimbursement to ensure the Scope of Work and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity which seeks reimbursement from the Government, REGENESIS does not knowingly present or cause to be presented any claim for payment to the Government.			
CEA Mass Flux through TTZ	lb/yr	172				
Total Mass Flux through TTZ	lb/yr	173				
Total Mass Flux 3DME Demand	lbs	537				
Application Dosing						
3-D Microemulsion to be Applied	lbs	6,000				
CRS to be Applied	lbs	2,400				
BDI Plus to be Applied	liters	30				
HRC Primer to be Applied	lbs	0				

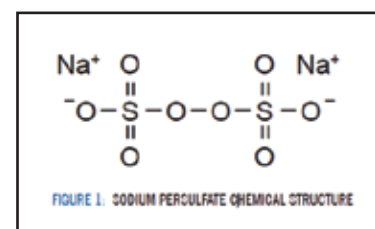
PersulfOx® Technical Description

PersulfOx is an *In Situ* Chemical Oxidation (ISCO) reagent that destroys organic contaminants found in groundwater and soil through powerful, yet controlled, chemical reactions. A sodium persulfate-based technology (figure 1), PersulfOx employs a patented catalyst to enhance the oxidative destruction of both hydrocarbons and chlorinated contaminants in the subsurface.

Typically, sodium persulfate is activated with the addition of heat, chelated metals, hydrogen peroxide, or base in order to generate sulfate radicals. These activation processes are inherently complex, costly and can pose additional health and safety risks. In comparison, PersulfOx is a relatively safe and easy-to-use ISCO agent with a built-in catalyst which activates the persulfate component, generating contaminant-destroying free radicals without the need for the addition of a separate activator. The equation below shows the net complete oxidation of toluene, a constituent of gasoline, by PersulfOx:



Example of PersulfOx



For a list of treatable contaminants with the use of PersulfOx, view the [Range of Treatable Contaminants Guide](#)

Chemical Composition

- Sodium Persulfate - CAS #7775-27-1
- Sodium Silicate - CAS #1344-09-8

Properties

- pH - 7 to 11.5 at 25°C
- Appearance - White, free-flowing powder, clear to cloudy when mixed with water
- Odor - Not detectable
- Vapor Pressure - None
- Chemical Hazard Classification - Class 5.1 Oxidizer

Storage and Handling Guidelines

Storage

Store locked up
Keep away from heat
Store in a cool, dry place out of direct sunlight

Handling

Minimize dust generation and accumulation
Routine housekeeping should be instituted to ensure that dust does not accumulate on surfaces



PersulfOx® Technical Description

Storage (continued)

Store in original tightly closed container
Store in a well-ventilated place
Do not store near combustible materials
Store away from incompatible materials
Recommended to store at less than 40°C
Provide appropriate exhaust ventilation in places where dust is formed

Handling (continued)

Avoid mixing with combustibles
Avoid contamination
Keep away from clothing and other combustible materials
Wear appropriate personal protective equipment
Avoid breathing dust
Avoid contact with eyes, skin, and clothing
Avoid prolonged exposure
Do not taste or swallow
When using, do not eat, drink or smoke
Wear appropriate personal protective equipment
Wash hands thoroughly after handling
Observe good industrial hygiene practices

Applications

- PersulfOx is mixed with water at a rate of 5% to 20% prior to application.
- For most applications, REGENESIS suggests a 10-15% solution. The resulting mixture has viscosity similar to water.
- Injects into formation through direct push injection points, injection wells or other injection delivery systems.

Application instructions for this product are contained here [PersulfOx Application Instructions](#).

Health and Safety

Material is relatively safe to handle; however, avoid contact with eyes, skin and clothing. OSHA Level D personal protection equipment including: vinyl or rubber gloves, eye protection, and dust mask are recommended when handling this product. Please review the Material Safety Data Sheet for additional storage, usage, and handling requirements here: [PersulfOx SDS](#).

3-D Microemulsion® Factory Emulsified Technical Description

3-D Microemulsion (3DME®) is comprised of a patented molecular structure containing oleic acids (i.e., oil component) and lactates/polylactates, which are molecularly bound to one another (figure 1). The 3DME molecule contains both a soluble (hydrophilic) and in-soluble (lipophilic) region. These two regions of the molecule are designed to be balanced in size and relative strength. The balanced hydrophilic/lipophilic regions of 3DME result in an electron donor with physical properties allowing it to initially adsorb to the aquifer material in the area of application, then slowly redistribute via very small 3DME “bundles” called micelles. These 3DME micelles spontaneously form within sections of the aquifer where concentrations of 3DME reach several hundred parts per million. The micelles’ small size and mobility allow it to move with groundwater flow through the aquifer matrix, passing easily through the pore throats in between soil grains resulting in the further redistribution of 3DME within the aquifer. This allows for advective distribution of the oleic acids which are otherwise insoluble and unable to distribute in this manner, allowing for increased persistence of the lactate/polylactates component due to their initial attachment to the oleic acids.

Due to its patented molecular structure, 3DME offers far greater transport when compared to blended emulsified vegetable oil (EVO) products, which fail to distribute beyond the limits of pumping. 3DME also provides greater persistence when compared to soluble substrates such as lactates or simple sugars. The 3DME molecular structures capitalize on the best features of the two electron-donor types while at the same time, minimize their limitations. 3DME is delivered to the site as a ready-to-apply emulsion that is simply diluted with water to generate a large volume of a 3DME colloidal suspension.

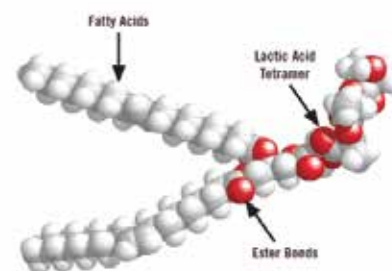
Suspension of 3DME generated by this mixing range from micelles on the order of .02 microns to .05 microns in diameter, to “swollen” micelles, (termed “microemulsions”) which are on the order of .05 to 5 microns in diameter. Once injected into the subsurface in high volumes, the colloidal suspension mixes and dilutes in existing pore waters. The micelles/microemulsions on the injection front will then begin to sorb onto the surfaces of soils as a result of zeta potential attraction and organic matter within the soils themselves. As the sorption continues, the 3DME will “coat” pore surfaces developing a layer of molecules and in some cases a bilayer. This sorption process continues as the micelles/microemulsion moves outward and disassociates into their hydrophilic/hydrophobic components. The specialized chemistry of 3DME results in a staged release of electron donors: free lactate (immediate); polylactate esters (mid-range) and free fatty acids & fatty acid esters (long-term). Material longevity of three years or greater has been seen at most sites as determined from biogeochemical analyses.

For a list of treatable contaminants with the use of 3DME, view the [Range of Treatable Contaminants Guide](#)



Example of 3-D Microemulsion

FIGURE 1: THE 3-D MICROEMULSION MOLECULAR STRUCTURE



Chemical Composition

- Hydrogen Release Compound Partitioning Electron Donor – CAS #823190-10-9
- Sodium Lactate – CAS# 72-17-3
- Water – CAS# – 7732-18-5

3-D Microemulsion® Factory Emulsified Technical Description

Properties

- Density – Approximately 1.0 grams per cubic centimeter (relative to water)
- pH – Neutral (approximately 6.5 to 7.5 standard units)
- Solubility – Soluble in Water
- Appearance – White emulsion
- Odor – Not detectable
- Vapor Pressure – None
- Non-hazardous

Storage and Handling Guidelines

Storage

Store in original tightly closed container

Store in a cool, dry, well-ventilated place

Store away from incompatible materials

Recommended storage containers: plastic lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass

Handling

Avoid contact with eyes, skin, and clothing

Provide adequate ventilation

Wear appropriate personal protective equipment

Observe good industrial hygiene practices

Applications

- 3DME is diluted with water prior to application. Resulting emulsion has viscosity similar to water.
- Easily injects into formation through direct push injection points, injection wells or other injection delivery systems.

Application instructions for this product are contained here [3DME FE Application Instructions](#).

Health and Safety

Material is food grade and relatively safe to handle. We recommend avoiding contact with eyes and prolonged contact with skin. OSHA Level D personal protection equipment including vinyl or rubber gloves, and eye protection are recommended when handling this product. Please review the Material Safety Data Sheet for additional storage, usage, and handling requirements here: [SDS-3DME FE](#).



www.regenesis.com
1011 Calle Sombra, San Clemente CA 92673
949.366.8000

BDI PLUS® Technical Description

Bio-Dechlor INOCULUM Plus (BDI PLUS®) is an enriched natural consortium containing species of *Dehalococcoides* sp. (DHC). BDI PLUS has been shown to simulate the rapid and complete dechlorination of chlorinated solvents such as tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE) and vinyl chloride (VC) to non-toxic end products, ethene, carbon dioxide and water.

The culture also contains microbes capable of dehalogenating halomethanes (e.g., carbon tetrachloride and chloroform) and haloethanes (e.g., 1,1,1-TCA and 1,1-DCA) as well as mixtures of these contaminants.



Species of *Dehalococcoides* sp. (DHC)

For a list of treatable contaminants with the use of BDI PLUS, view the [Range of Treatable Contaminants Guide](#)

Chemical Composition

- Non-hazardous, naturally-occurring, non-altered anaerobic microbes and enzymes in a water-based medium.

Properties

- Appearance – Murky, yellow to grey water
- Odor – Musty
- pH 6.0 to 8.0
- Density – Approximately 1.0 grams per cubic centimeter (0.9 to 1.1 g/cc)
- Solubility – Soluble in Water
- Vapor Pressure – None
- Non-hazardous

Storage and Handling Guidelines

Storage

Store in original tightly closed container

Store away from incompatible materials

Recommended storage containers: plastic lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass

Store in a cool, dry area at 4-5°C (39 - 41°F)

Material may be stored for up to 3 weeks at 2-4°C without aeration

Handling

Avoid prolonged exposure

Observe good industrial hygiene practices

Wear appropriate personal protective equipment

BDI PLUS® Technical Description

Applications

- BDI PLUS is delivered to the site in liquid form and is designed to be injected directly into the saturated zone requiring treatment.
- Most often diluted with de-oxygenated water prior to injection into either hydraulic push injection points or properly constructed injection wells.
- The typical dilution rate of the injected culture is 10 gallons of deoxygenated water to 1 liter of standard BDI PLUS culture.

Application instructions for this product are contained here [BDI PLUS Application Instructions](#).

Health and Safety

Material is non-hazardous and relatively safe to handle; however avoid contact with eyes and prolonged contact with skin. OSHA Level D personal protection equipment including: vinyl or rubber gloves and safety goggles or a splash shield are recommended when handling this product. An eyewash station is recommended. Please review the Material Safety Data Sheet for additional storage, usage, and handling requirements here: [BDI PLUS SDS](#).



www.regenesis.com
1011 Calle Sombra, San Clemente CA 92673
949.366.8000

CRS® Technical Description

CRS® (Chemical Reducing Solution) is an iron-based reagent that facilitates biogeochemical *in situ* chemical reduction (ISCR) of halogenated contaminants such as chlorinated ethenes and ethanes. CRS is a pH neutral, liquid iron solution that is easily mixed with 3-D Microemulsion® Factory Emulsified before injection into a contaminated aquifer. CRS provides a soluble, food-grade source of ferrous iron (Fe^{2+}), designed to precipitate as reduced iron sulfides, oxides, and/or hydroxides. These Fe^{2+} minerals are capable of destroying chlorinated solvents via chemical reduction pathways, thus improving the efficiency of the overall reductive dechlorination process by providing multiple pathways for contaminant degradation in groundwater.



Example of CRS

For a list of treatable contaminants with the use of CRS, view the [Range of Treatable Contaminants Guide](#).

Chemical Composition

- | | |
|---------------------|-----------|
| • Water | 7732-18-5 |
| • Ferrous Gluconate | 299-29-6 |

Properties

- Appearance – Dark green to black
- Odor – Odorless
- pH 6.0 to 8.0
- Density – Approximately 1.0 grams per cubic centimeter (0.9 to 1.1 g/cc)
- Solubility – Miscible
- Vapor Pressure – None
- Non-hazardous

Storage and Handling Guidelines

Storage

- Store in original tightly closed container
- Store away from incompatible materials
- Recommended storage containers: plastic-lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass
- Store in a cool, dry, well-ventilated place
- Keep away from extreme heat and strong oxidizing agents

Handling

- Avoid prolonged exposure
- Observe good industrial hygiene practices
- Wear appropriate personal protective equipment
- Avoid contact with eyes, skin, and clothing
- Avoid breathing spray mist
- Use with adequate ventilation

CRS® Technical Description

Applications

- Permanent injection wells
- Direct-push injection points

Application instructions for this product are contained in the CRS Application Instructions.

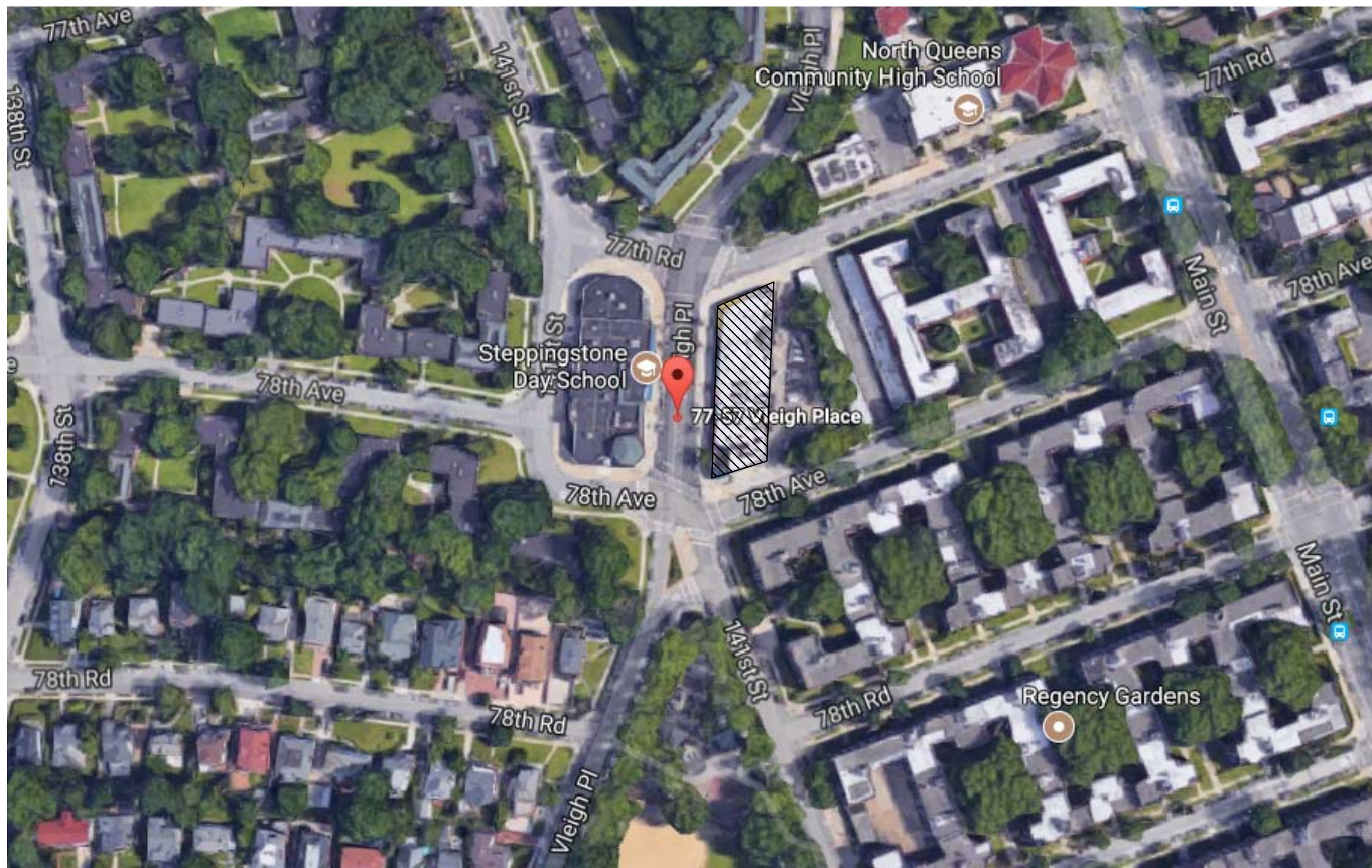
Health and Safety

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200. Observe good industrial hygiene practices. Wash hands after handling. Store away from incompatible materials. Dispose of waste and residues in accordance with local authority requirements. Please review the [CRS PLUS Material Safety Data Sheet](#) for additional storage, usage, and handling requirements.

APPENDIX 14

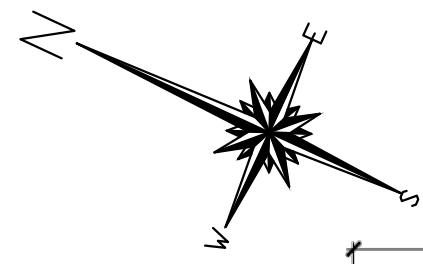
SVE SYSTEMS DESIGN AND SPECIFICATIONS

DESIGN DRAWINGS
SOIL VAPOR EXTRACTION SYSTEM
77-57 VLEIGH PLACE, FLUSHING, QUEENS
JUNE 2017



- 1. COVER SHEET WITH SITE LOCATION MAP
- 2. SVE DESIGN DETAILS
- 3. SVE TRAILER EQUIPMENT DETAILS

HAKS PROJECT NO. 810			
PROPOSED COMMERCIAL BUILDING AT: 77-57 VLEIGH PLACE, FLUSHING, QUEENS			
Site Location Map			
DWG. NO. 1	SCALE N.T.S.	DATE JUNE 2017	SHEET 1 OF 3



11TH ROAD
(60' WIDE)
100'-6"
(100'-6")

SEE SVE
EXTRACTION WELL
DETAIL

MAIN STREET
(100' WIDE)

SEE SVE
EXTRACTION WELL
DETAIL

4" SOLID PVC
MANIFOLD/HEADER
PIPE

SEE SVE
EXTRACTION WELL
DETAIL

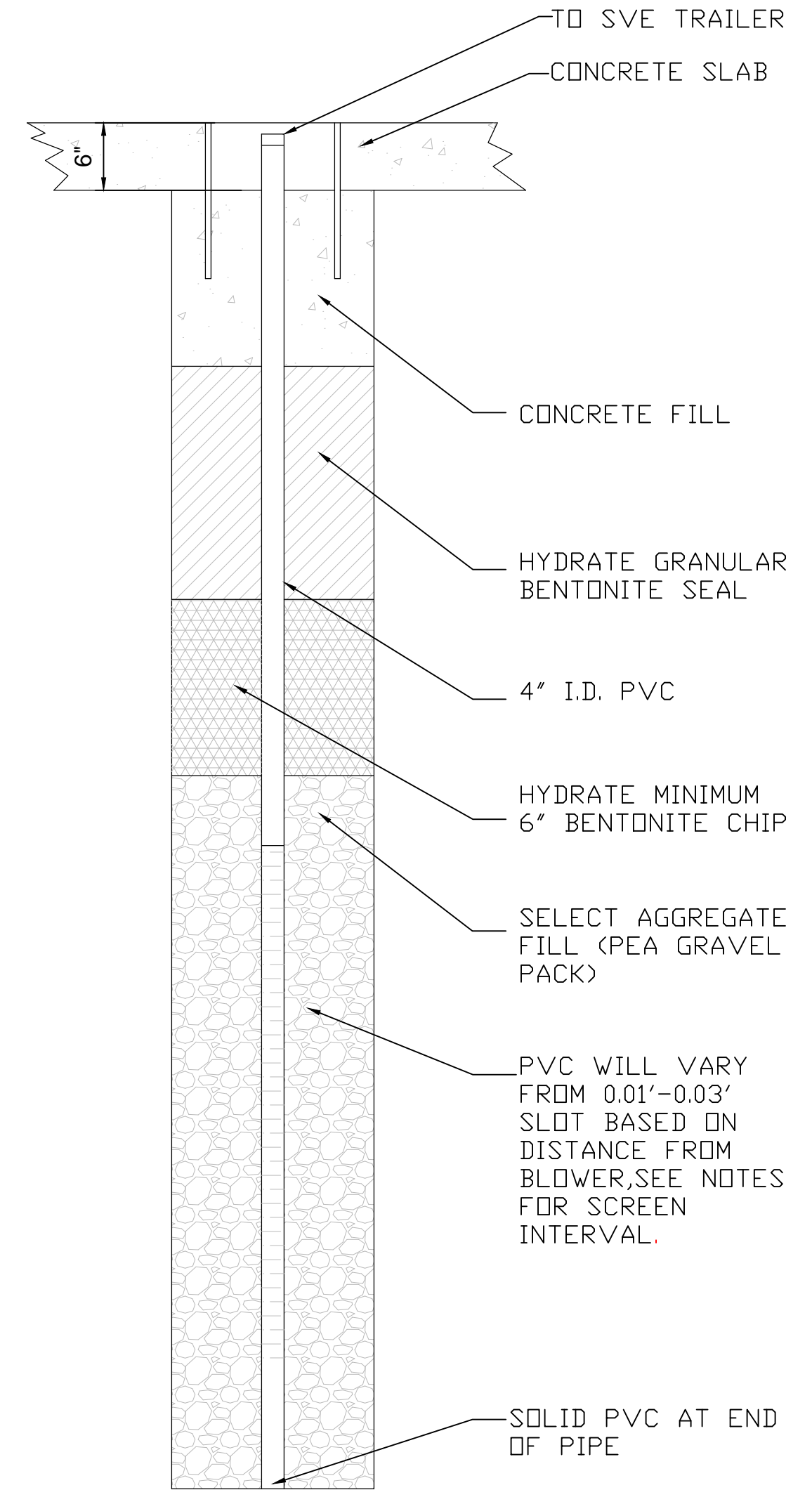
PROPOSED LOCATION
OF SVE TRAILER
EQUIPMENT

78TH AVENUE
(60' WIDE)
206'-3"
(206'-3")

CEILING HEIGHT 8'-0"
(FLOOR TO FLOOR)

PROPOSED CELLAR FLOOR PLAN
SCALE: 3/32" = 1'-0"

VLEIGH PLACE
(IRREGULAR WIDTH)
180'-3"
(180'-3")
253'-4"
(253'-4")



6" DIA. BOREHOLE

SOIL VAPOR EXTRACTION WELL
(TYPICAL)
SCALE: 1"=1'-0"

SVE WELLS DETAILS:

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

VACUUM MONITORING POINT DETAILS

EACH PRESSURE MONITORING POINT (VMP) WILL BE 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 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 MDRIE 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.

LEGEND:

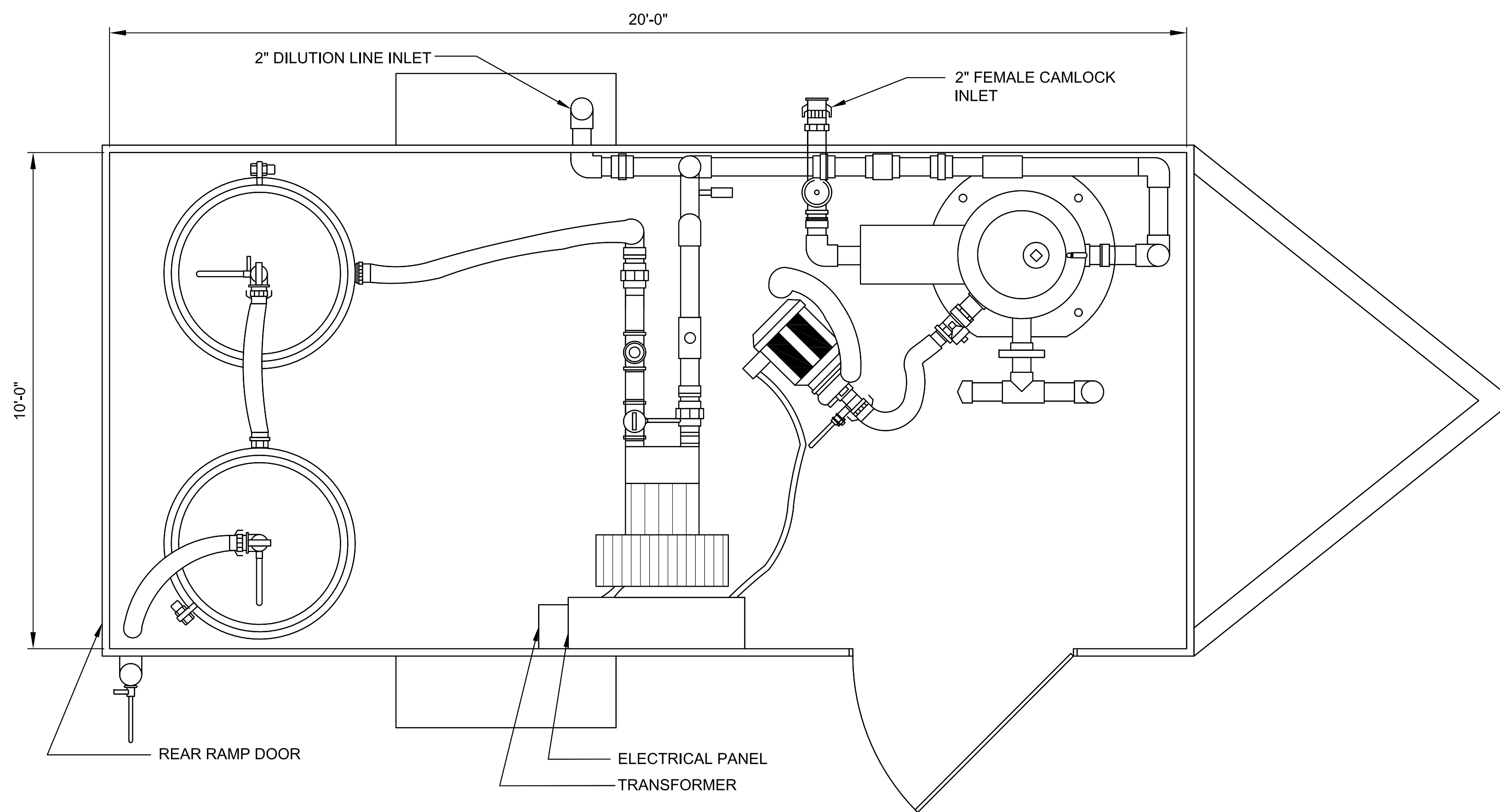
- 4" SOLID PVC MANIFOLDED PIPING TO SVE TRAILER
- PROPOSED SVE VAPOR EXTRACTION WELL
- RADIUS OF INFLUENCE (30')
- PROPOSED LOCATION OF SVE EQUIPMENT TRAILER (12'x7'x8')
- PRESSURE MONITORING POINTS

NOTES:

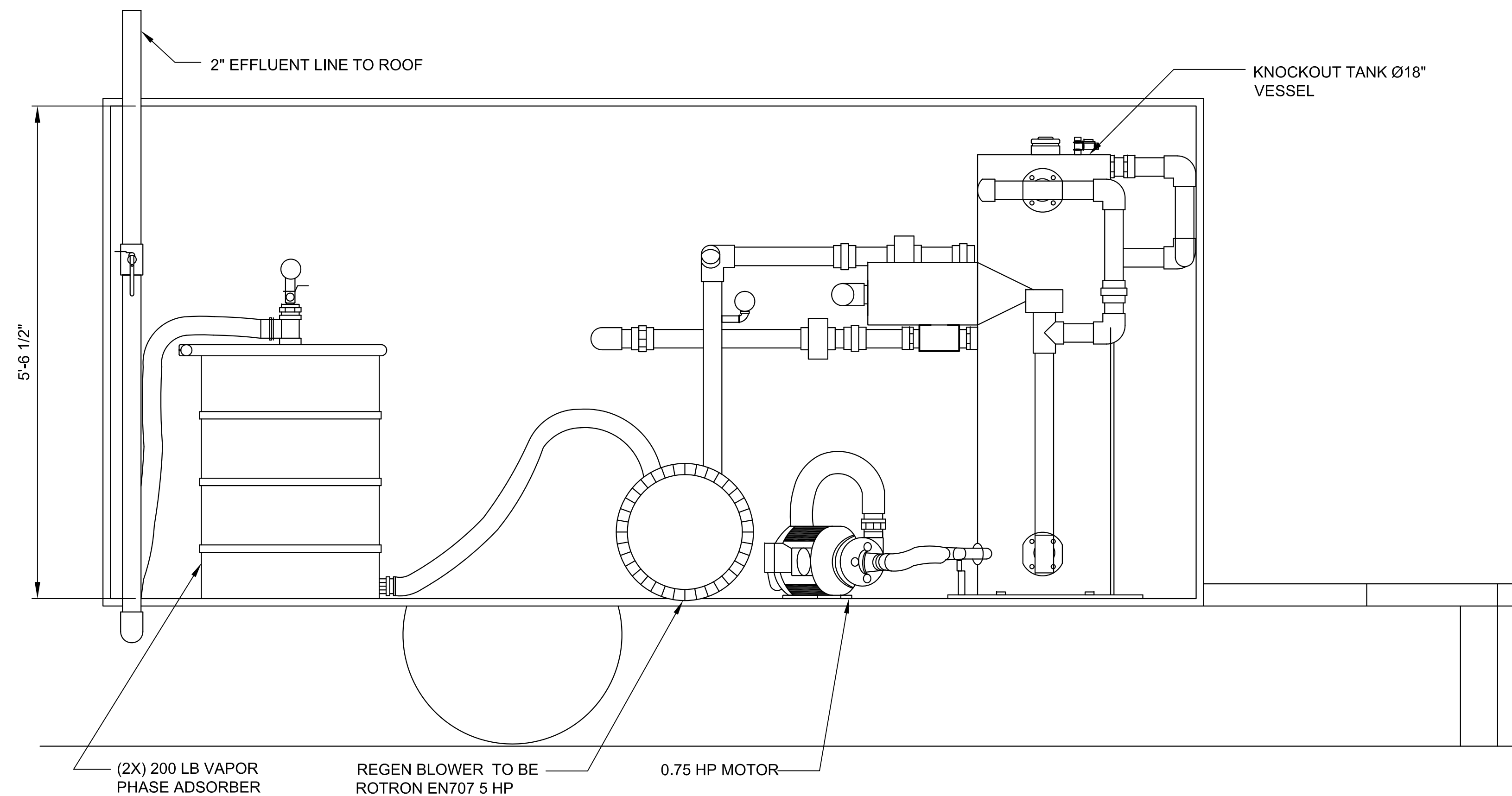
1. THE COMPONENTS OF THE SVE SYSTEM WILL BE LOCATED WITHIN A PORTABLE TRAILER AND CAN BE MOVED FOR SITE ACCESS PURPOSES. THE LOCATION AS SHOWN IS APPROXIMATE.
2. THE LOCATIONS OF THE SOLID MANIFOLDED PIPE ARE SHOWN AS APPROXIMATE AND MAY VARY BASED ON SITE CONDITIONS, ACCESS RESTRICTIONS, AND SITE LOGISTICS.
3. BASE DRAWING PROVIDED BY ARNOLD MONTAG, ARCHITECT - AM/PM DESIGN & CONSULTING, P.C.

SVE WELL ID	SCREENED INTERVAL	WELL SCREEN DIA.
EW - 1	20' - 25'	0.03'
EW - 2	29' - 34'	0.03'
EW - 3	25' - 30'	0.03'

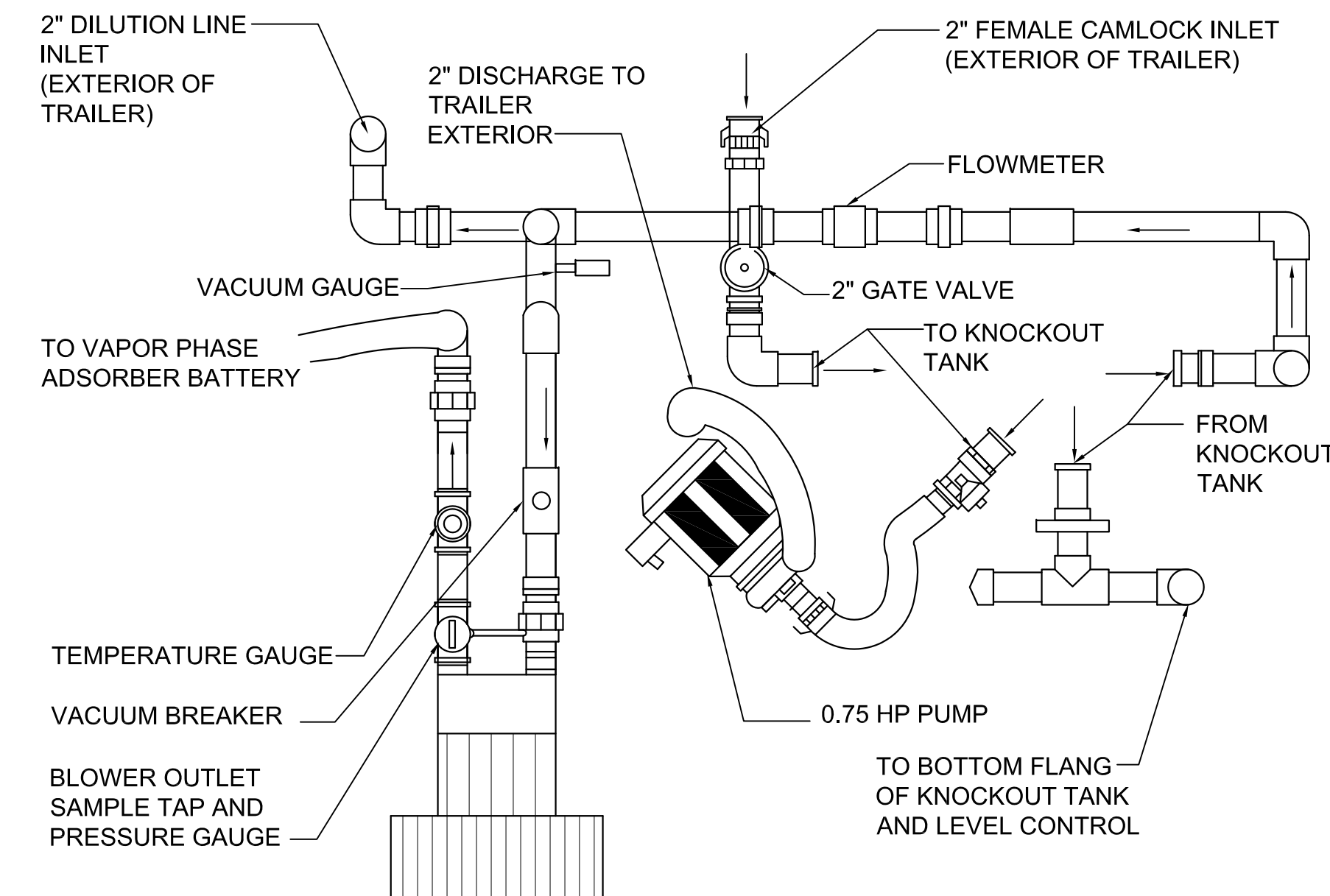
HAKS PROJECT NO. 810			
PROPOSED COMMERCIAL BUILDING AT: 77-57 VLEIGH PLACE, FLUSHING, QUEENS			
SVE DESIGN DETAILS			
DWG. NO. 2	SCALE N.T.S.	DATE JUNE 2017	SHEET 2 OF 3



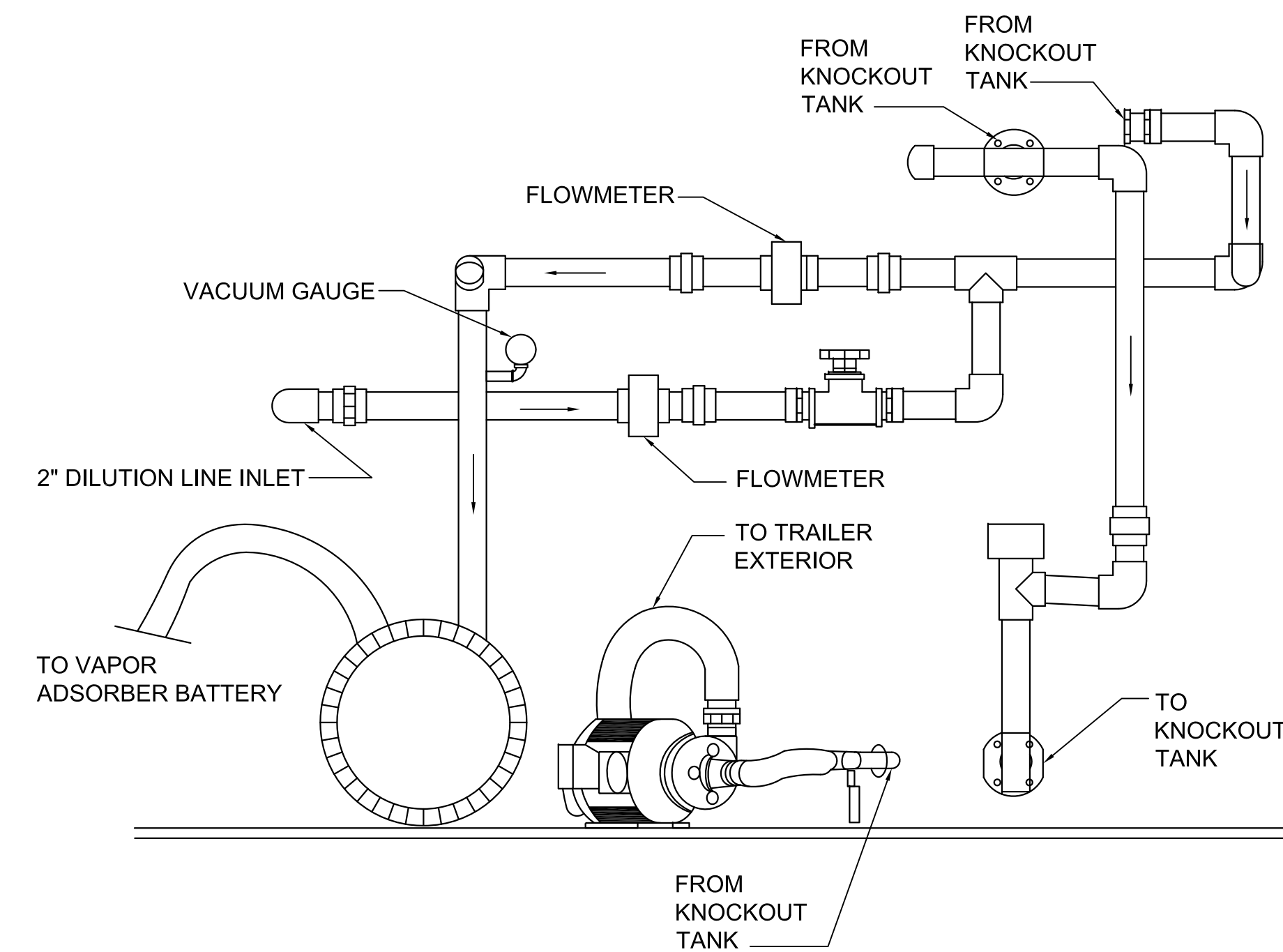
SVE TRAILER EQUIPMENT PLAN VIEW
SCALE: 1"=1'-0



SVE TRAILER EQUIPMENT SECTION VIEW
SCALE: 1"=1'-0



SVE EQUIPMENT PLAN VIEW
SCALE: 1"=1'-0



SVE EQUIPMENT SECTION VIEW
SCALE: 1"=1'-0

Notes:

1. The SVE System will be operated using a Rotron EN707 Sealed Regenerative Blower with explosion proof motor or equivalent. Design airflow was approximated between 150-200 cubic feet per minute. The standard motor is 5 horsepower.
2. A 0.75 HP liquid knockout motor will provide liquid phase removal prior to airflow reaching the Rotron blower.
3. Two (2) two hundred (200) pound vapor phase granular activated carbon drums or equivalent will be used for the treatment of vacuum extracted air.
4. Owner will be required to provide four sources of 208-230/415-460 VAC 3 Phase power to SVE equipment trailer.

APPENDIX 13
FER APPROVAL CHECKLIST

Checklist for Final Engineering Report (FER) Approval

Applies to sites in the Brownfield Cleanup Program (BCP), Environmental Restoration Program (ERP), Voluntary Cleanup Program (VCP) and Inactive Hazardous Waste Disposal Site Program (SSF)

Site Name:

Municipality:

County:

Site No.:

This FER is for a project which:

- ☐ Includes a summary of one or more construction completion reports (CCRs) - if checked the FER must reference of these previous CCRs for the areas identified below.
- ☐ Is for a single remedial action

All FERs submitted to DEC for approval will be prepared by an individual licensed or otherwise authorized in accordance with article 145 of the education law of the State of New York to practice the profession of engineering, and include the following:

Technical Content of the Report:

The FER must include the following:

- ☐ **Yes** Clear identification of the boundaries of the site as described in the Brownfield Cleanup Agreement (BCA), ERP State Assistance Contract, Voluntary Cleanup Agreement, or for a Superfund site as defined in the Order on Consent or the Inactive Hazardous Waste Disposal Site Registry.
- ☐ **Yes** ☐ **N/A** Clear identification of the boundaries of the real property subject to the environmental easement or other institutional controls, if different than the site boundaries described above.
- ☐ **Yes** A metes and bounds description and survey map must be included in the FER which corresponds to the above site boundaries. If no survey was required as part of an institutional control, (i.e., for Track 1 or unrestricted remedies of an entire tax parcel), then these can be the metes and bounds description from the property deed and the property tax map.
- ☐ **Yes** A description of the remedial activities completed at the site, including previous CCRs and the project which is the subject of this FER, completed in accordance with the remedial work plan(s) and/or decision document(s) for the site.
- ☐ **Yes** ☐ **N/A** A complete description of any ICs/ECs employed at the site.
- ☐ **Yes** Identification of the cleanup levels applied to the remedial actions, for each media of concern and area of concern at the site.
- ☐ **Yes** A summary of the implementation of the remedial actions, which includes as appropriate:

- ☐ A description of any problems encountered during construction and their resolution;
- ☐ A description of changes to the design documents and why the changes were made; including documentation of the approval of the change by DEC.
- ☐ Quantities and concentration of contaminants removed or treated;
- ☐ A listing of the waste streams, quantity of materials disposed and where they were disposed.

☐ **Yes** The FER substantially follows the guidance provided in [DER-10: Technical Guidance for Site Investigation and Remediation](#) and specifically includes the following, as appropriate to the remedy:

☐ **Yes** ☐ **No** ☐ **N/A** A detailed description of site restoration activities pursuant to DER-10.

☐ **Yes** ☐ **No** ☐ **N/A** A detailed description of the source and quality of imported fill pursuant to DER-10.

☐ **Yes** ☐ **No** ☐ **N/A** For active groundwater remedial actions consisting of groundwater extraction or control: The FER should also include figures representative of flow conditions immediately preceding initiation of the remedial action and flow conditions representative of pumping conditions required by the remedy.

☐ **Yes** ☐ **No** ☐ **N/A** For SSF and ERP projects, where State funding is provided: A detailed summary of actual costs including bid tabulations and change orders.

Tables and Figures:

Included ☐ **Yes** ☐ **No** ☐ **N/A**

As set forth in DER-10 tables and figures presenting post-remedial data as appropriate to document the satisfactory completion of the remedial action. The figure/tables should clearly indicate the nature and extent of any contamination remaining at the site.

As-Built Drawings:

Included ☐ **Yes** ☐ **No** ☐ **N/A**

"As-built" drawings, with a NYS P.E. stamp and signature on each drawing, were provided. The as-built drawings must identify:

☐ **Yes** The boundaries of the site, and if different, the real property subject to the environmental easement; other institutional controls must be incorporated on all figures.

☐ **Yes** ☐ **N/A** The location and extent of all engineering controls including, without limitation, slurry walls, treatment units, piping and instrumentation wiring or other remedial structures which will remain in place after completion of the remedial action.

☐ **Yes** ☐ **No** ☐ **N/A** Permanent survey markers for horizontal and vertical control for site management, where required.

☐ **Yes** ☐ **No** ☐ **N/A** For projects with soil covers and/or caps: the areal and vertical (depth) extent of the covered/capped area, including identification of buildings and/or paving which are considered part of the site cover/cap as well as a description of the material and depths of the demarcation layer.

☐ **Yes** ☐ **No** ☐ **N/A** For projects with soil removals: the limits of the excavation, the depth of the excavation and location of all documentation samples.

☐ **Yes** ☐ **No** ☐ **N/A** For projects with underground storage tank removals: the size and contents of the tank(s) identified and addressed by the remedy, the surveyed location of the tanks removed or abandoned in place and the extent of any soil removal as per above.

Electronic Attachments:

Included ☐ **Yes** ☐ **No** ☐ **N/A**

The following information should be submitted only in an electronic format that is acceptable to the DER with the FER.

☐ **Yes** ☐ **No** ☐ **N/A** Copies of all fully executed manifests documenting off-site transport and disposal of all material deemed hazardous or solid wastes.

☐ **Yes** ☐ **No** ☐ **N/A** All analytical data for pre and post-excavation samples, soil backfill analyses, treated water effluent analyses, and waste disposal characterizations, including all laboratory data sheets and the required laboratory data deliverables pursuant to DER-10.

☐ **Yes** ☐ **No** ☐ **N/A** Photographs

EQuIS Data Packages

☐ **Yes** ☐ **No** ☐ **At a minimum, post-excavation soil data and baseline groundwater groundwater data must be submitted and accepted into EQuIS.**

Site Management Plan (SMP):

☐ **N/A** If none is required for the remedy which is the subject of this FER, check here.

☐ **Yes** The approved SMP is included in, or specifically referenced by, the FER.

☐ **Yes** The required certification regarding the SMP is included in the Certification Section below.

Environmental Easement or Deed Restriction (where applicable)

☐ **N/A** If none is required for the remedy which is the subject of this FER, check here.

☐ **Yes** A filed copy of the environmental easement or deed restriction with proof of filing with the responsible municipal authority is included in the FER or has been provided to DEC.

☐ **Yes** A certification that the easement or deed restriction has been filed and the municipalities having jurisdiction over the easement or deed restriction have been notified is required. See Certification Section below for the language of this certification.

☐ **Yes** ☐ **No** The County Recording Identifier number is provided in the FER.

Financial Assurance

☐ **N/A** If none is required for the remedy which is the subject of this FER, check here.

☐ **Yes** ☐ **No** ☐ **N/A** Identify the financial assurance mechanisms required for the site and include the copy of the executed mechanism.

☐ **Yes** A certification that the Financial Assurance has been submitted by the applicant must be included in the FER. See Certification Section below for the language of this certification.

Citizen Participation

☐ **Yes (BCP Only)** A fact sheet was issued to the site contact list after the FER was submitted, but prior to DEC approval of the FER.

- ☐ **Yes (BCP Only)** A fact sheet to the site contact list will also be issued within 10 days of when the Certificate of Completion is issued by DEC and, if applicable, will include a summary of the institutional and/or engineering controls implemented by the remedy.
- ☐ **Yes (SSF Only)** A Notice of the COC/Reclassification shall be combined into one Fact Sheet and mailed to the site contact list no sooner than 20 days after issuance of the of the COC. If the site is being delisted, the notice may be mailed immediately; allow for a 30 day public comment period and the classification will be changed 60 days after the COC issuance (or end of comment period if later)
- ☐ **N/A (ERP)**

FER Professional Engineer Certification and Stamp:

Included ☐ **Yes** ☐ **No**

The FER will be prepared, stamped and the following certification signed by an [individual licensed or otherwise authorized in accordance with article 145 of the education law to practice the profession of engineering](#):

- ☐ I, _____, am currently a registered professional engineer licensed by the State of New York, I had primary direct responsibility for implementation of the remedial program activities, and I certify that the [Remedial Action Work Plan or Remedial Design] was implemented and that all construction activities were completed in substantial conformance with the Department-approved [Remedial Action Work Plan or Remedial Design].

Included ☐ **Yes** ☐ **No**

If the RAWP or RD identifies time frames to be achieved by the remedial program:

- ☐ I certify that the data submitted to the Department with this Final Engineering Report demonstrates that the remediation requirements set forth in the [Remedial Action Work Plan or Remedial Design] and in all applicable statutes and regulations have been or will be achieved in accordance with the time frames, if any, established for the remedy.

Included ☐ **Yes** ☐ **No**

- ☐ I certify that all use restrictions, Institutional Controls, Engineering Controls, and/or any operation and maintenance requirements applicable to the Site are contained in an environmental easement created and recorded pursuant ECL 71-3605 and that all affected local governments, as defined in ECL 71-3603, have been notified that such easement has been recorded.

Included ☐ **Yes** ☐ **No** ☐ **N/A**

- ☐ I certify that a Site Management Plan has been submitted for the continual and proper operation, maintenance, and monitoring of all Engineering Controls employed at the Site, including the proper maintenance of all remaining monitoring wells, and that such plan has been approved by Department.

Included ☐ **Yes** ☐ **No** ☐ **N/A**

If financial assurance is required:

- ☐ I certify that any financial assurance mechanisms required by the Department pursuant to Environmental Conservation Law have been executed.
Included ☐ **Yes** ☐ **No** ☐ **N/A**
- ☐ I certify that all documents generated in support of this report have been submitted in accordance with the DER's electronic submission protocols and have been accepted by the Department.
Included ☐ **Yes** ☐ **No**
- ☐ I certify that all data generated in support of this report have been submitted in accordance with the Department's electronic data deliverable and have been accepted by the Department.
Included ☐ **Yes** ☐ **No**
- ☐ 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's Designated Site Representative (and if the site consists of multiple properties): [and I have been authorized and designated by all site owners to sign this certification] for the site.
Included ☐ **Yes** ☐ **No**

For DEC Internal Use Only:

Site Contact List:

- ☐ **N/A** (BCP, ERP, SSF if site locality was canvassed for list serve)
- ☐ **Yes** (SSF if not exempt thru list serve participation and deemed necessary by ADD) Provide to SCS as defined in Part 375-1.2(as). For additional guidance in preparing the SCL, go to <http://internal.dec.state.ny.us/der/der309.html>

UIS:

Update Remedial Site Information on Main Page

- ☐ **Site Description:** For guidance see <http://internal.dec.state.ny.us/der/der274.html>
- ☐ **Site Environmental Assessment:** Be sure it reflects conditions after the remedy is implemented (see <http://internal.dec.state.ny.us/der/der274.html>)
- ☐ **Site Health Assessment:** request from DOH to reflect post-remediation conditions.
- ☐ **Site Name, Address, & Size:** verify and notify SCS for changes
- ☐ **Contacts:** verify owner and all other affiliations are accurate and complete
- ☐ **Easement Identifier:** Enter the County Recording Identifier using the Cross Reference button on the main site page.
- ☐ **Clean Up Track:** (for BCP sites) provide to SCS for data entry

Class History File - A Class History file (A to C) should have been auto-generated when the COC project was created. However, for older projects, this may not have occurred, and one must be

requested from Site Control. The Basis for Classification should be entered as follows:

- ☐ **Basis for Classification Change:** Use the standard language for this type of reclassification "Approval of the FER constitutes final approval of the Department's decision to reclassify the site to a class C. The classification in the UIS will be changed upon COC issuance and associated citizen participation." (see <http://internal.dec.state.ny.us/der/der256.html>)

IC/EC Module

- ☐ Property information is complete and accurate for all parcels
- ☐ Control information: If UNRESTRICTED USE/TRACK 1, check No Controls Needed in site property details
- ICs: ☐ **Yes** (indicate all) or; ☐ **N/A**
- ECs: ☐ **Yes** (indicate all) or; ☐ **N/A**
 - ☐ Dates - applicable dates, e.g. ☐ Control In Place ☐ date (filed with County Clerk)
 - ☐ Control Description - provide a summary of restrictions, in sufficient level of detail to list on the Site Management Form.

UIS Projects - as applicable, verify start and end dates, status for all projects, especially;

- ☐ RA End Date – Set this for the month the COC issuance is anticipated. This will auto-update the COC End Date, SM Start Date, and first PRR dates.

Filed in EDMS - as applicable, verify that all applicable documents or equivalent, are present and properly named;

- ☐ **Agreement/Order/SAC:** (e.g., agreement.C231011.2006-01-01.BCA.pdf)
- ☐ **Environmental Easement / Deed Restr.:** w/co. Clerk Certificate (e.g., easement.130058.2006-01-01.pdf)
- ☐ **Site Management Plan:** (e.g., workplan.130058.2006-01-01.SMP.pdf)
- ☐ **Final Engineering Report:** (e.g., report.E915182.2006-01-01.FER.pdf)
- ☐ **Site Boundary Map:** Provide tax map, or other that clearly indicates the site boundaries.

The review of the Final Engineering Report has been completed and found to satisfy all applicable requirements and guidance as detailed above. The Final Engineering Report is therefore recommended for approval.

Completed by: _____ Date: _____
Project Manager

Reviewed by: _____ Date: _____
Section Chief/Regional HWR Engineer

APPENDIX 16
PROJECT SCHEDULE

77-57 Vleigh Place - Estimated Remediation Project Schedule for a 2018 COC

#	Task	Duration (business days)	Start Date	Finish Date
1	Start of 45-day RAWP Public Comment period	45	Wed 11/1/17	Fri 12/15/17
2	Approval of RAWP and Issuance of Decision Document	5	Mon 12/18/17	Fri 12/22/17
3	Obtain Permits	15	Mon 12/25/2017	Mon 1/8/18
4	RAWP Implementation and construction of ECs*	127	Tue 1/9/18	Mon 5/14//18
5	Environmental Easement Development	22	Fri 5/11/2018	Fri 6/1/18
6	Draft FER and Draft SMP	87	5/7/2018	Wed 8/1/18
7	Environmental Easement recording	15	Mon 10/1/18	Tue 10/15/18
8	FER Fact Sheet	1	Mon 8/20/18	Mon 8/20/18
9	DEC Review and Approval of FER and SMP	32	Thur 8/2/18	Mon 9/3/18
10	Certificate of Completion	1	Mon 10/22/18	Mon 10/22/18
11	IC/EC Notice Fact Sheet (within 10 days of Notice)	1	Mon 11/5/18	Mon 11/5/18
12	Implement of SMP (Operations, Maintenance and Annual Inspections)	TBD	TBD	TBD

*ECs listed as SVE and Groundwater Remedial Action Work plan shall be implemented and operated/monitored as immediate interim remedial actions, should construction schedule is delayed for any unknown reasons.