# OU-3 GROUNDWATER REMEDIATION WORK PLAN

## Kings Plaza Shopping Center
## 5102, 5120 & 5502 Avenue U
## Brooklyn, Kings County, New York

## NYSDEC Spill No. 98-15289

***Prepared For:***

**Brooklyn Kings Plaza LLC**
**5120 Avenue U**
**Brooklyn, New York 11234**

***Prepared By:***

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LANGAN

**February 2020**
**140080120**

# CERTIFICATION

I, Stewart H. Abrams, certify that I am currently a New York State (NYS) registered professional engineer and that this Remedial Action Work Plan (RAWP) was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the Department of Environmental Remediation (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.


Stewart H. Abrams
NYS Professional Engineer #078833

2/14/2020
Date

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

## TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## LIST OF APPENDICES

## INTRODUCTION

This Groundwater Remediation Work Plan was prepared on behalf of Brooklyn Kings Plaza LLC for the former Standard Oil parcel (also known as operable unit [OU]-3) at 5102, 5120, and 5502 Avenue U in Brooklyn, New York (the "Site"). A Site Location map is provided as Figure 1. The Site is currently subject to a stipulation agreement with New York State Department of Environmental Conservation (NYSDEC) for two open petroleum spill cases. This plan outlines the proposed groundwater remediation activities along the northern portion of OU-3 to address residual dissolved-phase petroleum impacts associated with Spill No. 98-15289. The remediation specifically addresses impacts at, and near, monitoring well MW-52 (see Figure 2).

This plan was prepared based on the results presented in the Groundwater Monitoring Report for Former Standard Oil Parcel (OU-3), prepared by Langan, and dated February 2017 (included as Appendix A).

## SITE BACKGROUND

### 1.1 Site Description

The Site occupies an approximately 5.9-acre area and is improved with a 1-story Lowe's Home Improvement store (Lowe's) with associated asphalt parking lot. The Lowe's lot is at 5502 Avenue U (Block 8470, Lot 114) and bounded by Avenue U to the northwest, an adjacent shopping center (Block 8470, Lot 130) to the northeast, the Mill Basin to the southeast, and East 55$^{th}$ Street to the southwest. A Site Location Map is included as Figure 1.

### 1.2 Site History

The Site was developed as a Standard Oil petroleum bulk storage (PBS) facility from approximately 1930 to 1960. The former PBS facility reportedly maintained 24 100,000-gallon aboveground storage tanks (ASTs), gasoline pumps, two fuel-loading racks associated with the ASTs, two garages, and a warehouse. In addition, auto repair and rental operations reportedly took place at the Site. The ASTs and associated buildings were demolished in the early 1970s. The Site was used as an asphalt-paved parking lot after Alexander's Kings Plaza Center Inc. (Alexander's), a wholly owned subsidiary of Vornado Realty Trust (Vornado), acquired the property in 1970. Remediation of the Site was conducted between 2005 and 2010 to enable an expansion of the existing Kings Plaza shopping center. The expansion included construction of a 125,000-square-foot Lowe's with an asphalt-paved parking lot and a landscaped waterfront area adjacent to the Mill Basin, southeast of the Site.

## 1.3 Current Regulatory Status of the Site

NYSDEC Spill No. 97-04124 was opened at the Site in July 1997 to address historical releases from the former PBS facility. The Site was investigated between 1997 and 1999, and a second spill was opened on 25 March 1999 (NYSDEC Spill No. 98-15289) to address the same impacts as Spill No. 97-04124, but for a second responsible party. Alexander's, a wholly-owned subsidiary of Vornado, entered into a stipulation agreement with the NYSDEC on 13 May 2002 to investigate and remediate historic petroleum discharges to soil and shallow groundwater associated with Spill No. 97-04124, which occurred within OU-3.

Remediation of the Site was conducted between 2005 and 2010 to enable an out-parcel expansion of the existing Kings Plaza shopping center. The expansion included construction of a 125,000-square-foot Lowe's with an asphalt-paved parking lot and a landscaped waterfront area adjacent to the Mill Basin, southeast of the Site. Spill No. 09-04813 was opened for petroleum product identified during installation of a water line at the Site in 2009. Spill No. 97-04124 was closed in December 2008 following remediation of the Site. Spill No. 09-04813 was closed in November 2016 following receipt of a Construction Completion Report (CCR), submitted by Langan. Brooklyn Kings Plaza LLC purchased the Site from Vornado in 2012, along with the Kings Plaza shopping center. At the time of the purchase of the Site, remediation was complete with the exception that a final report for the remedial activities had not yet been submitted.

In March 2016, Langan submitted the CCR to the NYSDEC, summarizing the historic remediation activities of open spills at OU-3. In a conference call held on 2 November 2016, NYSDEC requested that Langan complete one additional round of groundwater sampling at four wells along Avenue U (MW-47R, MW-51R, MW-52, and MW-53). Based on the call with NYSDEC, if decreasing trends for petroleum-related volatile organic compounds (VOCs) were observed in the wells (compared to sampling conducted in August 2013), NYSDEC indicated that they would close Spill No. 98-15289. Groundwater sampling activities conducted in 2016 identified total VOCs in MW-52 at concentration of 1.018 parts per million (ppm). Based on the identified concentration exceeding 1 ppm, NYSDEC requested that additional remediation be completed to close the spill. A monitoring well inventory is included as Table 1 and groundwater analytical results are summarized in Table 2.

## 1.4 Site Physical Conditions

### 1.4.1 Surrounding Property Land Use

The Site is currently zoned M3-1 by the New York City Department of City Planning. M3-1 is described as a manufacturing district designated for areas with heavy industries that generate noise, traffic, or pollutants. The Site is bound by the Mill Basin waterway followed by various

commercial and residential properties to the south, Kings Plaza shopping center followed by Flatbush Avenue to the west, Macy's and Avenue U followed by various commercial and residential properties to the north, and an asphalt-paved parking area, followed by Home Depot and the Mill Basin to the east.

Land use within a ½ mile of the Site is highly urbanized. Surrounding land use within a ½-mile radius includes residential and commercial properties, the Mill Basin, cross streets and avenues, residential neighborhoods, and parkland.

The nearest ecological receptor is the Mill Basin, abutting the Site to the south and east, and approximately 750 feet from MW-52. The Mill Basin is a tributary of Jamaica Bay, which is approximately 1.75 miles downstream of the Site. Mill Basin and East Mill Basin join approximately 1 mile downstream of the Site before feeding into Jamaica Bay. The nearest sensitive receptor is a park approximately 250 feet south of the Site. There is no school, day care facility, or hospital within a ½ mile of the Site.

Additionally, the online NYSDEC Environmental Resource Mapper identifies an area containing rare plants and/or animals within a 1-mile radius of the Site. An area of significant natural communities is approximately 0.75 miles east of the Site.

### 1.4.2 Topography

The topography of the Site and the surrounding area is relatively flat with elevations ranging from approximately elevation (el.)[1] 8 to el. 10 based on the Federal Emergency Management Agency (FEMA) flood insurance rate map (FIRM).

### 1.4.3 Geology

Available United States Geologic Survey (USGS) reports and maps, historic topographic maps, and boring information from previous subsurface investigations performed at or near the Site were reviewed to obtain general geologic information. Geologic strata in this area of Brooklyn generally consist of a thin layer of fill overlying unconsolidated sediment that was deposited during multiple episodes of glaciation over bedrock basement. Based on a review of the USGS Subsurface Configuration of Crystalline Bedrock Map (Buxton et al., 1981), bedrock depth at the Site is between approximately 600 and 700 feet below grade.

Data obtained during subsurface investigations indicates that historic fill containing fine to coarse sand, silt, and varying amounts of brick, gravel, wood, coal, and concrete is present at depths up

[1] Elevations are relative to North American Vertical Datum of 1988 (NAVD88).

to 7 feet. The fill layer is underlain by a silty fine to coarse sand unit that is approximately 2 to 10 feet thick. A continuous organic clay unit underlies the silty sand at depths from approximately 8 to 18 feet at the Site, with the exception of an area near Mill Basin in which clay was not encountered at the boring termination depth of 15 feet.

#### 1.4.4 Hydrogeology

Subsurface data obtained during the December 2016 gauging event indicate that the depth of groundwater is approximately 4.6 to 7.43 feet, which corresponds to approximately el. 3.14 to 5.21 (see Table 1). The general direction of groundwater flow is to the southeast towards Mill Basin in the southern portion of the Site and to the northwest in the northern portion of the Site with a mound in the central portion of the Site. Groundwater is tidally influenced in the area, especially along the Mill Basin, and as a result, depths, hydraulic gradient, and flow directions may vary depending on the time of day and month. In addition, based on a 2003 geotechnical study completed by Langan at the Site, the organic clay layer has average permeabilities ranging from approximately $10^{-7}$ to $10^{-9}$ centimeters per second (cm/s), indicating that the organic clay layer is a confining unit.

#### 1.4.5 Wetlands

Based on the National Wetland Inventory (NWI) map, wetlands are not on or immediately adjacent to the Site.

### 1.5 Summary of Previous Environmental Investigations

The following environmental reports were reviewed and are summarized in our February 2017 Groundwater Report:

- Contamination Assessment/Site Investigation, prepared by IVI Environmental, Inc. (IVI), 29 July 1997;
- Remedial Investigation Report (RIR) Addendum/Remedial Investigation Work Plan (RIWP), Former Standard Oil Terminal (OU-3), prepared by Excel Environmental Resources, Inc. (Excel), April 2003;
- Geotechnical Study, Retail Center Kings Plaza Shopping Center, prepared by Langan, April 2003;
- Remedial Action Work Plan (RAWP), Former Standard Oil Terminal (OU-3), prepared by Excel, July 2003;
- Environmental Notice Bulletin (ENB) Public Notice, OU-3 – Former Standard Oil Terminal, prepared by NYSDEC, 4 July 2005;

- RAWP Amendment, Former Standard Oil Terminal (OU-3), prepared by Excel, 14 April 2006;
- Draft Site Management Plan (SMP), Former Standard Oil Terminal (OU-3), prepared by Excel, August 2010;
- Phase I Environmental Site Assessment (ESA), Kings Plaza Shopping Center, prepared by Partner Engineering and Science, Inc., May 2011;
- Phase I ESA, Kings Plaza Shopping Center, prepared by Certified Environments Inc., 27 July 2012;
- Transmittal of Post-Excavation Groundwater Analytical Data, prepared by Excel, dated 1 August 2012; and,
- CCR, NYSDEC Spill Numbers: 98-15289, 08-13330, and 09-04813, prepared by Langan Engineering, Environmental, Surveying, and Landscape Architecture, D.P.C. (Langan), dated March 2016.

## 2.0 FINDINGS OF FEBRUARY 2017 GROUNDWATER MONITORING

Langan's February 2017 Groundwater Monitoring Report concluded the following:

- No free-phase petroleum product was encountered in any of the monitoring wells (MW-47R, MW-51R, MW-52, and MW-53) during the gauging event on 1 December 2016 and the analytical data does not suggest presence of non-aqueous phase liquid (NAPL).
- One or more VOCs, including benzene, ethylbenzene, isopropylbenzene, n-butylbenzene, n-propylbenzene, sec-butylbenzene, toluene, and total xylenes, were detected at concentrations above the Ambient Water Quality Standards Guidance Values (AWQS/GV) in two (MW-52 and MW-53) of the four sampled monitoring wells.
    - Despite these exceedances, overall benzene, toluene, ethylbenzene, and xylene (BTEX) and VOC concentrations at both wells have decreased during the monitoring period.
    - n-Propylbenzene was the only compound to exceed AWQS/GV at MW-53 in the most recent sampling event.
    - Multiple compounds exceed the NYSDEC Technical and Operational Guidance Series (TOGS) standards at MW-52; however, BTEX concentrations continued to diminish during the monitoring period and are approaching the AWQS/GV.
    - Heavier, less mobile benzene-based compounds remain in the groundwater at MW-52. These compounds, including isopropylbenzene, n-butylbenzene, n-proplybenzene, and sec-butylbenzene, all have lower vapor pressures (generally one order of magnitude lower) and greater organic carbon partitioning coefficients (generally two orders of magnitude higher) than the BTEX compounds, indicating that they are significantly less mobile in the environment.

- Based on a comparison of analytical results from post-remediation sampling from 2011, 2012, and 2013, and the 2016 groundwater monitoring event, BTEX and VOC concentrations have exhibited a decrease or stabilization in all four monitoring wells.
- Heavy benzene based compounds identified in MW-52 have a low mobility and can remain in the smear zone for long periods; their partitioning to the groundwater will be significantly slower than the BTEX compounds. Because the heavier compounds have a higher affinity to the adsorbed phase, their potential for biodegradation is limited by their dissolution rate. This limited rate of biodegradation does not increase their potential transport in the environment because of their higher retardation rate.
- The decrease in VOC concentrations in the wells is one indicator that natural attenuation is likely occurring at the Site. Dissolved oxygen (DO) and oxidation-reduction potential (ORP) levels recorded during the 2016 groundwater monitoring event indicate anaerobic conditions exist at the Site, which allows for the possibility of anaerobic degradation. Aerobic conditions are more conducive to degrading BTEX compounds and the VEFR may increase DO and allow for a period of aerobic degradation. BTEX concentrations in MW-52 and MW-53 have shown sustained concentration reductions during the monitoring period. These reductions were evident even during sampling events where heavier benzene-based compounds were observed to increase for one event.
- Based on previous groundwater gauging and monitoring events, VOC concentrations have not increased as groundwater elevations rise.

## 3.0 REMEDIATION PLAN

This plan outlines the proposed tasks to reduce BTEX and total VOC concentrations at MW-52 to levels appropriate for natural attenuation. Given that these concentrations are currently close to compliance, we propose a remediation plan consisting of two phases: Phase One will consist of vacuum-enhanced fluid recovery (VEFR). If Phase One is unsuccessful, Phase Two will consist of a sulfate injection program (to be designed following completion of Phase One and a bench scale test). Langan will proceed with the proposed Phase One remediation plan upon receiving written approval from the NYSDEC if they agree with the phased approach.

Langan will implement the VEFR remediation and assess the effectiveness prior to assessing further options. This approach is appropriate for the Site because of the naturally reducing and anaerobic conditions near MW-52R, which would impede aerobic bioremediation, and the presence of high organic content in the soil that would reduce the efficacy of in-situ chemical oxidation (ISCO). The following section describes the VEFR scope.

### 3.1 Phase One: Vacuum-Enhanced Fluid Recovery (VEFR)

Prior to implementing VEFR, Langan will collect one baseline groundwater sample from MW-52, using low-flow techniques, for disposal of groundwater. The groundwater sample will be analyzed for VOCs, in addition to Resource Conservation and Recovery Act (RCRA) metals, sulfate, sulfide, iron, manganese, and sulfate-reducing bacteria concentrations. Additionally, groundwater elevation data will be collected from MW-52 and surrounding OU-3 monitoring wells including MW-47R, MW-51R, and MW-53.The purpose of the elevation data will be to confirm that groundwater returns to the pre-remediation elevation following completion of the VEFR.

The VEFR event will be conducted for up to 4 hours, and recovery of up to 1,000 gallons of groundwater is anticipated. The VEFR event will remove contaminated water and vapor near the well, and will enhance airflow through the saturated and unsaturated zone near MW-52 by lowering the groundwater elevation. The enhanced airflow will provide additional oxygen in the subsurface, which may provide a period of aerobic biodegradation of the BTEX compounds. The water extraction will remove impacted water and will flush fresh water through the subsurface near the well, potentially recovering residual petroleum contamination. Groundwater elevation data will be collected prior to and following the VEFR.

Subsequent to the VEFR event, Langan will return to the Site to conduct two rounds of groundwater sampling for VOCs only. The first post-remediation sampling will be conducted one week after the VEFR and a second round of post-remediation sampling will be conducted three months after VEFR. During each sampling event, one groundwater sample will be collected from MW-52 and groundwater elevation data will be collected from MW-47R, MW-51R, MW-52, and MW-53. The elevation data will be compared to measurements collected prior to the VEFR event to confirm the groundwater elevation has rebounded. If the sampling results show that total VOCs have been reduced below 1 ppm, Langan will provide the results to the NYSDEC and will request closure of Spill No. 98-15289. If the groundwater sample results do not show a decrease in VOC concentrations, a more robust remediation approach will be assessed (Phase Two).

### 3.2 Management of Investigation- and Remediation-Derived Waste

All groundwater investigation-derived wastes (IDW) will be containerized in United States Department of Transportation (USDOT)-approved 55-gallon drums. Decontamination, well purging, and sampling fluids will be placed in USDOT-approved drums with a closed top. The drums will be properly labeled, sealed, and characterized as necessary. The drums will be temporarily staged in a secure area on-site pending transportation to an appropriate disposal facility. All groundwater removed during VEFR activities will be pumped directly into a vacuum truck and disposed of at an appropriately licensed disposal facility.

### 3.3 Phase Two: Sulfate Injection Program

Design and Permitting

A remedial injection program will be developed to reduce VOC concentrations in the event that VEFR is proven ineffective. A bench scale test will be completed to determine the most effective chemical and injection rates; however, based on previous groundwater sampling results, we anticipate injection of a sulfate-based remediation product (magnesium sulfate and/or ferrous sulfate).

Once the chemical demand and need for supplemental nutrients are determined, Langan will prepare an Underground Injection Control (UIC) permit application for the United States Environmental Protection Agency (USEPA), which will provide information on the reagent, injection dosage, volume, injection locations, target injection intervals, injection duration, and performance-monitoring program. The permit application will also list any potential adverse impact to groundwater and the proposed methods to mitigate the impact. In addition, Langan will prepare a Sulfate Injection Work Plan to be submitted to NYSDEC for review and approval. The approved Work Plan will be submitted in conjunction with the permit application.

Chemical Injection

Based on previous groundwater monitoring results, sulfate injection will likely be conducted at four locations by a direct-push injection contractor. The actual chemical used, quantities, and methodology will be based on the results of bench scale testing prior to mobilization. Note that depending on the scope of potential bench testing, the schedule could be elongated by up to 3 months.

Prior to mobilization, all injection locations and the limits of the remediation area will be marked, and a geophysical survey will be completed to clear the injection locations for utilities and subsurface structures. Construction fencing will be installed to restrict pedestrian access to the area during remediation. Langan will provide oversight, and air monitoring in accordance with the Community Air Monitoring Plan (CAMP) developed for the property during the field sulfate injection.

Reagent mixing will be performed in a temporary staging area or in a trailer on-site. Potable water for mixing will be brought to the site by the injection contractor. The injection locations will be abandoned the same day and the sidewalk surface will be repaired before demobilizing.

Confirmation Sampling

Groundwater confirmation sampling will be conducted following a 3-month stabilization period. One groundwater sample will be collected from MW-52 to be analyzed for VOCs. If the sampling results show that total VOCs have been reduced below 1 ppm, Langan will provide the results to the NYSDEC and will request closure of Spill No. 98-15289.

## 4.0 REPORTING

Following completion of groundwater VEFR remediation activities and receipt of validated analytical data showing total VOCs below 1 ppm, Langan will submit the results and findings to the NYSDEC for review as a Remedial Action Report (RAR). The RAR will include a summary of field and sampling activities, tabulated analytical data, field forms, and laboratory analytical reports.

If chemical injection is deemed necessary, Langan will draft a brief Technical Summary, outlining the injection activities following completion of confirmation sampling. The Technical Summary will consist of injection dosages, locations, flow and pressure rates, and groundwater geochemical parameters during injections. Results of the post-injection groundwater sampling will also be included.

## 5.0 SCHEDULE

The table below summarizes the anticipated schedule for OU-3 remedial activities. Note that of the optional bench test becomes necessary, the impact on the project schedule will be assessed at that time.

| Activity | Month | | | | | | |
|---|---|---|---|---|---|---|---|
| | February 2020 | March 2020 | April 2020 | May 2020 | June 2020 | July 2020 | August 2020 |
| OU-3 Groundwater Remediation Work Plan Comments and Approval | | | | | | | |
| VEFR Remediation | | | | | | | |
| Post-Remediation Groundwater Monitoring | | | | | | | |
| Bench Test for Injection (if necessary) | | | | | | | |
| Injection Program (if necessary) | | | | | | | |
| RAR Preparation and Submittal (Date dependent on effectiveness of VEFR) | | | | | | | |

# TABLES

Table 1
Monitoring Well Inventory and Groundwater Elevations
Kings Plaza Shopping Center
Brooklyn, New York
NYSDEC Spill No. 98-15289
Langan Project No. 140080107

| Well ID | Headspace PID Reading (ppm)[1] | Total Well Depth (feet bgs)[1] | Depth to Water (feet bgs)[1] | Ground Surface Elevation[2] | Top of Casing Elevation[2] | Groundwater Elevation[2] |
|---|---|---|---|---|---|---|
| MW-47R | 0.0 | 12.6 | 4.6 | 10.13 | 9.81 | 5.21 |
| MW-51R | 0.5 | 12.05 | 7.43 | 10.91 | 10.57 | 3.14 |
| MW-52 | 9.9 | 15.1 | 5.58 | 10.62 | 10.39 | 4.81 |
| MW-53 | 0.4 | 9.98 | 5 | 10.52 | 10.28 | 5.28 |

**Notes:**

1. The monitoring well inventory was conducted by Langan on 1 December 2016.
2. The horizontal datum is referenced to the North American Datum of 1983 (NAD83), New York State Plane Coordinate System, Long Island Zone. The vertical datum is referenced to the North American Vertical Datum of 1988 (NAVD88).
3. Free-phase product was not encountered in any of the wells.
4. All wells were 2-inch diameter PVC.

**Definitions:**

PID = photoionization detector
ppm = parts per million
bgs = below grade surface

Table 2
Groundwater Analytical Results Summary
Kings Plaza Shopping Center
Brooklyn, New York
NYSDEC Spill No. 98-15289
Langan Project No. 140080107

| **Monitoring Well ID<br>Groundwater Elevations (el.)<br>Sampling Date** | **NYSDEC TOGS Standards and Guidance Values - GA** | **MW-47R<br>4.59<br>5/17/2011** | **MW-47R<br>4.66<br>12/28/2011** | **MW-47R<br>NM<br>3/29/2012** | **MW-47R<br>4.76<br>6/28/2012** | **MW-47R<br>4.6<br>9/3/2013** | **MW-47R<br>5.21<br>12/2/2016** |
|---|---|---|---|---|---|---|---|
| **CP-51 Volatile Organic Compounds (µg/L)** | | | | | | | |
| 1,2,4-Trimethylbenzene | 5 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| 1,3,5-Trimethylbenzene | 5 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| Benzene | 1 | ND | ND | ND | ND | ND<1 | ND<0.5 |
| Ethylbenzene | 5 | ND | ND | ND | ND | ND<1 | ND<0.5 |
| Isopropylbenzene | 5 | ND | ND | ND | NA | 0.18 J | ND<0.5 |
| Methyl tert-butyl ether (MTBE) | 10 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| n-Butylbenzene | 5 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| n-Propylbenzene | 5 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| p-Isopropyltoluene | 5 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| sec-Butylbenzene | 5 | ND | ND | ND | NA | 0.26 J | 0.2 J |
| tert-Butylbenzene | 5 | NA | NA | NA | NA | 0.28 J | ND<0.5 |
| Toluene | 5 | ND | ND | ND | ND | ND<1 | ND<0.5 |
| Naphthalene | 10 | NA | NA | NA | NA | NA | ND<2 |
| Xylenes, Total | 5 | ND | ND | ND | ND | ND<3 | ND<1.5 |
| BTEX | ~ | ND | ND | ND | ND | ND | ND |
| Total VOCs | ~ | ND | ND | ND | ND | 0.72 | 0.2 |

**Notes:**
1. Groundwater sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) 1.1.1. Ambient Water Quality Standards (AWQS) and guidance values for drinking water (class GA).
2. Results exceeding NYSDEC TOGS are shaded and bolded.

**Definitions:**
~ = No regulatory limit has been established for this analyte
BTEX = Benzene, Toluene, Ethylbenzene, and Total Xylenes
D = Result is from an analysis that required a dilution.
J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
J* = Indicates the concentration is below the reporting limit but greater than or equal to the method detection limit. The concentration reported is estimated.

NA = Not analyzed
ND = Not detected
µg/L = micrograms per liter

Table 2
Groundwater Analytical Results Summary
Kings Plaza Shopping Center
Brooklyn, New York
NYSDEC Spill No. 98-15289
Langan Project No. 140080107

| **Monitoring Well ID<br>Groundwater Elevations (el.)<br>Sampling Date** | **NYSDEC TOGS Standards and Guidance Values - GA** | **MW-51R<br>2.88<br>5/17/2011** | **MW-51R<br>3.44<br>12/28/2011** | **MW-51R<br>2.62<br>3/29/2012** | **MW-51R<br>3.52<br>6/28/2012** | **MW-51R<br>3.03<br>8/29/2013** | **MW-51R<br>3.14<br>12/2/2016** |
|---|---|---|---|---|---|---|---|
| **CP-51 Volatile Organic Compounds (µg/L)** | | | | | | | |
| 1,2,4-Trimethylbenzene | 5 | 1.1 | ND | ND | NA | **22** | ND<0.5 |
| 1,3,5-Trimethylbenzene | 5 | ND | ND | ND | NA | 3.1 | ND<0.5 |
| Benzene | 1 | ND | ND | ND | ND | **6.1** | ND<0.5 |
| Ethylbenzene | 5 | ND | ND | ND | ND | 4.6 | ND<0.5 |
| Isopropylbenzene | 5 | ND | ND | ND | NA | **58** | ND<0.5 |
| Methyl tert-butyl ether (MTBE) | 10 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| n-Butylbenzene | 5 | ND | ND | ND | NA | **9.4** | ND<0.5 |
| n-Propylbenzene | 5 | ND | ND | ND | NA | **180** | ND<0.5 |
| p-Isopropyltoluene | 5 | ND | ND | ND | NA | 0.79 J | ND<0.5 |
| sec-Butylbenzene | 5 | ND | ND | ND | NA | **9.6** | ND<0.5 |
| tert-Butylbenzene | 5 | NA | NA | NA | NA | ND<1 | ND<0.5 |
| Toluene | 5 | ND | ND | ND | ND | 1.3 | ND<0.5 |
| Naphthalene | 10 | NA | NA | NA | NA | NA | ND<2 |
| Xylenes, Total | 5 | ND | ND | ND | ND | **13** | ND<1.5 |
| BTEX | ~ | ND | ND | ND | ND | 25 | ND |
| Total VOCs | ~ | 1.1 | ND | ND | ND | 307.89 | ND |

**Notes:**
1. Groundwater sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) 1.1.1. Ambient Water Quality Standards (AWQS) and guidance values for drinking water (class GA).
2. Results exceeding NYSDEC TOGS are shaded and bolded.

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~ = No regulatory limit has been established for this analyte
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Table 2
Groundwater Analytical Results Summary
Kings Plaza Shopping Center
Brooklyn, New York
NYSDEC Spill No. 98-15289
Langan Project No. 140080107

| **Monitoring Well ID<br>Groundwater Elevations (el.)<br>Sampling Date** | **NYSDEC TOGS Standards and Guidance Values - GA** | **MW-52<br>3.71<br>5/17/2011** | **MW-52<br>4.01<br>12/28/2011** | **MW-52<br>NM<br>3/29/2012** | **MW-52<br>4.16<br>6/28/2012** | **MW-52<br>4.81<br>12/2/2016** |
|---|---|---|---|---|---|---|
| **CP-51 Volatile Organic Compounds (µg/L)** | | | | | | |
| 1,2,4-Trimethylbenzene | 5 | **680** | ND | ND | NA | 0.39 J |
| 1,3,5-Trimethylbenzene | 5 | **230** | ND | ND | NA | ND<0.5 |
| Benzene | 1 | **200** | **92** | **81** | **68** | **17** |
| Ethylbenzene | 5 | **120** | **41** | **43** | **31** | **22** |
| Isopropylbenzene | 5 | **160** | ND | **180** | NA | **220 D** |
| Methyl tert-butyl ether (MTBE) | 10 | ND | ND | ND | NA | ND<0.5 |
| n-Butylbenzene | 5 | **12** | ND | ND | NA | **36** |
| n-Propylbenzene | 5 | **430** | ND | ND | NA | **680 D** |
| p-Isopropyltoluene | 5 | ND | ND | ND | NA | 0.28 J |
| sec-Butylbenzene | 5 | **21** | ND | ND | NA | **25** |
| tert-Butylbenzene | 5 | NA | NA | NA | NA | 0.47 J |
| Toluene | 5 | **11** | **8** | **7.5** | **6.7** | **5.5** |
| Naphthalene | 10 | NA | NA | NA | NA | 4.6 |
| Xylenes, Total | 5 | **175** | **43** | **33** | **17** | **6.8** |
| BTEX | ~ | 506 | 184 | 164.5 | 122.7 | 51.3 |
| Total VOCs | ~ | 2,039 | 184 | 344.5 | 122.7 | 1,018.04 |

**Notes:**
1. Groundwater sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) 1.1.1. Ambient Water Quality Standards (AWQS) and guidance values for drinking water (class GA).
2. Results exceeding NYSDEC TOGS are shaded and bolded.

**Definitions:**
~ = No regulatory limit has been established for this analyte
BTEX = Benzene, Toluene, Ethylbenzene, and Total Xylenes
D = Result is from an analysis that required a dilution.
J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
J* = Indicates the concentration is below the reporting limit but greater than or equal to the method detection limit. The concentration reported is estimated.

NA = Not analyzed
ND = Not detected
µg/L = micrograms per liter

Table 2
Groundwater Analytical Results Summary
Kings Plaza Shopping Center
Brooklyn, New York
NYSDEC Spill No. 98-15289
Langan Project No. 140080107

| **Monitoring Well ID<br>Groundwater Elevations (el.)<br>Sampling Date** | **NYSDEC TOGS Standards and Guidance Values - GA** | **MW-53<br>4.38<br>5/17/2011** | **MW-53<br>4.49<br>12/28/2011** | **MW-53<br>3.96<br>3/29/2012** | **MW-53<br>4.41<br>6/28/2012** | **MW-53<br>3.66<br>8/29/2013** | **MW-53<br>5.28<br>12/2/2016** | **DUP (MW-53)<br>5.28<br>12/2/2016** |
|---|---|---|---|---|---|---|---|---|
| **CP-51 Volatile Organic Compounds (µg/L)** | | | | | | | | |
| 1,2,4-Trimethylbenzene | 5 | ND | ND | ND | NA | **34** | ND<0.5 | ND<0.5 |
| 1,3,5-Trimethylbenzene | 5 | ND | ND | ND | NA | 4.7 | ND<0.5 | ND<0.5 |
| Benzene | 1 | **12** | **11** | ND | **8.1** | **5.3** | 0.77 | 0.76 |
| Ethylbenzene | 5 | 2.3 | 2.7 | ND | 2.1 | 4.2 | 0.29 J | 0.26 J |
| Isopropylbenzene | 5 | **82** | ND | ND | NA | **54** | 5 | 4.8 |
| Methyl tert-butyl ether (MTBE) | 10 | ND | ND | ND | NA | ND<1 | ND<0.5 | ND<0.5 |
| n-Butylbenzene | 5 | 3.3 | ND | ND | NA | **9.2** | 2.2 | 2.1 |
| n-Propylbenzene | 5 | **150** | ND | ND | NA | **160** | **11** | **11** |
| p-Isopropyltoluene | 5 | ND | ND | ND | NA | 1.2 | ND<0.5 | ND<0.5 |
| sec-Butylbenzene | 5 | **9.7** | ND | ND | NA | **9.1** | 4.9 | 4.9 |
| tert-Butylbenzene | 5 | NA | NA | NA | NA | 0.36 J | ND<0.5 | ND<0.5 |
| Toluene | 5 | ND | 2 | ND | 1.3 | 1.2 | 0.27 J | ND<0.5 |
| Naphthalene | 10 | NA | NA | NA | NA | NA | ND<2 | ND<2 |
| Xylenes, Total | 5 | 1.1 | 1.8 J* | ND | 1.6 J* | **13** | ND<1.5 | ND<1.5 |
| BTEX | ~ | 15.4 | 17.5 | ND | 13.1 | 23.7 | 1.33 | 1 |
| Total VOCs | ~ | 260 | 17.5 | ND | 13.1 | 296.26 | 24.43 | 23.82 |

**Notes:**
1. Groundwater sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) 1.1.1. Ambient Water Quality Standards (AWQS) and guidance values for drinking water (class GA).
2. Results exceeding NYSDEC TOGS are shaded and bolded.

**Definitions:**
~ = No regulatory limit has been established for this analyte
BTEX = Benzene, Toluene, Ethylbenzene, and Total Xylenes
D = Result is from an analysis that required a dilution.
J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
J* = Indicates the concentration is below the reporting limit but greater than or equal to the method detection limit. The concentration reported is estimated.

NA = Not analyzed
ND = Not detected
µg/L = micrograms per liter

# FIGURES


NOTES:
MAP REFERENCED: UNITED STATES GEOLOGICAL SURVEY (USGS), CONEY ISLAND, N.Y. - N.J.
TOPOGRAPHIC QUADRANGLE MAP, DATED 1966, PHOTOREVISED 1979.


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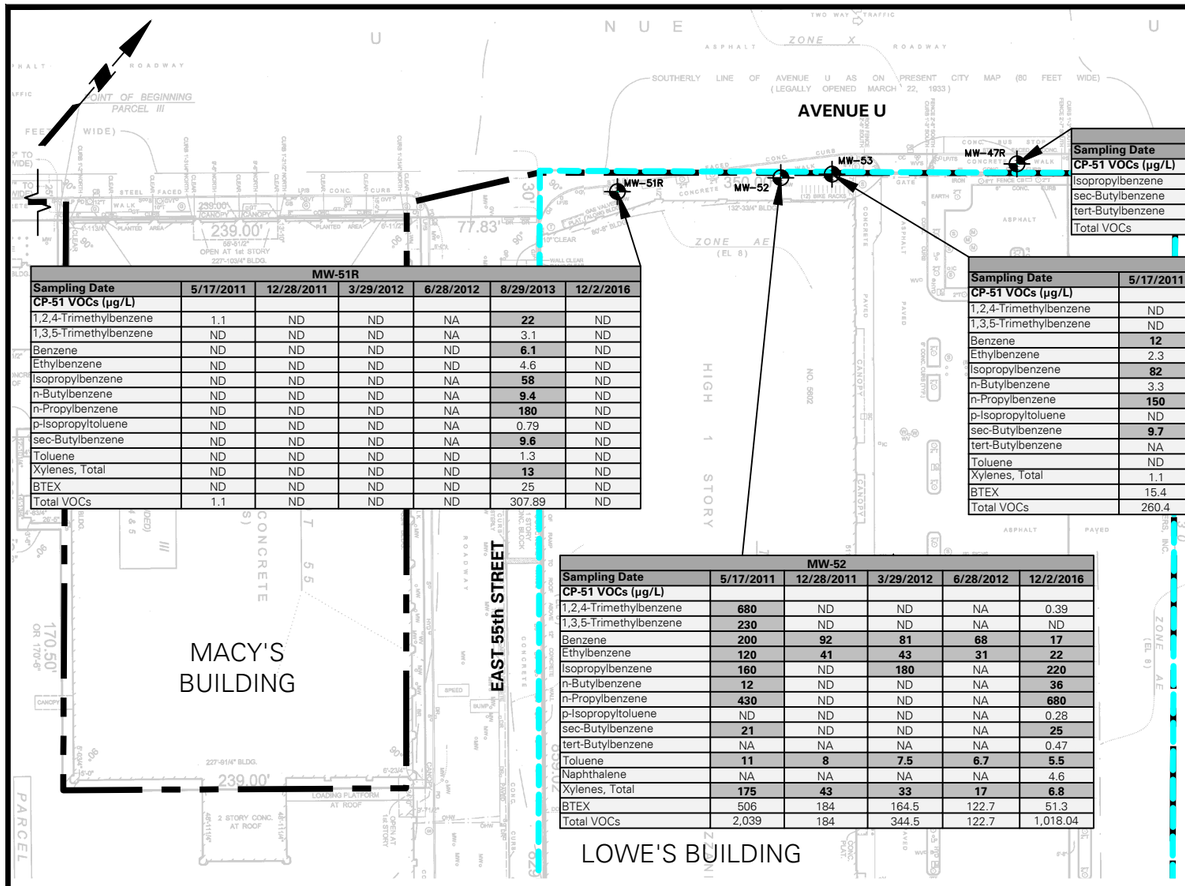
| | |
|---|---|
| Project | KINGS PLAZA<br>FORMER STANDARD OIL PARCEL (OU-3)<br>BROOKLYN NEW YORK |
| Drawing Title | SITE LOCATION MAP |
| Project No. | 140080107 |
| Date | 05/01/2013 |
| Scale | NTS |
| Drawn By | EB |
| Submission Date | DECEMBER 2016 |
| Figure No. | 1 |
| Sheet | 1 of 3 |



Filename: \\langan.com\data\NYC\data1\140080101\Cadd Data - 140080101\OU-3\OU-3_Baseline GW Monitoring Report\Figure 1 - Site Location Map.dwg Date: 12/23/2016 Time: 16:22 User: hgriesbach Style Table: Langan.stb Layout: ANSIA-BP




| MW-51R | | | | | | |
|---|---|---|---|---|---|---|
| **Sampling Date** | **5/17/2011** | **12/28/2011** | **3/29/2012** | **6/28/2012** | **8/5/2013** | **12/2/2016** |
| **CP-51 VOCs (µg/L)** | | | | | | |
| 1,2,4-Trimethylbenzene | 1.1 | ND | ND | NA | **22** | ND |
| 1,3,5-Trimethylbenzene | ND | ND | ND | NA | 3.1 | ND |
| Benzene | ND | ND | ND | ND | **6.1** | ND |
| Ethylbenzene | ND | ND | ND | ND | 4.6 | ND |
| Isopropylbenzene | ND | ND | ND | NA | **58** | ND |
| n-Butylbenzene | ND | ND | ND | NA | **9.4** | ND |
| n-Propylbenzene | ND | ND | ND | NA | **180** | ND |
| p-Isopropyltoluene | ND | ND | ND | NA | 0.79 | ND |
| sec-Butylbenzene | ND | ND | ND | NA | **9.6** | ND |
| Toluene | ND | ND | ND | ND | 1.3 | ND |
| Xylenes, Total | ND | ND | ND | ND | **13** | ND |
| BTEX | ND | ND | ND | ND | 25 | ND |
| Total VOCs | 1.1 | ND | ND | ND | 307.89 | ND |

| MW-47R | | | | | | |
|---|---|---|---|---|---|---|
| **Sampling Date** | **5/17/2011** | **12/28/2011** | **3/29/2012** | **6/28/2012** | **9/3/2013** | **12/2/2016** |
| **CP-51 VOCs (µg/L)** | | | | | | |
| Isopropylbenzene | ND | ND | ND | NA | 0.18 | ND |
| sec-Butylbenzene | ND | ND | ND | NA | 0.26 | 0.2 |
| tert-Butylbenzene | NA | NA | NA | NA | 0.28 | ND |
| Total VOCs | ND | ND | ND | ND | 0.72 | 0.2 |

| MW-53 | | | | | | | DUP |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | **5/17/2011** | **12/28/2011** | **3/29/2012** | **8/28/2012** | **8/29/2013** | **12/2/2016** | **12/2/2016** |
| **CP-51 VOCs (µg/L)** | | | | | | | |
| 1,2,4-Trimethylbenzene | ND | ND | ND | NA | **34** | ND | ND |
| 1,3,5-Trimethylbenzene | ND | ND | ND | NA | 4.7 | ND | ND |
| Benzene | **12** | **11** | ND | **8.1** | **5.3** | 0.77 | 0.76 |
| Ethylbenzene | 2.3 | 2.7 | ND | 2.1 | 4.2 | 0.29 | 0.26 |
| Isopropylbenzene | **82** | ND | ND | NA | **54** | 5 | 4.8 |
| n-Butylbenzene | 3.3 | ND | ND | NA | **9.2** | 2.2 | 2.1 |
| n-Propylbenzene | **150** | ND | ND | NA | **160** | **11** | **11** |
| p-Isopropyltoluene | ND | ND | ND | NA | 1.2 | ND | ND |
| sec-Butylbenzene | **9.7** | ND | ND | NA | **9.1** | 4.9 | 4.9 |
| tert-Butylbenzene | NA | NA | NA | NA | 0.36 | ND | ND |
| Toluene | ND | 2 | ND | 1.3 | 1.2 | 0.27 | ND |
| Xylenes, Total | 1.1 | 1.8 | ND | 1.6 | **13** | ND | ND |
| BTEX | 15.4 | 17.5 | ND | 13.1 | 23.7 | 1.33 | 1 |
| Total VOCs | 260.4 | 17.5 | ND | 13.1 | 296.26 | 24.43 | 23.82 |

| MW-52 | | | | | |
|---|---|---|---|---|---|
| **Sampling Date** | **5/17/2011** | **12/28/2011** | **3/29/2012** | **6/28/2012** | **12/2/2016** |
| **CP-51 VOCs (µg/L)** | | | | | |
| 1,2,4-Trimethylbenzene | **680** | ND | ND | NA | 0.39 |
| 1,3,5-Trimethylbenzene | **230** | ND | ND | NA | ND |
| Benzene | **200** | **92** | **81** | **68** | **17** |
| Ethylbenzene | **120** | **41** | **43** | **31** | **22** |
| Isopropylbenzene | **160** | ND | **180** | NA | **220** |
| n-Butylbenzene | **12** | ND | ND | NA | **36** |
| n-Propylbenzene | **430** | ND | ND | NA | **680** |
| p-Isopropyltoluene | ND | ND | ND | NA | 0.28 |
| sec-Butylbenzene | **21** | ND | ND | NA | **25** |
| tert-Butylbenzene | NA | NA | NA | NA | 0.47 |
| Toluene | **11** | **8** | **7.5** | **6.7** | **5.5** |
| Naphthalene | NA | NA | NA | NA | 4.6 |
| Xylenes, Total | **175** | **43** | **33** | **17** | **6.8** |
| BTEX | 506 | 184 | 164.5 | 122.7 | 51.3 |
| Total VOCs | 2,039 | 184 | 344.5 | 122.7 | 1,018.04 |

**CHART 1**

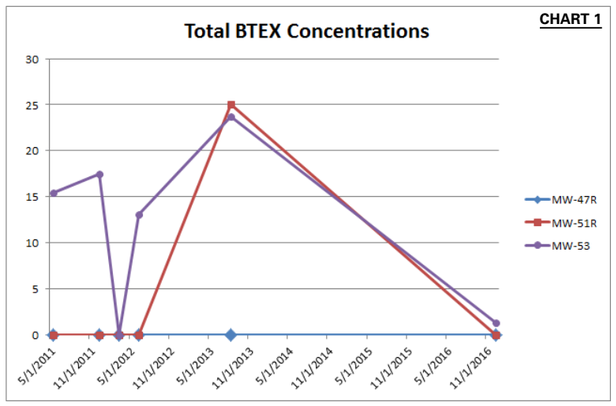



**CHART 2**

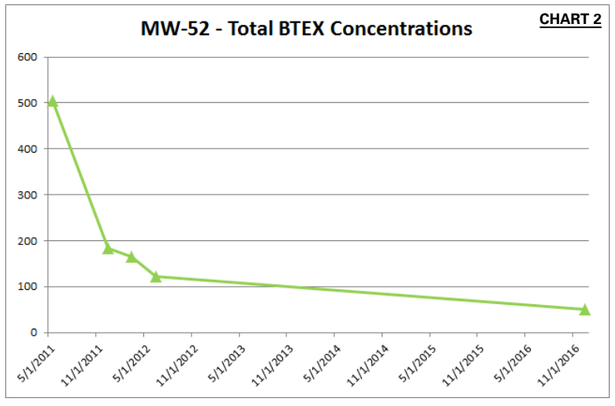



**CHART NOTES:**

1. MW-47R, MW-51R, AND MW-53 TOTAL BTEX CONCENTRATIONS DISPLAYED ON CHART 1.
2. MW-52 TOTAL BTEX CONCENTRATIONS DISPLAYED ON CHART 2.
3. BTEX = BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENES

100 0 50 100
SCALE IN FEET

**LEGEND:**

- KINGS PLAZA MALL BOUNDARY
- FORMER STANDARD OIL PARCEL BOUNDARY (OU-3)
- MW-31R — EXISTING MONITORING WELLS
- MW-55 — REMOVED OR DESTROYED WELLS
- LMW-3 — LANGAN MONITORING WELLS (AUGUST 2013)

**NOTES:**

1. BASEMAP INFORMATION FROM ALTA/ASCM LAND TITLE SURVEY BY BARTLETT, LUDLAM & DILL ASSOCIATES DATED 5 MAY 2011.
2. REMOVED OR DESTROYED MONITORING WELL LOCATIONS ARE APPROXIMATE BASED ON FIGURE 24 TITLED "POST REMEDIATION PROPOSED MONITORING WELLS", DATED 26 AUGUST 2010, AND INCLUDED IN THE SITE MANAGEMENT PLAN PREPARED BY EXCEL IN AUGUST 2010.
3. GROUNDWATER SAMPLE ANALYTICAL RESULTS ARE COMPARED TO THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TECHNICAL AND OPERATIONAL GUIDANCE SERIES (TOGS) 1.1.1. AMBIENT WATER QUALITY STANDARDS (AWQS) AND GUIDANCE VALUES FOR DRINKING WATER (CLASS GA).
4. EXCEEDANCES ARE HIGHLIGHTED AND BOLD.
5. VOCs = VOLATILE ORGANIC COMPOUNDS
6. µg/L = MICROGRAMS PER LITER
7. ND = NOT DETECTED
8. NA = NOT ANALYZED
9. BTEX = BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENES
10. MTBE = METHYL TERT-BUTYL ETHER

| CP-51 Volatile Organic Compounds (µg/L) | NYSDEC TOGS Standards and Guidance Values - GA |
|---|---|
| 1,2,4-Trimethylbenzene | 5 |
| 1,3,5-Trimethylbenzene | 5 |
| Benzene | 1 |
| Ethylbenzene | 5 |
| Isopropylbenzene | 5 |
| n-Butylbenzene | 5 |
| n-Propylbenzene | 5 |
| p-Isopropyltoluene | 5 |
| sec-Butylbenzene | 5 |
| tert-Butylbenzene | 5 |
| Toluene | 5 |
| Naphthalene | 10 |
| Xylenes, Total | 5 |
| BTEX | ~ |
| Total VOCs | ~ |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Langan International LLC
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Project: KINGS PLAZA
FORMER STANDARD OIL PARCEL (OU-3)
BROOKLYN NEW YORK

Figure Title: MONITORING WELL LOCATION AND RESULTS MAP

Project No. 140080107
Date 9/27/2013
Scale 1" = 100'
Drawn By HHG
Submission Date DECEMBER 2016

Figure No. 2
Sheet 2 of 3



Filename: \\langan.com\data\NYC\data1\140080101\Cadd Data - 140080101\OU-3\OU-3_Baseline GW Monitoring Report\Figure 5 - GW Sample and Results Location Map.dwg Date: 1/9/2017 Time: 11:45 User: hgriesbach Style Table: Langan.stb Layout: 2016 Results

# APPENDIX A
# GROUNDWATER MONITORING REPORT FOR FORMER STANDARD OIL PARCEL (OU-3)

# GROUNDWATER MONITORING REPORT FOR FORMER STANDARD OIL PARCEL (OU-3)

## Kings Plaza Shopping Center
## 5102, 5120 & 5502 Avenue U
## Brooklyn, New York

## NYSDEC Spill No. 98-15289

***Prepared For:***

**Macerich Management Company, LLC.**
**401 Wilshire Boulevard, Suite 700**
**Santa Monica, California 90401**

***Prepared By:***

**Langan Engineering, Environmental, Surveying, and Landscape Architecture, D.P.C.**
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**360 West 31st Street, 8th Floor**
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**David V. Granucci**
**Project Engineer**

**Jamie P. Barr, LEP**
**Senior Associate/Vice President**

LANGAN

**February 2017**
**140080107**

## TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## LIST OF APPENDICES

## INTRODUCTION

This Groundwater Monitoring Report was prepared on behalf of Macerich Management Company, LLC (Macerich) for the former Standard Oil parcel (also known as operable unit [OU] 3) at 5602 Avenue U in Brooklyn, New York (the "site"). The site is currently subject to a stipulation agreement under New York State Department of Environmental Conservation (NYSDEC) Spill Nos. 98-15289 and 09-04813. This report summarizes on-site groundwater monitoring and sampling activities conducted during December 2016 to demonstrate decreasing concentrations of petroleum compounds. Groundwater sampling activities were conducted in accordance with the 2 November 2016 request from NYSDEC.

In March 2016, Langan submitted a Construction Completion Report (CCR), summarizing the historic remediation activities of open spills at OU-3, to the NYSDEC. In a conference call held on 2 November 2016, NYSDEC requested that Langan complete one additional round of groundwater sampling at four wells along Avenue U (MW-47R, MW-51R, MW-52, and MW-53). If decreasing trends for petroleum-related volatile organic compounds (VOCs) were observed in the wells, (compared to sampling conducted in August 2013), the NYSDEC indicated that they would close Spill No. 98-15289. According to NYSDEC, this is the only outstanding issue to address prior to closure of the spill. Following the conference call, Spill No. 09-04813 was closed.

# 1.0 SITE BACKGROUND

## 1.1 Site Description

The site occupies an approximately 5.9-acre area and is improved with a 1-story Lowe's Home Improvement store (Lowe's) with an associated asphalt parking lot. The Lowe's lot is at 5502 Avenue U (Block 8470, Lot 114) and bounded by Avenue U to the northwest, an adjacent shopping center (Block 8470, Lot 130) to the northeast, the Mill Basin to the southeast, and East 55th Street to the southwest. A Site Location Map is included as Figure 1.

## 1.2 Site History

The site was developed as a Standard Oil petroleum bulk storage (PBS) facility from approximately 1930 to 1960. The former PBS facility reportedly maintained 24 100,000-gallon aboveground storage tanks (ASTs), gasoline pumps, two fuel loading racks associated with the ASTs, two garages, and a warehouse. In addition, auto repair and rental operations reportedly took place at the site.

## 1.3 Current Regulatory Status of the Site

Alexander's Kings Plaza Center Inc. (Alexander's), a wholly-owned subsidiary of Vornado Realty Trust (Vornado), entered into a stipulation agreement with the New York State Department of Environmental Conservation (NYSDEC) on 13 May 2002 to investigate and remediate historic petroleum discharges to soil and shallow groundwater associated with Spill No. 97-04124, which occurred within OU-3. NYSDEC Spill No. 97-04124 was opened at the Site in July 1997 to address historical releases from the former PBS facility. The Site was investigated between 1997 and 1999, and a second spill was opened on 25 March 1999 (NYSDEC Spill No. 98-15289) to address the same impacts as Spill No. 97-04124, but for a second responsible party.

Remediation of the Site was conducted between 2005 and 2010 to enable an expansion of the existing Kings Plaza shopping mall. The expansion included construction of a 125,000-square-foot Lowe's Home Improvement Center (Lowe's) with an asphalt-paved parking lot and a landscaped waterfront area adjacent to the Mill Basin, southeast of the Site. Spill No. 09-04813 was also opened for petroleum product identified during installation of a water line at the Site in 2009. This spill was remediated during redevelopment of the Site. Construction of the Lowe's was completed in 2010.

Macerich purchased the Site from Vornado in 2012, along with the Kings Plaza mall. At the time of Macerich's purchase of the Site, remediation was complete with the exception that a final report for the remedial activities had not yet been submitted. Spill No. 97-04124 was closed in

December 2008 following remediation of the Site. Spill No. 09-04813 was closed in November 2016 following receipt of the CCR.

## 1.4 Site Physical Conditions

### 1.4.1 Surrounding Property Land Use

The site is currently zoned M3-1 by the New York City Department of City Planning. M3-1 is described as a manufacturing district designated for areas with heavy industries that generate noise, traffic, or pollutants. The site is bound by the Mill Basin waterway followed by various commercial and residential properties to the south, Flatbush Avenue followed by various commercial properties to the west, Macy's and Avenue U followed by various commercial and residential properties to the north, and an asphalt paved parking area, Home Depot and the Mill Basin followed by various commercial and residential properties to the east.

Land use within a ½ mile of the site is highly urbanized. Surrounding land use within a ½-mile radius includes residential and commercial properties, the Mill Basin, cross streets and avenues, residential neighborhoods, and park land.

The nearest ecological receptor is the Mill Basin, abutting the site to the south and east. The Mill Basin is a tributary of Jamaica Bay, which is located approximately 1.75 miles downstream of the site. Mill Basin and East Mill Basin join approximately 1 mile downstream of the site before feeding into Jamaica Bay. The nearest sensitive receptor is a park approximately 250 feet south of the site. There is no school, day care facility, or hospital within a ½ mile of the site.

Additionally, the online NYSDEC Environmental Resource Mapper identifies an area containing rare plants and/or animals within a 1-mile radius of the site. An area of significant natural communities is approximately 0.75 miles east of the site.

### 1.4.2 Topography

The topography of the site and the surrounding area is relatively flat with elevations ranging from approximately elevation (el.)[1] 8 to el. 10 based on the Federal Emergency Management Agency (FEMA) flood insurance rate map (FIRM).

[1] Elevations are relative to North American Vertical Datum of 1988 (NAVD88).

1.4.3 Geology

Available United States Geologic Survey (USGS) reports and maps, historic topographic maps, and boring information from previous subsurface investigations performed at or near the site were reviewed to obtain general geologic information. Geologic strata in this area of Brooklyn generally consist of a thin layer of fill overlying unconsolidated sediment that was deposited during multiple episodes of glaciation over bedrock basement. Based on a review of the USGS Subsurface Configuration of Crystalline Bedrock Map (Buxton et al., 1981), bedrock depth at the site is between approximately 600 and 700 feet below ground surface (bgs).

Data obtained during subsurface investigations indicates that historic fill containing fine to coarse sand, silt, and varying amounts of brick, gravel, wood, coal, and concrete is present at depths up to 7 feet. The fill layer is underlain by a silty fine to coarse sand unit that is approximately 2 to 10 feet thick. A continuous organic clay unit underlies the silty sand at depths from approximately 8 to 18 feet at the site, with the exception of an area near Mill Basin in which clay was not encountered at the boring termination depth of 15 feet.

1.4.4 Hydrogeology

Subsurface data obtained during the December 2016 gauging event indicate that the depth of groundwater is approximately 4.6 to 7.43 feet, which corresponds to el. 3.14 to 5.21. The general direction of groundwater flow is to the southeast towards Mill Basin in the southern portion of the site and to the northwest in the northern portion of the site with a mound in the central portion of the site. Groundwater is tidally influenced in the area, especially along the Mill Basin, and as a result, depths, hydraulic gradient, and flow directions may vary depending on the time of day and month. In addition, based on a 2003 geotechnical study completed by Langan at the site, the organic clay layer has average permeabilities ranging from approximately $10^{-7}$ to $10^{-9}$ centimeters per second (cm/s), indicating that the organic clay layer is a confining unit.

1.4.5 Wetlands

Based on the National Wetland Inventory (NWI) map, wetlands are not on or immediately adjacent to the site.

## 1.5 Summary of Previous Environmental Investigations

The following environmental reports were reviewed and summarized below:

- Contamination Assessment/Site Investigation, prepared by IVI Environmental, Inc. (IVI), 29 July 1997;

- Remedial Investigation Report (RIR) Addendum/Remedial Investigation Workplan (RIWP), Former Standard Oil Terminal (OU-3), prepared by Excel Environmental Resources, Inc. (Excel), April 2003;
- Geotechnical Study, Retail Center Kings Plaza Shopping Center, prepared by Langan, April 2003;
- Remedial Action Work Plan (RAWP), Former Standard Oil Terminal (OU-3), prepared by Excel, July 2003;
- ENB Public Notice, OU-3 – Former Standard Oil Terminal, prepared by NYSDEC, 4 July 2005;
- RAWP Amendment, Former Standard Oil Terminal (OU-3), prepared by Excel, 14 April 2006;
- Draft Site Management Plan (SMP), Former Standard Oil Terminal (OU-3), prepared by Excel, August 2010;
- Phase I ESA, Kings Plaza Shopping Center, prepared by Partner Engineering and Science, Inc., May 2011;
- Phase I ESA, Kings Plaza Shopping Center, prepared by Certified Environments Inc., 27 July 2012;
- Transmittal of Post-Excavation Groundwater Analytical Data, prepared by Excel, dated 1 August 2012; and,
- Construction Completion Report, NYSDEC Spill Numbers: 98-15289, 08-13330 and 09-04813, prepared by Langan Engineering, Environmental, Surveying, and Landscape Architecture, D.P.C., dated March 2016.

Petroleum impacts to soil and groundwater at the site were first identified during a subsurface investigation conducted by IVI in July 1997. Petroleum-impacted soil was identified in soil borings advanced from depths of 2 to 10 feet to the top of the clay layer. No free-phase petroleum product was encountered during this investigation. Elevated concentrations of VOCs, including benzene, toluene, ethylbenzene, xylene (BTEX) and methyl tert-butyl ether (MTBE), were detected in groundwater samples at concentrations exceeding NYSDEC Division of Water Technical and Operation Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards (AWQS) and guidance values for Class GA water in the six on-site monitoring wells.

Excel identified the following areas of concern (AOCs) in the draft SMP, dated August 2010:

- AOC A – Former gasoline pumps;
- AOC B – Former fuel racks;
- AOC C – Former garages;
- AOC D – Area to the southeast of the former gasoline ASTs;
- AOC E – Area to the southwest of the former gasoline ASTs; and,

- AOC F – Former AOC containment pad.

Remedial investigations were conducted by IVI in 1999 and Excel in 2003. Based on a review of the RIR Addendum/RIWP and the RAWP prepared by Excel, petroleum-impacted soil and groundwater were encountered in the vicinity of AOCs A, B, and F. In addition, free-phase petroleum product was encountered in monitoring wells located in the area of AOC F.

The following remedial activities were conducted on site between 2003 and 2010:

- Removal and off-site disposal of approximately 23,600 tons of petroleum-impacted soil;
- On-site treatment and discharge of approximately 571,500 gallons of groundwater using a groundwater treatment system;
- Recovery and off-site disposal of approximately 1,000 gallons of free-phase petroleum product;
- Backfilling of the excavation with approximately 16,500 tons of clean fill blended with approximately 7,700 pounds of an oxygen release compound (Permeox$^{TM}$) to enhance natural biodegradation of residual petroleum compounds in the saturated soil and groundwater;
- Collection and laboratory analysis of soil, groundwater, and soil vapor post-excavation samples to confirm that petroleum-impacted soil was removed; and,
- Installation of a vapor barrier and passive sub-slab depressurization system (SSDS) under the Lowe's building slab.

In addition, Excel conducted four bi-annual groundwater monitoring events between May 2011 and June 2012 to monitor post-remediation groundwater quality and natural attenuation of petroleum-related compounds in groundwater. Langan implemented the August 2013 NYSDEC-approved Groundwater Monitoring Plan (GWMP) between 19 August and 3 September 2013, 10 October 2013, and 12 November 2013. The objectives of the groundwater monitoring were to assess current site conditions and establish a baseline for groundwater quality and remedial actions for closure of Spill Nos. 98-15289 and 09-04813.

## 2.0 GROUNDWATER MONITORING

Langan conducted one round of limited groundwater sampling for four wells (MW-47R, MW-51R, MW-52, and MW-53) on 1 and 2 December 2016. The objectives of the groundwater monitoring were to evaluate decreasing concentrations of petroleum compounds along the northern portion of OU-3. The limited groundwater monitoring was conducted in accordance with the NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (May 2010) and the NYSDEC-approved GWMP. The scope of the groundwater monitoring included the following activities:

- Purging each of the four wells (MW-47R, MW-51R, MW-52, and MW-53) to remove stagnant water which may not be indicative of the actual groundwater conditions;
- Sampling of each of the four wells using United State Environmental Protection Agency (USEPA) low-flow techniques; and,
- Laboratory analysis of four groundwater samples for the CP-51 list of VOCs via USEPA method 8260.

### 2.1 Groundwater Monitoring

#### 2.1.1 Field Observations and Measurements

Prior to groundwater sample collection, synoptic water level and head space total organic vapor (TOV) measurements were collected on 1 December 2016 using a decontaminated Solinst® 122 oil/water interface probe and a MiniRAE 3000 photoionization detector (PID). The depth to water level was measured to the nearest 0.01-foot from the top of the PVC well casing. Water levels were recorded and converted to elevations relative to North American Vertical Datum of 1988 (NAVD88) for groundwater contouring purposes (see Table 1). Depths to groundwater ranged from 4.6 feet (el. +5.21) in MW-47R to 7.43 feet (el. +3.14) in MW-51R. LNAPL was not identified in any of the four wells gauged; a very light sheen and hydrocarbon odor were observed while gauging and pumping MW-52.

Head space TOV readings ranged from 0.0 ppm (MW-47R) to 9.9 ppm (MW-52) during the pre-purging synoptic gauging conducted on 1 December 2016. Groundwater depths, groundwater elevations, and head space PID measurements are presented in Table 1. Based on well gauging conducted in 2013, which included up- and down-gradient wells, the direction of groundwater flow is to the south towards the Mill Basin in the southern portion of the site and to the northwest in the northern portion of the site with a mound in the central portion of the site. A 2013 groundwater contour map is provided as Figure 3.

### 2.1.2 Well Purging

Prior to groundwater sampling, Langan purged each of the four wells to remove stagnant water. Monitoring wells MW-47R, MW-51R, MW-52, and MW-53 were purged using a Grundfos Redi-Flo2 submersible pump. First, each well was gauged for the presence of light non-aqueous phase liquid (LNAPL) using an oil/water interface probe. Then, each well was pumped and surged (lifting and dropping the pump to mechanically agitate and remove fine particles from the screened interval) until the effluent ran clear and a minimum of three well volumes was removed. Monitoring well MW-51R ran dry during pumping activities; pumping was halted until approximately 1 to 3 feet of groundwater had recharged and then the well was pumped dry again. This sequence was repeated until approximately three well volumes had been pumped out. Subsequent to purging, the wells were allowed to recharge and settle for at least 24 hours prior to low-flow sampling. All purge water was containerized pending characterization and off-site disposal.

### 2.1.3 Groundwater Sampling

Langan performed one round of groundwater sampling and the sampling methodology was in accordance with the procedures set forth in the NYSDEC-approved GWMP. Groundwater samples were collected from MW-47R, MW-51R, MW-52, and MW-53 on 2 December 2016 at least 24 hours after wells were purged. Prior to sampling, all wells were gauged to determine if measurable product was present using an oil/water interface probe. The monitoring wells were sampled using low-flow purging techniques to minimize drawdown using a Geotech Model II peristaltic pump with dedicated polyethylene tubing at a rate of 100 to 150 milliliters (mL) per minute. Water-quality parameters (pH, temperature, specific conductance, turbidity, ORP, and DO) were measured and recorded at approximately 5-minute intervals. Measurements were collected until the parameters stabilized for at least three consecutive readings.

Groundwater samples were collected into laboratory-supplied glassware and delivered via courier service to York Analytical Laboratories, Inc. (York), a New York State Department of Health Environmental Laboratory Accreditation Program (ELAP)-certified laboratory in Stratford, Connecticut, under standard chain-of-custody protocol. For quality assurance and quality control (QA/QC) purposes, a duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples were collected, and a trip blank was included with the sample shipment. Groundwater samples were analyzed for CP-51 list VOCs via USEPA Method 8260. Groundwater sampling logs are provided in Appendix A. Laboratory data packages and chain-of-custody documentation are provided in Appendix B.

2.1.4 Groundwater Sample Analytical Results

Groundwater sample results were compared to NYSDEC TOGS Standards and Guidance Values for Class GA (drinking water) groundwater. Groundwater sample analytical results are summarized in Table 2. Groundwater sample locations and results are presented on Figure 2.

- One or more VOCs, including benzene, ethylbenzene, isopropylbenzene, n-butylbenzene, n-propylbenzene, sec-butylbenzene, toluene, and total xylenes, were detected at concentrations above the AWQS/GV in two of the four sampled monitoring wells.
- BTEX concentrations ranged from 1.33 to 51.3 micrograms per liter (µg/L).
- Total VOC concentrations ranged from 0.2 to 1,018.04 µg/L.
- Concentrations of all VOCs detected during the December 2016 sampling event were lower than previous sampling events with the exception of MW-52, which was lower than the May 2011 event.

*MW-47R*
Sec-butylbenzene was detected at a concentration of 0.2 µg/L, below the AWQS/GV of 5 µg/L. Maximum BTEX and total VOC concentrations were non-detect and 0.2 µg/L, respectively, for the sample collected from MW-47R.

*MW-51R*
No VOCs were detected at concentrations above laboratory reporting limits in the sample collected from MW-51R.

*MW-52*
Eight VOCs, including benzene, ethylbenzene, isopropylbenzene, n-butylbenzene, n-propylbenzene, sec-butylbenzene, toluene, and total xylenes, were detected at concentrations exceeding the AWQS/GV. Four VOCs, including 1,2,4-trimethylbenzene, p-isopropyltoluene, tert-butylbenzene, and naphthalene, were detected at concentrations below the AWQS/GV. Maximum BTEX and total VOC concentrations were 51.3 and 1,018.04 µg/L, respectively, for the sample collected from MW-52.

*MW-53*
N-propylbenzene was detected at a concentration of 11 µg/L, exceeding the AWQS/GV of 5 µg/L. Six VOCs, including benzene, ethylbenzene, isopropylbenzene, n-butylbenzene, sec-butylbenzene, and toluene, were detected at concentrations below AWQS/GV. Maximum BTEX and total VOC concentrations were 1.33 and 24.43 µg/L, respectively, for the sample collected from MW-53.

2.1.5 Data Evaluation

A comparison of historical well monitoring data from Excel's 2011 and 2012 events, and the 2013 Langan monitoring event, and the results of this investigation indicate that concentrations of BTEX have decreased or stabilized in all four monitoring wells over the monitoring period. Total VOC concentrations have decreased in all monitoring wells between 2011 and 2016. A stable trend or plume is one in which the concentration trends remain the same over time and new wells are not observed to become impacted. A decreasing trend is observed when contaminant concentrations in groundwater are shown to be decreasing over the monitoring event. One sampling result with higher contaminant concentrations does not necessarily invalidate an overall decreasing trend.

A summary of the groundwater trend observations for each well is provided below.

*MW-47R*

- Contaminant concentrations are below AWQS/GV for all compounds.
- No compound has been detected above the AWQS/GV in any sampling event at this well.

*MW-51R*

- All contaminant concentrations were observed to be below the AWQS/GV in the latest sampling event.
- With the exception of the August 2013 sampling event, no compounds have been detected above the AWQS/GV.
- The August 2013 sampling event showed anomalous results in MW-51R and MW-53, with a sharp increase in BTEX and overall VOC concentrations observed in both wells.
- The most recent sampling event conducted in December 2016 did not replicate the August 2013 results, and confirmed that the contaminant concentrations are generally stable and below the AWQS/GV.

*MW-53*

- With the exception of n-propylbenzene, all contaminant concentrations were below the AWQS/GV during the December 2016 sampling event.
- Contaminant concentrations have shown an overall decreasing trend between the 2011 and 2016 sampling events.
- The August 2013 sampling event showed anomalous results in MW-53 and MW-51R, with a sharp increase in BTEX and overall VOC concentrations observed in both wells.
- Benzene concentrations have steadily decreased over time and are currently below the AWQS/GV.

- Total BTEX and VOC concentrations have decreased by approximately 91% during the monitoring period, demonstrating a strong attenuation trend.

*MW-52*

- Contaminant concentrations have been observed to decrease during the monitoring period.
- Concentrations of BTEX compounds have decreased by approximately 90% over the monitoring period with individual compound concentrations reduced by an order of magnitude or more at this well.
- Total VOC concentrations have decreased by approximately 50% during the monitoring period. Heavier benzene based compounds have shown mixed trends during the monitoring period. Trimethylbenzenes have decreased to below the AWQS/GV, while other benzene based compounds, such as n-butylbenzene, isopropylbenzene and n-propylbenzene, have increased during the monitoring period.

Historic post-remediation groundwater monitoring analytical results are summarized in Table 2. Figure 2 displays analytical results (tables and graphs) for each well (MW-47R, MW-51R, MW-52, and MW-53).

2.1.6 Data Validation

Upon receipt of the final Analytical Services Protocol (ASP) Level B laboratory report, data validation was performed in accordance with the USEPA validation guidelines for organic and inorganic data review. The Data Usability Report (DUSR) is included as Appendix C.

## 2.2 Management of Investigation-Derived Waste

All groundwater investigation-derived wastes (IDW) were containerized in United States Department of Transportation (USDOT)-approved 55-gallon drums. Decontamination, well purging, and sampling fluids were placed in the same USDOT-approved drum with a closed top. The drum was properly labeled, sealed, and characterized as necessary. The drum is temporarily staged in a secure area on-site pending transportation to an appropriate disposal facility.

## 3.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the information provided herein, we conclude the following:

- No free-phase petroleum product was encountered in any of the monitoring wells (MW-47R, MW-51R, MW-52, and MW-53) during the gauging event on 1 December 2016 and the analytical data does not suggest presence of non-aqueous phase liquid (NAPL).
- One or more VOCs, including benzene, ethylbenzene, isopropylbenzene, n-butylbenzene, n-propylbenzene, sec-butylbenzene, toluene, and total xylenes, were detected at concentrations above the AWQS/GV in two (MW-52 and MW-53) of the four sampled monitoring wells.
    - Despite these exceedances, overall BTEX and VOC concentrations at both wells have decreased during the monitoring period.
    - N-Propylbenzene was the only compound to exceed AWQS/GV at MW-53 in the most recent sampling event.
    - Multiple compounds exceed the TOGS at MW-52; however, BTEX concentrations continued to diminish during the monitoring period and are approaching the AWQS/GV.
    - Heavier, less mobile benzene-based compounds remain in the groundwater at MW-52. These compounds, including isopropylbenzene, n-butylbenzene, n-proplybenzene, and sec-butylbenzene, all have lower vapor pressures (generally 1 order of magnitude lower) and greater organic carbon partitioning coefficients (generally 2 orders of magnitude higher) than the BTEX compounds, indicating that they are significantly less mobile in the environment.
- Based on a comparison of analytical results from post-remediation sampling from 2011, 2012, and 2013, and the 2016 groundwater monitoring event, BTEX and VOC concentrations have exhibited a decrease or stabilization in all four monitoring wells.
- Heavy benzene based compounds identified in MW-52 have a low mobility and are likely exhibiting sporadic spikes as groundwater elevation fluctuates. These compounds can remain in the smear zone and their partitioning to the groundwater will be significantly slower than the BTEX compounds. Because the heavier compounds have a higher affinity to the adsorbed phase, their potential for biodegradation is limited by their dissolution rate. This limited rate of biodegradation does not increase their potential transport in the environment because of their higher retardation rate.
- The decrease in VOC concentrations in the wells indicates that natural attenuation is occurring at the site. BTEX concentrations in MW-52 and MW-53 have shown sustained concentration reductions during the monitoring period. These reductions were evident even during sampling events where heavier benzene-based compounds were observed to increase for one event.

The petroleum-impacted soil source areas that were impacting groundwater have been either removed from the site or treated with an oxygen release compound during the historic remedial activities and continue to attenuate. In a conference call held on 2 November 2016, NYSDEC requested that Langan complete an additional round of groundwater sampling of the four wells located along Avenue U to demonstrate that concentrations of petroleum compounds are decreasing before the two open spill numbers will be closed. Based on current and historic groundwater monitoring data and the following site conditions, Langan recommends that NYSDEC Spill No. 98-15289 be closed:

- The site is used as a commercial property, and most of the site is capped with asphalt pavement, concrete slab (Lowe's building), concrete walkways, and landscaped areas along the Mill Basin.
- There is no direct contact with the groundwater at the site and groundwater in New York City is not used as a potable water source.
- The on-site building (Lowe's) was built with a vapor barrier and a passive sub-slab depressurization system (SSDS); therefore, potential for vapor intrusion in the building is limited.

# TABLES

Table 1
Monitoring Well Inventory and Groundwater Elevations
Kings Plaza Shopping Center
Brooklyn, New York
NYSDEC Spill No. 98-15289
Langan Project No. 140080107

| Well ID | Headspace PID Reading (ppm)[1] | Total Well Depth (feet bgs)[1] | Depth to Water (feet bgs)[1] | Ground Surface Elevation[2] | Top of Casing Elevation[2] | Groundwater Elevation[2] |
|---|---|---|---|---|---|---|
| MW-47R | 0.0 | 12.6 | 4.6 | 10.13 | 9.81 | 5.21 |
| MW-51R | 0.5 | 12.05 | 7.43 | 10.91 | 10.57 | 3.14 |
| MW-52 | 9.9 | 15.1 | 5.58 | 10.62 | 10.39 | 4.81 |
| MW-53 | 0.4 | 9.98 | 5 | 10.52 | 10.28 | 5.28 |

**Notes:**

1. The monitoring well inventory was conducted by Langan on 1 December 2016.
2. The horizontal datum is referenced to the North American Datum of 1983 (NAD83), New York State Plane Coordinate System, Long Island Zone. The vertical datum is referenced to the North American Vertical Datum of 1988 (NAVD88).
3. Free-phase product was not encountered in any of the wells.
4. All wells were 2-inch diameter PVC.

**Definitions:**

PID = photoionization detector
ppm = parts per million
bgs = below grade surface

Table 2
Groundwater Analytical Results Summary
Kings Plaza Shopping Center
Brooklyn, New York
NYSDEC Spill No. 98-15289
Langan Project No. 140080107

| **Monitoring Well ID<br>Groundwater Elevations (el.)<br>Sampling Date** | **NYSDEC TOGS Standards and Guidance Values - GA** | **MW-47R<br>4.59<br>5/17/2011** | **MW-47R<br>4.66<br>12/28/2011** | **MW-47R<br>NM<br>3/29/2012** | **MW-47R<br>4.76<br>6/28/2012** | **MW-47R<br>4.6<br>9/3/2013** | **MW-47R<br>5.21<br>12/2/2016** |
|---|---|---|---|---|---|---|---|
| **CP-51 Volatile Organic Compounds (µg/L)** | | | | | | | |
| 1,2,4-Trimethylbenzene | 5 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| 1,3,5-Trimethylbenzene | 5 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| Benzene | 1 | ND | ND | ND | ND | ND<1 | ND<0.5 |
| Ethylbenzene | 5 | ND | ND | ND | ND | ND<1 | ND<0.5 |
| Isopropylbenzene | 5 | ND | ND | ND | NA | 0.18 J | ND<0.5 |
| Methyl tert-butyl ether (MTBE) | 10 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| n-Butylbenzene | 5 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| n-Propylbenzene | 5 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| p-Isopropyltoluene | 5 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| sec-Butylbenzene | 5 | ND | ND | ND | NA | 0.26 J | 0.2 J |
| tert-Butylbenzene | 5 | NA | NA | NA | NA | 0.28 J | ND<0.5 |
| Toluene | 5 | ND | ND | ND | ND | ND<1 | ND<0.5 |
| Naphthalene | 10 | NA | NA | NA | NA | NA | ND<2 |
| Xylenes, Total | 5 | ND | ND | ND | ND | ND<3 | ND<1.5 |
| BTEX | ~ | ND | ND | ND | ND | ND | ND |
| Total VOCs | ~ | ND | ND | ND | ND | 0.72 | 0.2 |

**Notes:**
1. Groundwater sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) 1.1.1. Ambient Water Quality Standards (AWQS) and guidance values for drinking water (class GA).
2. Results exceeding NYSDEC TOGS are shaded and bolded.

**Definitions:**
~ = No regulatory limit has been established for this analyte
BTEX = Benzene, Toluene, Ethylbenzene, and Total Xylenes
D = Result is from an analysis that required a dilution.
J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
J* = Indicates the concentration is below the reporting limit but greater than or equal to the method detection limit. The concentration reported is estimated.

NA = Not analyzed
ND = Not detected
µg/L = micrograms per liter

Table 2
Groundwater Analytical Results Summary
Kings Plaza Shopping Center
Brooklyn, New York
NYSDEC Spill No. 98-15289
Langan Project No. 140080107

| **Monitoring Well ID<br>Groundwater Elevations (el.)<br>Sampling Date** | **NYSDEC TOGS Standards and Guidance Values - GA** | **MW-51R<br>2.88<br>5/17/2011** | **MW-51R<br>3.44<br>12/28/2011** | **MW-51R<br>2.62<br>3/29/2012** | **MW-51R<br>3.52<br>6/28/2012** | **MW-51R<br>3.03<br>8/29/2013** | **MW-51R<br>3.14<br>12/2/2016** |
|---|---|---|---|---|---|---|---|
| **CP-51 Volatile Organic Compounds (µg/L)** | | | | | | | |
| 1,2,4-Trimethylbenzene | 5 | 1.1 | ND | ND | NA | **22** | ND<0.5 |
| 1,3,5-Trimethylbenzene | 5 | ND | ND | ND | NA | 3.1 | ND<0.5 |
| Benzene | 1 | ND | ND | ND | ND | **6.1** | ND<0.5 |
| Ethylbenzene | 5 | ND | ND | ND | ND | 4.6 | ND<0.5 |
| Isopropylbenzene | 5 | ND | ND | ND | NA | **58** | ND<0.5 |
| Methyl tert-butyl ether (MTBE) | 10 | ND | ND | ND | NA | ND<1 | ND<0.5 |
| n-Butylbenzene | 5 | ND | ND | ND | NA | **9.4** | ND<0.5 |
| n-Propylbenzene | 5 | ND | ND | ND | NA | **180** | ND<0.5 |
| p-Isopropyltoluene | 5 | ND | ND | ND | NA | 0.79 J | ND<0.5 |
| sec-Butylbenzene | 5 | ND | ND | ND | NA | **9.6** | ND<0.5 |
| tert-Butylbenzene | 5 | NA | NA | NA | NA | ND<1 | ND<0.5 |
| Toluene | 5 | ND | ND | ND | ND | 1.3 | ND<0.5 |
| Naphthalene | 10 | NA | NA | NA | NA | NA | ND<2 |
| Xylenes, Total | 5 | ND | ND | ND | ND | **13** | ND<1.5 |
| BTEX | ~ | ND | ND | ND | ND | 25 | ND |
| Total VOCs | ~ | 1.1 | ND | ND | ND | 307.89 | ND |

**Notes:**
1. Groundwater sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) 1.1.1. Ambient Water Quality Standards (AWQS) and guidance values for drinking water (class GA).
2. Results exceeding NYSDEC TOGS are shaded and bolded.

**Definitions:**
~ = No regulatory limit has been established for this analyte
BTEX = Benzene, Toluene, Ethylbenzene, and Total Xylenes
D = Result is from an analysis that required a dilution.
J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
J* = Indicates the concentration is below the reporting limit but greater than or equal to the method detection limit. The concentration reported is estimated.

NA = Not analyzed
ND = Not detected
µg/L = micrograms per liter

Table 2
Groundwater Analytical Results Summary
Kings Plaza Shopping Center
Brooklyn, New York
NYSDEC Spill No. 98-15289
Langan Project No. 140080107

| **Monitoring Well ID<br>Groundwater Elevations (el.)<br>Sampling Date** | **NYSDEC TOGS Standards and Guidance Values - GA** | **MW-52<br>3.71<br>5/17/2011** | **MW-52<br>4.01<br>12/28/2011** | **MW-52<br>NM<br>3/29/2012** | **MW-52<br>4.16<br>6/28/2012** | **MW-52<br>4.81<br>12/2/2016** |
|---|---|---|---|---|---|---|
| **CP-51 Volatile Organic Compounds (µg/L)** | | | | | | |
| 1,2,4-Trimethylbenzene | 5 | **680** | ND | ND | NA | 0.39 J |
| 1,3,5-Trimethylbenzene | 5 | **230** | ND | ND | NA | ND<0.5 |
| Benzene | 1 | **200** | **92** | **81** | **68** | **17** |
| Ethylbenzene | 5 | **120** | **41** | **43** | **31** | **22** |
| Isopropylbenzene | 5 | **160** | ND | **180** | NA | **220 D** |
| Methyl tert-butyl ether (MTBE) | 10 | ND | ND | ND | NA | ND<0.5 |
| n-Butylbenzene | 5 | **12** | ND | ND | NA | **36** |
| n-Propylbenzene | 5 | **430** | ND | ND | NA | **680 D** |
| p-Isopropyltoluene | 5 | ND | ND | ND | NA | 0.28 J |
| sec-Butylbenzene | 5 | **21** | ND | ND | NA | **25** |
| tert-Butylbenzene | 5 | NA | NA | NA | NA | 0.47 J |
| Toluene | 5 | **11** | **8** | **7.5** | **6.7** | **5.5** |
| Naphthalene | 10 | NA | NA | NA | NA | 4.6 |
| Xylenes, Total | 5 | **175** | **43** | **33** | **17** | **6.8** |
| BTEX | ~ | 506 | 184 | 164.5 | 122.7 | 51.3 |
| Total VOCs | ~ | 2,039 | 184 | 344.5 | 122.7 | 1,018.04 |

**Notes:**
1. Groundwater sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) 1.1.1. Ambient Water Quality Standards (AWQS) and guidance values for drinking water (class GA).
2. Results exceeding NYSDEC TOGS are shaded and bolded.

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BTEX = Benzene, Toluene, Ethylbenzene, and Total Xylenes
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Table 2
Groundwater Analytical Results Summary
Kings Plaza Shopping Center
Brooklyn, New York
NYSDEC Spill No. 98-15289
Langan Project No. 140080107

| **Monitoring Well ID<br>Groundwater Elevations (el.)<br>Sampling Date** | **NYSDEC TOGS Standards and Guidance Values - GA** | **MW-53<br>4.38<br>5/17/2011** | **MW-53<br>4.49<br>12/28/2011** | **MW-53<br>3.96<br>3/29/2012** | **MW-53<br>4.41<br>6/28/2012** | **MW-53<br>3.66<br>8/29/2013** | **MW-53<br>5.28<br>12/2/2016** | **DUP (MW-53)<br>5.28<br>12/2/2016** |
|---|---|---|---|---|---|---|---|---|
| **CP-51 Volatile Organic Compounds (µg/L)** | | | | | | | | |
| 1,2,4-Trimethylbenzene | 5 | ND | ND | ND | NA | **34** | ND<0.5 | ND<0.5 |
| 1,3,5-Trimethylbenzene | 5 | ND | ND | ND | NA | 4.7 | ND<0.5 | ND<0.5 |
| Benzene | 1 | **12** | **11** | ND | **8.1** | **5.3** | 0.77 | 0.76 |
| Ethylbenzene | 5 | 2.3 | 2.7 | ND | 2.1 | 4.2 | 0.29 J | 0.26 J |
| Isopropylbenzene | 5 | **82** | ND | ND | NA | **54** | 5 | 4.8 |
| Methyl tert-butyl ether (MTBE) | 10 | ND | ND | ND | NA | ND<1 | ND<0.5 | ND<0.5 |
| n-Butylbenzene | 5 | 3.3 | ND | ND | NA | **9.2** | 2.2 | 2.1 |
| n-Propylbenzene | 5 | **150** | ND | ND | NA | **160** | **11** | **11** |
| p-Isopropyltoluene | 5 | ND | ND | ND | NA | 1.2 | ND<0.5 | ND<0.5 |
| sec-Butylbenzene | 5 | **9.7** | ND | ND | NA | **9.1** | 4.9 | 4.9 |
| tert-Butylbenzene | 5 | NA | NA | NA | NA | 0.36 J | ND<0.5 | ND<0.5 |
| Toluene | 5 | ND | 2 | ND | 1.3 | 1.2 | 0.27 J | ND<0.5 |
| Naphthalene | 10 | NA | NA | NA | NA | NA | ND<2 | ND<2 |
| Xylenes, Total | 5 | 1.1 | 1.8 J* | ND | 1.6 J* | **13** | ND<1.5 | ND<1.5 |
| BTEX | ~ | 15.4 | 17.5 | ND | 13.1 | 23.7 | 1.33 | 1 |
| Total VOCs | ~ | 260 | 17.5 | ND | 13.1 | 296.26 | 24.43 | 23.82 |

**Notes:**
1. Groundwater sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) 1.1.1. Ambient Water Quality Standards (AWQS) and guidance values for drinking water (class GA).
2. Results exceeding NYSDEC TOGS are shaded and bolded.

**Definitions:**
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J* = Indicates the concentration is below the reporting limit but greater than or equal to the method detection limit. The concentration reported is estimated.

NA = Not analyzed
ND = Not detected
µg/L = micrograms per liter

# FIGURES


NOTES:
MAP REFERENCED: UNITED STATES GEOLOGICAL SURVEY (USGS), CONEY ISLAND, N.Y. - N.J.
TOPOGRAPHIC QUADRANGLE MAP, DATED 1966, PHOTOREVISED 1979.


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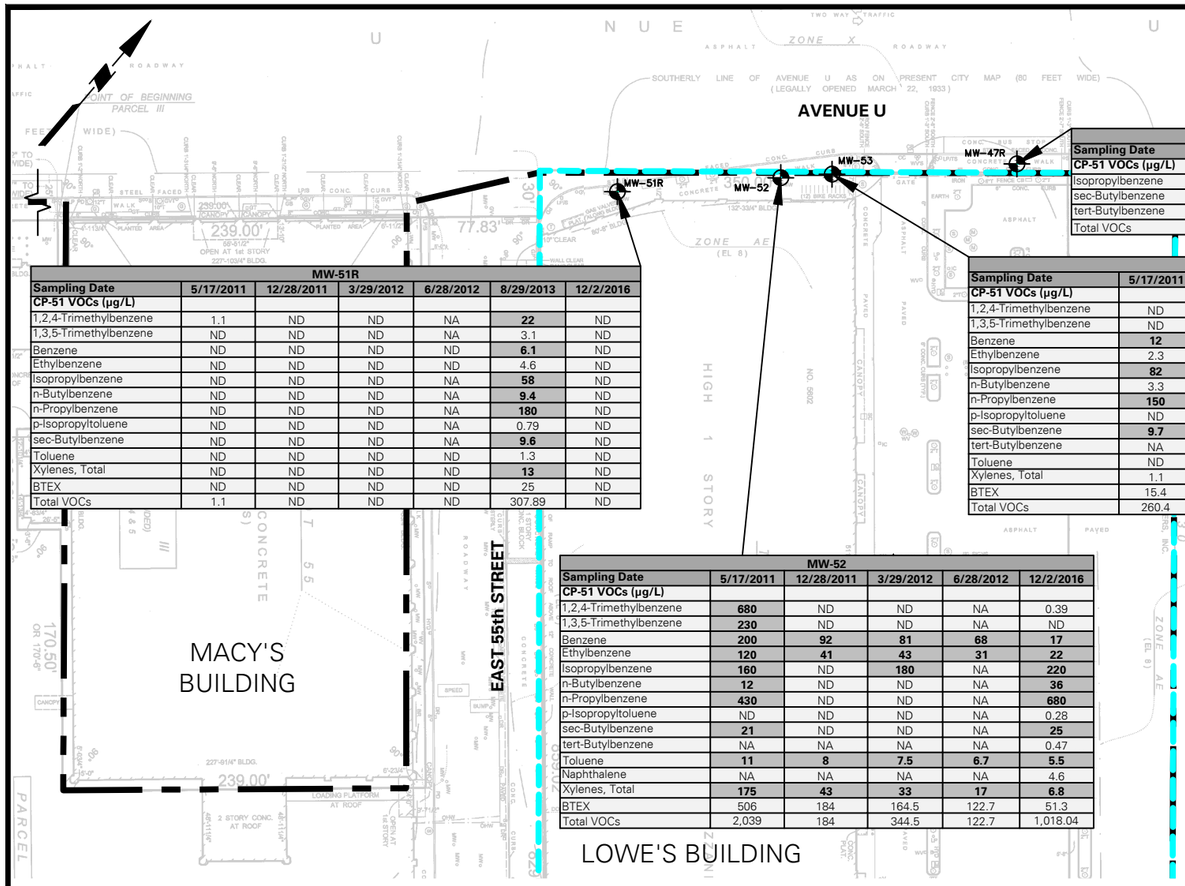
Langan International LLC
Collectively known as Langan


| | |
|---|---|
| Project | KINGS PLAZA<br>FORMER STANDARD OIL PARCEL (OU-3)<br>BROOKLYN NEW YORK |
| Drawing Title | SITE LOCATION MAP |
| Project No. | 140080107 |
| Date | 05/01/2013 |
| Scale | NTS |
| Drawn By | EB |
| Submission Date | DECEMBER 2016 |
| Figure No. | 1 |
| Sheet | 1 of 3 |



Filename: \\langan.com\data\NYC\data1\140080101\Cadd Data - 140080101\OU-3\OU-3_Baseline GW Monitoring Report\Figure 1 - Site Location Map.dwg Date: 12/23/2016 Time: 16:22 User: hgriesbach Style Table: Langan.stb Layout: ANSIA-BP




| MW-51R | | | | | | |
|---|---|---|---|---|---|---|
| **Sampling Date** | **5/17/2011** | **12/28/2011** | **3/29/2012** | **6/28/2012** | **8/5/2013** | **12/2/2016** |
| **CP-51 VOCs (µg/L)** | | | | | | |
| 1,2,4-Trimethylbenzene | 1.1 | ND | ND | NA | **22** | ND |
| 1,3,5-Trimethylbenzene | ND | ND | ND | NA | 3.1 | ND |
| Benzene | ND | ND | ND | ND | **6.1** | ND |
| Ethylbenzene | ND | ND | ND | ND | 4.6 | ND |
| Isopropylbenzene | ND | ND | ND | NA | **58** | ND |
| n-Butylbenzene | ND | ND | ND | NA | **9.4** | ND |
| n-Propylbenzene | ND | ND | ND | NA | **180** | ND |
| p-Isopropyltoluene | ND | ND | ND | NA | 0.79 | ND |
| sec-Butylbenzene | ND | ND | ND | NA | **9.6** | ND |
| Toluene | ND | ND | ND | ND | 1.3 | ND |
| Xylenes, Total | ND | ND | ND | ND | **13** | ND |
| BTEX | ND | ND | ND | ND | 25 | ND |
| Total VOCs | 1.1 | ND | ND | ND | 307.89 | ND |

| MW-47R | | | | | | |
|---|---|---|---|---|---|---|
| **Sampling Date** | **5/17/2011** | **12/28/2011** | **3/29/2012** | **6/28/2012** | **9/3/2013** | **12/2/2016** |
| **CP-51 VOCs (µg/L)** | | | | | | |
| Isopropylbenzene | ND | ND | ND | NA | 0.18 | ND |
| sec-Butylbenzene | ND | ND | ND | NA | 0.26 | 0.2 |
| tert-Butylbenzene | NA | NA | NA | NA | 0.28 | ND |
| Total VOCs | ND | ND | ND | ND | 0.72 | 0.2 |

| MW-53 | | | | | | | DUP |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | **5/17/2011** | **12/28/2011** | **3/29/2012** | **8/28/2012** | **8/29/2013** | **12/2/2016** | **12/2/2016** |
| **CP-51 VOCs (µg/L)** | | | | | | | |
| 1,2,4-Trimethylbenzene | ND | ND | ND | NA | **34** | ND | ND |
| 1,3,5-Trimethylbenzene | ND | ND | ND | NA | 4.7 | ND | ND |
| Benzene | **12** | **11** | ND | **8.1** | **5.3** | 0.77 | 0.76 |
| Ethylbenzene | 2.3 | 2.7 | ND | 2.1 | 4.2 | 0.29 | 0.26 |
| Isopropylbenzene | **82** | ND | ND | NA | **54** | 5 | 4.8 |
| n-Butylbenzene | 3.3 | ND | ND | NA | **9.2** | 2.2 | 2.1 |
| n-Propylbenzene | **150** | ND | ND | NA | **160** | **11** | **11** |
| p-Isopropyltoluene | ND | ND | ND | NA | 1.2 | ND | ND |
| sec-Butylbenzene | **9.7** | ND | ND | NA | **9.1** | 4.9 | 4.9 |
| tert-Butylbenzene | NA | NA | NA | NA | 0.36 | ND | ND |
| Toluene | ND | 2 | ND | 1.3 | 1.2 | 0.27 | ND |
| Xylenes, Total | 1.1 | 1.8 | ND | 1.6 | **13** | ND | ND |
| BTEX | 15.4 | 17.5 | ND | 13.1 | 23.7 | 1.33 | 1 |
| Total VOCs | 260.4 | 17.5 | ND | 13.1 | 296.26 | 24.43 | 23.82 |

| MW-52 | | | | | |
|---|---|---|---|---|---|
| **Sampling Date** | **5/17/2011** | **12/28/2011** | **3/29/2012** | **6/28/2012** | **12/2/2016** |
| **CP-51 VOCs (µg/L)** | | | | | |
| 1,2,4-Trimethylbenzene | **680** | ND | ND | NA | 0.39 |
| 1,3,5-Trimethylbenzene | **230** | ND | ND | NA | ND |
| Benzene | **200** | **92** | **81** | **68** | **17** |
| Ethylbenzene | **120** | **41** | **43** | **31** | **22** |
| Isopropylbenzene | **160** | ND | **180** | NA | **220** |
| n-Butylbenzene | **12** | ND | ND | NA | **36** |
| n-Propylbenzene | **430** | ND | ND | NA | **680** |
| p-Isopropyltoluene | ND | ND | ND | NA | 0.28 |
| sec-Butylbenzene | **21** | ND | ND | NA | **25** |
| tert-Butylbenzene | NA | NA | NA | NA | 0.47 |
| Toluene | **11** | **8** | **7.5** | **6.7** | **5.5** |
| Naphthalene | NA | NA | NA | NA | 4.6 |
| Xylenes, Total | **175** | **43** | **33** | **17** | **6.8** |
| BTEX | 506 | 184 | 164.5 | 122.7 | 51.3 |
| Total VOCs | 2,039 | 184 | 344.5 | 122.7 | 1,018.04 |

**CHART 1**

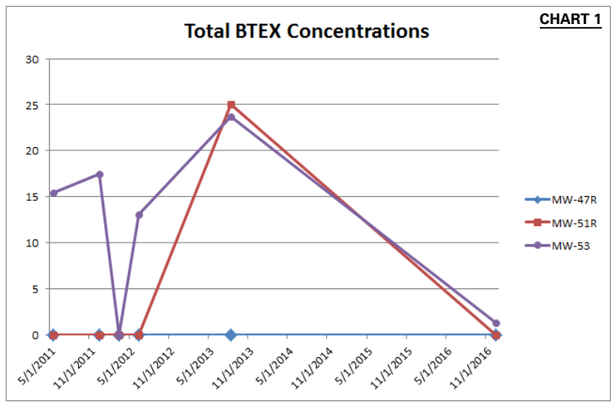



**CHART 2**

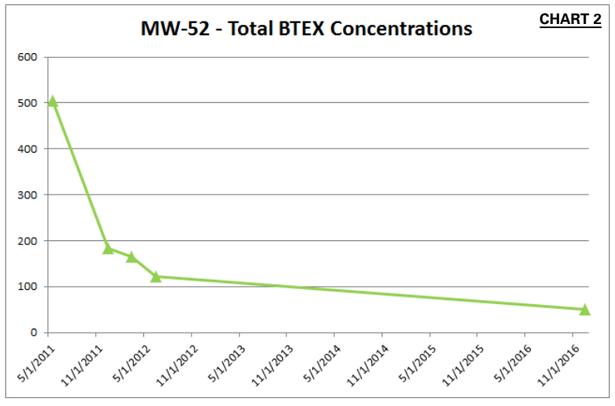



**CHART NOTES:**

1. MW-47R, MW-51R, AND MW-53 TOTAL BTEX CONCENTRATIONS DISPLAYED ON CHART 1.
2. MW-52 TOTAL BTEX CONCENTRATIONS DISPLAYED ON CHART 2.
3. BTEX = BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENES

100 0 50 100
SCALE IN FEET

**LEGEND:**

- KINGS PLAZA MALL BOUNDARY
- FORMER STANDARD OIL PARCEL BOUNDARY (OU-3)
- MW-31R — EXISTING MONITORING WELLS
- MW-55 — REMOVED OR DESTROYED WELLS
- LMW-3 — LANGAN MONITORING WELLS (AUGUST 2013)

**NOTES:**

1. BASEMAP INFORMATION FROM ALTA/ASCM LAND TITLE SURVEY BY BARTLETT, LUDLAM & DILL ASSOCIATES DATED 5 MAY 2011.
2. REMOVED OR DESTROYED MONITORING WELL LOCATIONS ARE APPROXIMATE BASED ON FIGURE 24 TITLED "POST REMEDIATION PROPOSED MONITORING WELLS", DATED 26 AUGUST 2010, AND INCLUDED IN THE SITE MANAGEMENT PLAN PREPARED BY EXCEL IN AUGUST 2010.
3. GROUNDWATER SAMPLE ANALYTICAL RESULTS ARE COMPARED TO THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TECHNICAL AND OPERATIONAL GUIDANCE SERIES (TOGS) 1.1.1. AMBIENT WATER QUALITY STANDARDS (AWQS) AND GUIDANCE VALUES FOR DRINKING WATER (CLASS GA).
4. EXCEEDANCES ARE HIGHLIGHTED AND BOLD.
5. VOCs = VOLATILE ORGANIC COMPOUNDS
6. µg/L = MICROGRAMS PER LITER
7. ND = NOT DETECTED
8. NA = NOT ANALYZED
9. BTEX = BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENES
10. MTBE = METHYL TERT-BUTYL ETHER

| CP-51 Volatile Organic Compounds (µg/L) | NYSDEC TOGS Standards and Guidance Values - GA |
|---|---|
| 1,2,4-Trimethylbenzene | 5 |
| 1,3,5-Trimethylbenzene | 5 |
| Benzene | 1 |
| Ethylbenzene | 5 |
| Isopropylbenzene | 5 |
| n-Butylbenzene | 5 |
| n-Propylbenzene | 5 |
| p-Isopropyltoluene | 5 |
| sec-Butylbenzene | 5 |
| tert-Butylbenzene | 5 |
| Toluene | 5 |
| Naphthalene | 10 |
| Xylenes, Total | 5 |
| BTEX | ~ |
| Total VOCs | ~ |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Langan Engineering and Environmental Services, Inc.
Langan International LLC
Collectively known as Langan


Project: KINGS PLAZA
FORMER STANDARD OIL PARCEL (OU-3)
BROOKLYN NEW YORK

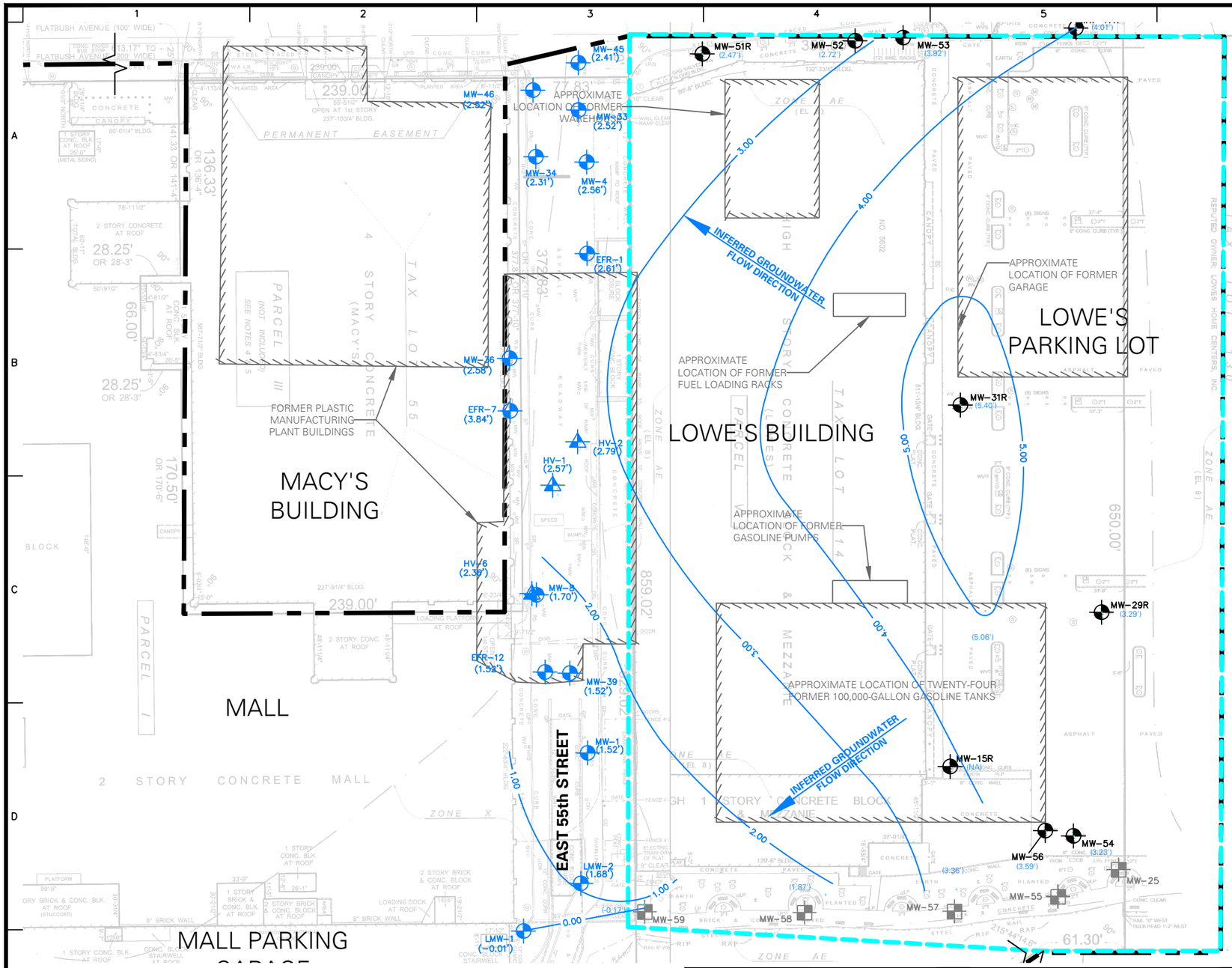
Figure Title: MONITORING WELL LOCATION AND RESULTS MAP

Project No. 140080107
Date 9/27/2013
Scale 1" = 100'
Drawn By HHG
Submission Date DECEMBER 2016

Figure No. 2
Sheet 2 of 3



Filename: \\langan.com\data\NYC\data1\140080101\Cadd Data - 140080101\OU-3\OU-3_Baseline GW Monitoring Report\Figure 5 - GW Sample and Results Location Map.dwg Date: 1/9/2017 Time: 11:45 User: hgriesbach Style Table: Langan.stb Layout: 2016 Results




**LEGEND:**

- KINGS PLAZA MALL BOUNDARY
- FORMER STANDARD OIL PARCEL BOUNDARY (OU-3)
- MW-31R (5.40') — EXISTING MONITORING WELLS (GROUNDWATER ELEVATION IN PARENTHESES)
- HV-6 (5.40') — EXISTING HVDPE RECOVERY WELL
- MW-55R — REMOVED OR DESTROYED WELLS
- LMW-3 (5.06') — LANGAN MONITORING WELLS (AUGUST 2013) (GROUNDWATER ELEVATION IN PARENTHESES)
- 5.00 — GROUNDWATER CONTOUR IN FEET
- INFERRED GROUNDWATER CONTOUR IN FEET

**NOTES:**

1. BASEMAP INFORMATION FROM ALTA/ASCM LAND TITLE SURVEY BY BARTLETT, LUDLAM & DILL ASSOCIATES DATED 5 MAY 2011.
2. REMOVED OR DESTROYED MONITORING WELL LOCATIONS ARE APPROXIMATE BASED ON FIGURE 24 TITLED "POST REMEDIATION PROPOSED MONITORING WELLS", DATED 26 AUGUST 2010, AND INCLUDED IN THE SITE MANAGEMENT PLAN PREPARED BY EXCEL IN AUGUST 2010.
3. THE LOCATION OF MONITORING WELL MW-15R IS APPROXIMATED BASED ON FIGURE 1 TITLED "GENERALIZED SITE PLAN SHOWING MONITORING WELL LOCATIONS AND GROUNDWATER ANALYTICAL RESULTS", DATED 2 JUNE 2011, AND INCLUDED IN THE TRANSMITTAL OF POST-EXCAVATION GROUNDWATER ANALYTICAL DATA PREPARED BY EXCEL IN AUGUST 2012.
4. ALL MONITORING WELLS, EXCEPT MW-15R, WERE SURVEYED BY LANGAN IN AUGUST 2013.
5. THE ELEVATION DATUM IS REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
6. CONTOUR INTERVAL IS 1 FOOT.
7. GROUNDWATER CONTOURS ARE INFERRED BASED ON THE 12 NOVEMBER 2013 GAUGING EVENT.
8. NA = NOT AVAILABLE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Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
Langan Engineering and Environmental Services, Inc.
Langan International LLC
Collectively known as Langan


Project
KINGS PLAZA
FORMER STANDARD OIL PARCEL (OU-3)
BROOKLYN NEW YORK

Figure Title
GROUNDWATER CONTOUR MAP NOVEMBER 2013

| | |
|---|---|
| Project No. 140080107 | Figure No. 3 |
| Date 12/19/2013 | |
| Scale 1"=80' | |
| Drawn By HHG | |
| Submission Date JANUARY 2017 | Sheet 3 of 3 |



Filename: \\langan.com\data\NYC\data1\140080101\Cadd Data - 140080101\OU-3\GW0101 - 2016 OU-3 Monitoring Report.dwg Date: 1/13/2017 Time: 18:01 User: hgriesbach Style Table: Langan.stb Layout: ANSIB-BL

# APPENDIX A – GROUNDWATER SAMPLING LOGS

**Low Flow Sampling Field Parameter Measurements**
**December 2016**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project:** | Kings Plaza Shopping Center | **Site Location:** | Brooklyn, NY | **Well No:** | MW-47R | **Date:** | 12/2/2016 |
| **Job Number:** | 140080107 | **Weather:** | 40-50s, clear, windy | | | **Sampling Crew:** | HG |
| **Initial Depth to Water (ft):** | 5.10 | **Well Depth (ft):** | 12.60 | | | **Pump Intake Depth (ft):** | 9.50 |

| TIME | pH* (std. Units) | COND.* (µS/cm) | DO* (mg/L) | ORP* (mV) | Turbidtiy* (NTU) | TEMP. °C | DTW (ft) | Q (mL/m) | NOTES color, odor etc. |
|---|---|---|---|---|---|---|---|---|---|
| 10:35 | | | | | | | 5.10 | 150 | Begin pumping |
| 10:40 | 8.30 | 798 | 1.45 | -78.7 | 5.5 | 17.52 | 5.20 | 150 | Clear, no odor |
| 10:45 | 8.31 | 801 | 0.63 | -125.2 | 23.9 | 17.65 | 5.40 | 150 | |
| 10:50 | 8.30 | 792 | 0.60 | -123.3 | 31.8 | 17.52 | 5.45 | 150 | |
| 10:55 | 8.28 | 781 | 0.42 | -123.8 | 29.3 | 17.49 | 5.50 | 150 | |
| 11:00 | 8.26 | 779 | 0.56 | -121.2 | 24.6 | 17.49 | 5.55 | 150 | |
| 11:05 | 8.19 | 789 | 0.41 | -138.1 | 12.9 | 17.57 | 5.60 | 150 | Begin sampling |
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| | +/- 0.1 pH | +/- 3% | +/- 10% | +/- 10 mV | < 5 NTU | +/- 3% | < 0.3' draw down | | |

*=Stabilization is achieved after all parameters have stabilized for three successive readings.

**Langan Engineering, Environmental, Surveying, and Landscape Architecture, D.P.C.**
21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001

**Low Flow Sampling Field Parameter Measurements**
**December 2016**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project:** | Kings Plaza Shopping Center | **Site Location:** | Brooklyn, NY | **Well No:** | MW-51R | **Date:** | 12/2/2016 |
| **Job Number:** | 140080107 | **Weather:** | 40-50s, clear, windy | | | **Sampling Crew:** | HG |
| **Initial Depth to Water (ft):** | 7.90 | **Well Depth (ft):** | 12.05 | | | **Pump Intake Depth (ft):** | 9.00 |

| TIME | pH* (std. Units) | COND.* (µS/cm) | DO* (mg/L) | ORP* (mV) | Turbidtiy* (NTU) | TEMP. °C | DTW (ft) | Q (mL/m) | NOTES color, odor etc. |
|---|---|---|---|---|---|---|---|---|---|
| 9:05 | | | | | | | 7.90 | 100 | Begin pumping |
| 9:10 | 7.61 | 5,066 | 2.58 | -275.3 | 23.2 | 15.03 | 8.10 | 100 | Clear, no odor |
| 9:15 | 7.64 | 5,062 | 1.76 | -287.9 | 22.3 | 15.02 | 8.25 | 100 | |
| 9:20 | 7.68 | 5,101 | 1.07 | -283.3 | 17.8 | 15.11 | 8.50 | 100 | |
| 9:25 | 7.72 | 5,003 | 0.91 | -263.2 | 14.7 | 15.42 | 8.80 | 100 | |
| 9:30 | 7.70 | 4,970 | 0.92 | -266.3 | 12.2 | 15.75 | 9.20 | 100 | |
| 9:35 | 7.69 | 5,041 | 0.91 | -235.4 | 16.9 | 15.80 | 9.42 | 100 | Begin sampling |
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| | +/- 0.1 pH | +/- 3% | +/- 10% | +/- 10 mV | < 5 NTU | +/- 3% | < 0.3' draw down | | |

*=Stabilization is achieved after all parameters have stabilized for three successive readings.

**Langan Engineering, Environmental, Surveying, and Landscape Architecture, D.P.C.**
21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001

**Low Flow Sampling Field Parameter Measurements**
**December 2016**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project:** | Kings Plaza Shopping Center | **Site Location:** | Brooklyn, NY | **Well No:** | MW-52 | **Date:** | 12/2/2016 |
| **Job Number:** | 140080107 | **Weather:** | 40-50s, clear, windy | | | **Sampling Crew:** | HG |
| **Initial Depth to Water (ft):** | 5.70 | **Well Depth (ft):** | 15.10 | | | **Pump Intake Depth (ft):** | 12.00 |

| TIME | pH* (std. Units) | COND.* (µS/cm) | DO* (mg/L) | ORP* (mV) | Turbidtiy* (NTU) | TEMP. °C | DTW (ft) | Q (mL/m) | NOTES color, odor etc. |
|---|---|---|---|---|---|---|---|---|---|
| 8:55 | | | | | | | 5.70 | 150 | Begin pumping |
| 9:00 | 7.18 | 811 | 0.72 | -29.0 | 17.9 | 14.72 | 5.70 | 150 | Clear, no odor |
| 9:05 | 7.26 | 818 | 0.65 | -76.2 | 19.4 | 15.15 | 5.70 | 150 | |
| 9:10 | 7.27 | 810 | 0.69 | -84.4 | 18.3 | 15.25 | 5.70 | 150 | |
| 9:15 | 7.29 | 875 | 0.59 | -92.7 | 16.5 | 15.31 | 5.70 | 150 | |
| 9:20 | 7.30 | 875 | 0.60 | -98.2 | 14.9 | 15.26 | 5.70 | 150 | |
| 9:25 | 7.30 | 826 | 0.60 | -98.3 | 16.0 | 15.42 | 5.70 | 150 | Begin sampling & MS/MSD |
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| | +/- 0.1 pH | +/- 3% | +/- 10% | +/- 10 mV | < 5 NTU | +/- 3% | < 0.3' draw down | | |

*=Stabilization is achieved after all parameters have stabilized for three successive readings.

**Langan Engineering, Environmental, Surveying, and Landscape Architecture, D.P.C.**
21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001

**Low Flow Sampling Field Parameter Measurements**
**December 2016**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project:** | Kings Plaza Shopping Center | **Site Location:** | Brooklyn, NY | **Well No:** | MW-53 | **Date:** | 12/2/2016 |
| **Job Number:** | 140080107 | **Weather:** | 40-50s, clear, windy | | | **Sampling Crew:** | HG |
| **Initial Depth to Water (ft):** | 5.00 | **Well Depth (ft):** | 9.98 | | | **Pump Intake Depth (ft):** | 7.00 |

| TIME | pH* (std. Units) | COND.* (µS/cm) | DO* (mg/L) | ORP* (mV) | Turbidtiy* (NTU) | TEMP. °C | DTW (ft) | Q (mL/m) | NOTES color, odor etc. |
|---|---|---|---|---|---|---|---|---|---|
| 10:30 | | | | | | | 5.00 | 150 | Begin pumping |
| 10:35 | 7.74 | 867 | 0.62 | -325.8 | 47.3 | 14.25 | 5.00 | 150 | Clear, no odor |
| 10:40 | 7.73 | 854 | 0.47 | -316.8 | 41.6 | 14.73 | 5.00 | 150 | |
| 10:45 | 7.68 | 851 | 0.48 | -332.9 | 36.7 | 14.80 | 5.00 | 150 | |
| 10:50 | 7.68 | 849 | 0.37 | -331.4 | 31.2 | 15.16 | 5.00 | 150 | |
| 10:55 | 7.68 | 849 | 0.34 | -326.7 | 24.9 | 15.13 | 5.00 | 150 | |
| 11:00 | 7.67 | 847 | 0.26 | -327.0 | 16.6 | 15.27 | 5.00 | 150 | Begin sampling & DUP |
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| | +/- 0.1 pH | +/- 3% | +/- 10% | +/- 10 mV | < 5 NTU | +/- 3% | < 0.3' draw down | | |

*=Stabilization is achieved after all parameters have stabilized for three successive readings.

**Langan Engineering, Environmental, Surveying, and Landscape Architecture, D.P.C.**
21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001

# APPENDIX B – LABORATORY ANALYTICAL REPORTS

# Technical Report

prepared for:

**Langan Engineering & Environmental Services (CT)**
Long Wharf Maritime Center, 555 Long Wharf Drive
New Haven CT, 06511
**Attention: Hannah Griesbach**

Report Date: 12/07/2016
**Client Project ID: 140080114 Kings Plaza**
York Project (SDG) No.: 16L0105

CT Cert. No. PH-0723 New Jersey Cert. No. CT-005 New York Cert. Nos. 10854 and 12058 PA Cert. No. 68-04440

120 RESEARCH DRIVE STRATFORD, CT 06615 ■ 132-02 89th AVENUE RICHMOND HILL, NY 11418
www.YORKLAB.com (203) 325-1371 FAX (203) 357-0166 ClientServices@yorklab.com

Report Date: 12/07/2016
Client Project ID: 140080114 Kings Plaza
York Project (SDG) No.: 16L0105

**Langan Engineering & Environmental Services (CT)**
Long Wharf Maritime Center, 555 Long Wharf Drive
New Haven CT, 06511
Attention: Hannah Griesbach

## Purpose and Results

This report contains the analytical data for the sample(s) identified on the attached chain-of-custody received in our laboratory on December 02, 2016 and listed below. The project was identified as your project: **140080114 Kings Plaza**.

The analyses were conducted utilizing appropriate EPA, Standard Methods, and ASTM methods as detailed in the data summary tables.

All samples were received in proper condition meeting the customary acceptance requirements for environmental samples except those indicated under the Notes section of this report.

All analyses met the method and laboratory standard operating procedure requirements except as indicated by any data flags, the meaning of which are explained in the attachment to this report, and case narrative if applicable.

The results of the analyses, which are all reported on dry weight basis (soils) unless otherwise noted, are detailed in the following pages.

Please contact Client Services at 203.325.1371 with any questions regarding this report.

| York Sample ID | Client Sample ID | Matrix | Date Collected | Date Received |
|---|---|---|---|---|
| 16L0105-01 | MW-51R | Water | 12/02/2016 | 12/02/2016 |
| 16L0105-02 | MW-52 | Water | 12/01/2016 | 12/02/2016 |
| 16L0105-03 | MW-53 | Water | 12/02/2016 | 12/02/2016 |
| 16L0105-04 | MW-47R | Water | 12/02/2016 | 12/02/2016 |
| 16L0105-05 | DUP | Water | 12/02/2016 | 12/02/2016 |
| 16L0105-06 | Trip Blank | Water | 12/02/2016 | 12/02/2016 |

## General Notes for York Project (SDG) No.: 16L0105

1. The RLs and MDLs (Reporting Limit and Method Detection Limit respectively) reported are adjusted for any dilution necessary due to the levels of target and/or non-target analytes and matrix interference. The RL(REPORTING LIMIT) is based upon the lowest standard utilized for the calibration where applicable.
2. Samples are retained for a period of thirty days after submittal of report, unless other arrangements are made.
3. York's liability for the above data is limited to the dollar value paid to York for the referenced project.
4. This report shall not be reproduced without the written approval of York Analytical Laboratories, Inc.
5. All samples were received in proper condition for analysis with proper documentation, unless otherwise noted.
6. All analyses conducted met method or Laboratory SOP requirements. See the Qualifiers and/or Narrative sections for further information.
7. It is noted that no analyses reported herein were subcontracted to another laboratory, unless noted in the report.
8. This report reflects results that relate only to the samples submitted on the attached chain-of-custody form(s) received by York.
9. Analyses conducted at York Analytical Laboratories, Inc. Stratford, CT are indicated by NY Cert. No. 10854; those conducted at York Analytical Laboratories, Inc., Richmond Hill, NY are indicated by NY Cert. No. 12058.

**Approved By:** 

**Date:** 12/07/2016

Benjamin Gulizia
Laboratory Director

## Sample Information

**Client Sample ID:** **MW-51R** **York Sample ID:** **16L0105-01**

| York Project (SDG) No. | Client Project ID | Matrix | Collection Date/Time | Date Received |
|---|---|---|---|---|
| 16L0105 | 140080114 Kings Plaza | Water | December 2, 2016 2:00 pm | 12/02/2016 |

**Volatile Organics, CP-51 (STARS) Low level**

**Log-in Notes:**

**Sample Notes:**

Sample Prepared by Method: EPA 5030B

| CAS No. | Parameter | Result | Flag | Units | Reported to LOD/MDL | LOQ | Dilution | Reference Method | Date/Time Prepared | Date/Time Analyzed | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 71-43-2 | Benzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 100-41-4 | Ethyl Benzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 108-88-3 | Toluene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 95-47-6 | o-Xylene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>NELAC-NY10854 | 12/06/2016 13:50 | SS |
| 179601-23-1 | p- & m- Xylenes | ND | | ug/L | 0.50 | 1.0 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>NELAC-NY10854 | 12/06/2016 13:50 | SS |
| 98-82-8 | Isopropylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 103-65-1 | n-Propylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 99-87-6 | p-Isopropyltoluene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 95-63-6 | 1,2,4-Trimethylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 108-67-8 | 1,3,5-Trimethylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 104-51-8 | n-Butylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 135-98-8 | sec-Butylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 98-06-6 | tert-Butylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 91-20-3 | Naphthalene | ND | | ug/L | 1.0 | 2.0 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 1634-04-4 | Methyl tert-butyl ether (MTBE) | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 13:50 | SS |
| 1330-20-7 | * Xylenes, Total | ND | | ug/L | 0.60 | 1.5 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NJDEP | 12/06/2016 13:50 | SS |

| | Surrogate Recoveries | Result | Acceptance Range |
|---|---|---|---|
| 17060-07-0 | *Surrogate: 1,2-Dichloroethane-d4* | *100 %* | *69-130* |
| 460-00-4 | *Surrogate: p-Bromofluorobenzene* | *97.2 %* | *79-122* |
| 2037-26-5 | *Surrogate: Toluene-d8* | *95.8 %* | *81-117* |

## Sample Information

**Client Sample ID:** **MW-52** **York Sample ID:** **16L0105-02**

| York Project (SDG) No. | Client Project ID | Matrix | Collection Date/Time | Date Received |
|---|---|---|---|---|
| 16L0105 | 140080114 Kings Plaza | Water | December 1, 2016 2:00 pm | 12/02/2016 |

### Volatile Organics, CP-51 (STARS) Low level

**Log-in Notes:**

**Sample Notes:**

Sample Prepared by Method: EPA 5030B

| CAS No. | Parameter | Result | Flag | Units | Reported to LOD/MDL | LOQ | Dilution | Reference Method | Date/Time Prepared | Date/Time Analyzed | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 71-43-2 | **Benzene** | **17** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 100-41-4 | **Ethyl Benzene** | **22** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 108-88-3 | **Toluene** | **5.5** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 95-47-6 | **o-Xylene** | **3.7** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | NELAC-NY10854 | | |
| 179601-23-1 | **p- & m- Xylenes** | **3.1** | | ug/L | 0.50 | 1.0 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | NELAC-NY10854 | | |
| 98-82-8 | **Isopropylbenzene** | **220** | | ug/L | 4.0 | 10 | 20 | EPA 8260C | 12/06/2016 07:59 | 12/07/2016 12:52 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 103-65-1 | **n-Propylbenzene** | **680** | | ug/L | 4.0 | 10 | 20 | EPA 8260C | 12/06/2016 07:59 | 12/07/2016 12:52 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 99-87-6 | **p-Isopropyltoluene** | **0.28** | J | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 95-63-6 | **1,2,4-Trimethylbenzene** | **0.39** | J | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 108-67-8 | 1,3,5-Trimethylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 104-51-8 | **n-Butylbenzene** | **36** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 135-98-8 | **sec-Butylbenzene** | **25** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 98-06-6 | **tert-Butylbenzene** | **0.47** | J | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 91-20-3 | **Naphthalene** | **4.6** | | ug/L | 1.0 | 2.0 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | NELAC-NY10854,NJDEP | | |
| 1634-04-4 | Methyl tert-butyl ether (MTBE) | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 1330-20-7 | *** Xylenes, Total** | **6.8** | | ug/L | 0.60 | 1.5 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 14:30 | SS |
| | | | | | | | | Certifications: | CTDOH,NJDEP | | |

| | Surrogate Recoveries | Result | Acceptance Range |
|---|---|---|---|
| 17060-07-0 | *Surrogate: 1,2-Dichloroethane-d4* | *108 %* | *69-130* |
| 460-00-4 | *Surrogate: p-Bromofluorobenzene* | *105 %* | *79-122* |
| 2037-26-5 | *Surrogate: Toluene-d8* | *94.7 %* | *81-117* |

## Sample Information

**Client Sample ID:** **MW-53** **York Sample ID:** **16L0105-03**

| York Project (SDG) No. | Client Project ID | Matrix | Collection Date/Time | Date Received |
|---|---|---|---|---|
| 16L0105 | 140080114 Kings Plaza | Water | December 2, 2016 2:00 pm | 12/02/2016 |

**Volatile Organics, CP-51 (STARS) Low level**

**Log-in Notes:**

**Sample Notes:**

Sample Prepared by Method: EPA 5030B

| CAS No. | Parameter | Result | Flag | Units | Reported to LOD/MDL | LOQ | Dilution | Reference Method | Date/Time Prepared | Date/Time Analyzed | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 71-43-2 | **Benzene** | **0.77** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 100-41-4 | **Ethyl Benzene** | **0.29** | J | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 108-88-3 | **Toluene** | **0.27** | J | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 95-47-6 | o-Xylene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | NELAC-NY10854 | | |
| 179601-23-1 | p- & m- Xylenes | ND | | ug/L | 0.50 | 1.0 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | NELAC-NY10854 | | |
| 98-82-8 | **Isopropylbenzene** | **5.0** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 103-65-1 | **n-Propylbenzene** | **11** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 99-87-6 | p-Isopropyltoluene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 95-63-6 | 1,2,4-Trimethylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 108-67-8 | 1,3,5-Trimethylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 104-51-8 | **n-Butylbenzene** | **2.2** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 135-98-8 | **sec-Butylbenzene** | **4.9** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 98-06-6 | tert-Butylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 91-20-3 | Naphthalene | ND | | ug/L | 1.0 | 2.0 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | NELAC-NY10854,NJDEP | | |
| 1634-04-4 | Methyl tert-butyl ether (MTBE) | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 1330-20-7 | * Xylenes, Total | ND | | ug/L | 0.60 | 1.5 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 17:09 | SS |
| | | | | | | | | Certifications: | CTDOH,NJDEP | | |

| | Surrogate Recoveries | Result | Acceptance Range |
|---|---|---|---|
| 17060-07-0 | *Surrogate: 1,2-Dichloroethane-d4* | *100 %* | *69-130* |
| 460-00-4 | *Surrogate: p-Bromofluorobenzene* | *91.8 %* | *79-122* |
| 2037-26-5 | *Surrogate: Toluene-d8* | *94.5 %* | *81-117* |

## Sample Information

**Client Sample ID:** **MW-47R** **York Sample ID:** **16L0105-04**

| York Project (SDG) No. | Client Project ID | Matrix | Collection Date/Time | Date Received |
|---|---|---|---|---|
| 16L0105 | 140080114 Kings Plaza | Water | December 2, 2016 2:00 pm | 12/02/2016 |

## Sample Information

**Client Sample ID:** **MW-47R** **York Sample ID:** **16L0105-04**

| York Project (SDG) No. | Client Project ID | Matrix | Collection Date/Time | Date Received |
|---|---|---|---|---|
| 16L0105 | 140080114 Kings Plaza | Water | December 2, 2016 2:00 pm | 12/02/2016 |

**Volatile Organics, CP-51 (STARS) Low level**

**Log-in Notes:**

**Sample Notes:**

Sample Prepared by Method: EPA 5030B

| CAS No. | Parameter | Result | Flag | Units | Reported to LOD/MDL | LOQ | Dilution | Reference Method | Date/Time Prepared | Date/Time Analyzed | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 71-43-2 | Benzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 100-41-4 | Ethyl Benzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 108-88-3 | Toluene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 95-47-6 | o-Xylene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: NELAC-NY10854 | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 179601-23-1 | p- & m- Xylenes | ND | | ug/L | 0.50 | 1.0 | 1 | EPA 8260C<br>Certifications: NELAC-NY10854 | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 98-82-8 | Isopropylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 103-65-1 | n-Propylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 99-87-6 | p-Isopropyltoluene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 95-63-6 | 1,2,4-Trimethylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 108-67-8 | 1,3,5-Trimethylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 104-51-8 | n-Butylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 135-98-8 | **sec-Butylbenzene** | **0.20** | J | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 98-06-6 | tert-Butylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 91-20-3 | Naphthalene | ND | | ug/L | 1.0 | 2.0 | 1 | EPA 8260C<br>Certifications: NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 1634-04-4 | Methyl tert-butyl ether (MTBE) | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |
| 1330-20-7 | * Xylenes, Total | ND | | ug/L | 0.60 | 1.5 | 1 | EPA 8260C<br>Certifications: CTDOH,NJDEP | 12/06/2016 07:59 | 12/06/2016 17:49 | SS |

| | Surrogate Recoveries | Result | Acceptance Range |
|---|---|---|---|
| 17060-07-0 | *Surrogate: 1,2-Dichloroethane-d4* | *100 %* | *69-130* |
| 460-00-4 | *Surrogate: p-Bromofluorobenzene* | *97.6 %* | *79-122* |
| 2037-26-5 | *Surrogate: Toluene-d8* | *96.7 %* | *81-117* |

## Sample Information

**Client Sample ID:** **DUP** **York Sample ID:** **16L0105-05**

| York Project (SDG) No. | Client Project ID | Matrix | Collection Date/Time | Date Received |
|---|---|---|---|---|
| 16L0105 | 140080114 Kings Plaza | Water | December 2, 2016 2:00 pm | 12/02/2016 |

## Sample Information

**Client Sample ID:** **DUP** **York Sample ID:** **16L0105-05**

| York Project (SDG) No. | Client Project ID | Matrix | Collection Date/Time | Date Received |
|---|---|---|---|---|
| 16L0105 | 140080114 Kings Plaza | Water | December 2, 2016 2:00 pm | 12/02/2016 |

**Volatile Organics, CP-51 (STARS) Low level**

**Log-in Notes:**

**Sample Notes:**

Sample Prepared by Method: EPA 5030B

| CAS No. | Parameter | Result | Flag | Units | Reported to LOD/MDL | LOQ | Dilution | Reference Method | Date/Time Prepared | Date/Time Analyzed | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 71-43-2 | **Benzene** | **0.76** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 100-41-4 | **Ethyl Benzene** | **0.26** | J | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 108-88-3 | Toluene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 95-47-6 | o-Xylene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | NELAC-NY10854 | | |
| 179601-23-1 | p- & m- Xylenes | ND | | ug/L | 0.50 | 1.0 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | NELAC-NY10854 | | |
| 98-82-8 | **Isopropylbenzene** | **4.8** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 103-65-1 | **n-Propylbenzene** | **11** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 99-87-6 | p-Isopropyltoluene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 95-63-6 | 1,2,4-Trimethylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 108-67-8 | 1,3,5-Trimethylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 104-51-8 | **n-Butylbenzene** | **2.1** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 135-98-8 | **sec-Butylbenzene** | **4.9** | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 98-06-6 | tert-Butylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 91-20-3 | Naphthalene | ND | | ug/L | 1.0 | 2.0 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | NELAC-NY10854,NJDEP | | |
| 1634-04-4 | Methyl tert-butyl ether (MTBE) | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NELAC-NY10854,NJDEP | | |
| 1330-20-7 | * Xylenes, Total | ND | | ug/L | 0.60 | 1.5 | 1 | EPA 8260C | 12/06/2016 07:59 | 12/06/2016 18:29 | SS |
| | | | | | | | | Certifications: | CTDOH,NJDEP | | |

| | Surrogate Recoveries | Result | Acceptance Range |
|---|---|---|---|
| 17060-07-0 | *Surrogate: 1,2-Dichloroethane-d4* | *102 %* | *69-130* |
| 460-00-4 | *Surrogate: p-Bromofluorobenzene* | *93.8 %* | *79-122* |
| 2037-26-5 | *Surrogate: Toluene-d8* | *96.1 %* | *81-117* |

## Sample Information

**Client Sample ID:** **Trip Blank** **York Sample ID:** **16L0105-06**

| York Project (SDG) No. | Client Project ID | Matrix | Collection Date/Time | Date Received |
|---|---|---|---|---|
| 16L0105 | 140080114 Kings Plaza | Water | December 2, 2016 2:00 pm | 12/02/2016 |

## Sample Information

**Client Sample ID:** **Trip Blank** **York Sample ID:** **16L0105-06**

| York Project (SDG) No. | Client Project ID | Matrix | Collection Date/Time | Date Received |
|---|---|---|---|---|
| 16L0105 | 140080114 Kings Plaza | Water | December 2, 2016 2:00 pm | 12/02/2016 |

**Volatile Organics, CP-51 (STARS) Low level**

**Log-in Notes:**

**Sample Notes:**

Sample Prepared by Method: EPA 5030B

| CAS No. | Parameter | Result | Flag | Units | Reported to LOD/MDL | LOQ | Dilution | Reference Method | Date/Time Prepared | Date/Time Analyzed | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 71-43-2 | Benzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 100-41-4 | Ethyl Benzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 108-88-3 | Toluene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 95-47-6 | o-Xylene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>NELAC-NY10854 | 12/06/2016 19:09 | SS |
| 179601-23-1 | p- & m- Xylenes | ND | | ug/L | 0.50 | 1.0 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>NELAC-NY10854 | 12/06/2016 19:09 | SS |
| 98-82-8 | Isopropylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 103-65-1 | n-Propylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 99-87-6 | p-Isopropyltoluene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 95-63-6 | 1,2,4-Trimethylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 108-67-8 | 1,3,5-Trimethylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 104-51-8 | n-Butylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 135-98-8 | sec-Butylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 98-06-6 | tert-Butylbenzene | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 91-20-3 | Naphthalene | ND | | ug/L | 1.0 | 2.0 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 1634-04-4 | Methyl tert-butyl ether (MTBE) | ND | | ug/L | 0.20 | 0.50 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NELAC-NY10854,NJDEP | 12/06/2016 19:09 | SS |
| 1330-20-7 | * Xylenes, Total | ND | | ug/L | 0.60 | 1.5 | 1 | EPA 8260C<br>Certifications: | 12/06/2016 07:59<br>CTDOH,NJDEP | 12/06/2016 19:09 | SS |

| | Surrogate Recoveries | Result | Acceptance Range |
|---|---|---|---|
| 17060-07-0 | *Surrogate: 1,2-Dichloroethane-d4* | *99.6 %* | *69-130* |
| 460-00-4 | *Surrogate: p-Bromofluorobenzene* | *95.2 %* | *79-122* |
| 2037-26-5 | *Surrogate: Toluene-d8* | *96.7 %* | *81-117* |

# Analytical Batch Summary

**Batch ID:** BL60244 **Preparation Method:** EPA 5030B **Prepared By:** OW

| YORK Sample ID | Client Sample ID | Preparation Date |
|---|---|---|
| 16L0105-01 | MW-51R | 12/06/16 |
| 16L0105-02 | MW-52 | 12/06/16 |
| 16L0105-03 | MW-53 | 12/06/16 |
| 16L0105-04 | MW-47R | 12/06/16 |
| 16L0105-05 | DUP | 12/06/16 |
| 16L0105-06 | Trip Blank | 12/06/16 |
| BL60244-BLK1 | Blank | 12/06/16 |
| BL60244-BS1 | LCS | 12/06/16 |
| BL60244-BSD1 | LCS Dup | 12/06/16 |
| BL60244-MS1 | Matrix Spike | 12/06/16 |
| BL60244-MSD1 | Matrix Spike Dup | 12/06/16 |

**Batch ID:** BL60325 **Preparation Method:** EPA 5030B **Prepared By:** OW

| YORK Sample ID | Client Sample ID | Preparation Date |
|---|---|---|
| 16L0105-02RE1 | MW-52 | 12/07/16 |
| BL60325-BLK1 | Blank | 12/07/16 |
| BL60325-BS1 | LCS | 12/07/16 |
| BL60325-BSD1 | LCS Dup | 12/07/16 |

## Volatile Organic Compounds by GC/MS - Quality Control Data

## York Analytical Laboratories, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source* Result | %REC | %REC Limits | Flag | RPD | RPD Limit | Flag |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch BL60244 - EPA 5030B** | | | | | | | | | | | |
| **Blank (BL60244-BLK1)** | | | | | | | | Prepared & Analyzed: 12/06/2016 | | | |
| Benzene | ND | 0.50 | ug/L | | | | | | | | |
| Ethyl Benzene | ND | 0.50 | " | | | | | | | | |
| Toluene | ND | 0.50 | " | | | | | | | | |
| o-Xylene | ND | 0.50 | " | | | | | | | | |
| p- & m- Xylenes | ND | 1.0 | " | | | | | | | | |
| Isopropylbenzene | ND | 0.50 | " | | | | | | | | |
| n-Propylbenzene | ND | 0.50 | " | | | | | | | | |
| p-Isopropyltoluene | ND | 0.50 | " | | | | | | | | |
| 1,2,4-Trimethylbenzene | ND | 0.50 | " | | | | | | | | |
| 1,3,5-Trimethylbenzene | ND | 0.50 | " | | | | | | | | |
| n-Butylbenzene | ND | 0.50 | " | | | | | | | | |
| sec-Butylbenzene | ND | 0.50 | " | | | | | | | | |
| tert-Butylbenzene | ND | 0.50 | " | | | | | | | | |
| Naphthalene | ND | 2.0 | " | | | | | | | | |
| Methyl tert-butyl ether (MTBE) | ND | 0.50 | " | | | | | | | | |
| Xylenes, Total | ND | 1.5 | " | | | | | | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *10.3* | | *"* | *10.0* | | *103* | *69-130* | | | | |
| *Surrogate: p-Bromofluorobenzene* | *9.97* | | *"* | *10.0* | | *99.7* | *79-122* | | | | |
| *Surrogate: Toluene-d8* | *9.55* | | *"* | *10.0* | | *95.5* | *81-117* | | | | |
| **LCS (BL60244-BS1)** | | | | | | | | Prepared & Analyzed: 12/06/2016 | | | |
| Benzene | 11 | | ug/L | 10.0 | | 114 | 85-126 | | | | |
| Ethyl Benzene | 11 | | " | 10.0 | | 106 | 80-131 | | | | |
| Toluene | 10 | | " | 10.0 | | 102 | 80-127 | | | | |
| o-Xylene | 10 | | " | 10.0 | | 101 | 78-130 | | | | |
| p- & m- Xylenes | 21 | | " | 20.0 | | 104 | 77-133 | | | | |
| Isopropylbenzene | 9.9 | | " | 10.0 | | 99.4 | 76-140 | | | | |
| n-Propylbenzene | 10 | | " | 10.0 | | 101 | 78-133 | | | | |
| p-Isopropyltoluene | 11 | | " | 10.0 | | 106 | 81-136 | | | | |
| 1,2,4-Trimethylbenzene | 11 | | " | 10.0 | | 105 | 82-132 | | | | |
| 1,3,5-Trimethylbenzene | 11 | | " | 10.0 | | 106 | 80-131 | | | | |
| n-Butylbenzene | 11 | | " | 10.0 | | 106 | 79-132 | | | | |
| sec-Butylbenzene | 9.7 | | " | 10.0 | | 96.9 | 79-137 | | | | |
| tert-Butylbenzene | 9.9 | | " | 10.0 | | 99.3 | 77-138 | | | | |
| Naphthalene | 9.1 | | " | 10.0 | | 91.2 | 70-147 | | | | |
| Methyl tert-butyl ether (MTBE) | 12 | | " | 10.0 | | 116 | 76-135 | | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *10.3* | | *"* | *10.0* | | *103* | *69-130* | | | | |
| *Surrogate: p-Bromofluorobenzene* | *10.3* | | *"* | *10.0* | | *103* | *79-122* | | | | |
| *Surrogate: Toluene-d8* | *9.45* | | *"* | *10.0* | | *94.5* | *81-117* | | | | |

## Volatile Organic Compounds by GC/MS - Quality Control Data

## York Analytical Laboratories, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source* Result | %REC | %REC Limits | Flag | RPD | RPD Limit | Flag |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch BL60244 - EPA 5030B** | | | | | | | | | | | |
| **LCS Dup (BL60244-BSD1)** | | | | | | | | Prepared & Analyzed: 12/06/2016 | | | |
| Benzene | 11 | | ug/L | 10.0 | | 113 | 85-126 | | 0.353 | 30 | |
| Ethyl Benzene | 10 | | " | 10.0 | | 104 | 80-131 | | 1.62 | 30 | |
| Toluene | 10 | | " | 10.0 | | 102 | 80-127 | | 0.491 | 30 | |
| o-Xylene | 10 | | " | 10.0 | | 99.9 | 78-130 | | 1.29 | 30 | |
| p- & m- Xylenes | 21 | | " | 20.0 | | 105 | 77-133 | | 0.525 | 30 | |
| Isopropylbenzene | 10 | | " | 10.0 | | 101 | 76-140 | | 1.20 | 30 | |
| n-Propylbenzene | 10 | | " | 10.0 | | 102 | 78-133 | | 0.890 | 30 | |
| p-Isopropyltoluene | 10 | | " | 10.0 | | 104 | 81-136 | | 1.34 | 30 | |
| 1,2,4-Trimethylbenzene | 10 | | " | 10.0 | | 105 | 82-132 | | 0.190 | 30 | |
| 1,3,5-Trimethylbenzene | 11 | | " | 10.0 | | 107 | 80-131 | | 1.41 | 30 | |
| n-Butylbenzene | 10 | | " | 10.0 | | 104 | 79-132 | | 1.24 | 30 | |
| sec-Butylbenzene | 9.7 | | " | 10.0 | | 96.9 | 79-137 | | 0.00 | 30 | |
| tert-Butylbenzene | 10 | | " | 10.0 | | 99.6 | 77-138 | | 0.302 | 30 | |
| Naphthalene | 8.9 | | " | 10.0 | | 89.3 | 70-147 | | 2.11 | 30 | |
| Methyl tert-butyl ether (MTBE) | 12 | | " | 10.0 | | 116 | 76-135 | | 0.517 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *10.4* | | *"* | *10.0* | | *104* | *69-130* | | | | |
| *Surrogate: p-Bromofluorobenzene* | *10.1* | | *"* | *10.0* | | *101* | *79-122* | | | | |
| *Surrogate: Toluene-d8* | *9.44* | | *"* | *10.0* | | *94.4* | *81-117* | | | | |
| **Matrix Spike (BL60244-MS1)** | *Source sample: 16L0105-02 (MW-52) | | | | | | | Prepared & Analyzed: 12/06/2016 | | | |
| Benzene | 25 | | ug/L | 10.0 | 17 | 89.0 | 38-155 | | | | |
| Ethyl Benzene | 31 | | " | 10.0 | 22 | 92.6 | 72-128 | | | | |
| Toluene | 15 | | " | 10.0 | 5.5 | 91.9 | 76-123 | | | | |
| o-Xylene | 13 | | " | 10.0 | 3.7 | 90.2 | 69-126 | | | | |
| p- & m- Xylenes | 22 | | " | 20.0 | 3.1 | 93.4 | 67-130 | | | | |
| Isopropylbenzene | 240 | | " | 10.0 | 220 | 208 | 66-139 | High Bias | | | |
| n-Propylbenzene | 420 | | " | 10.0 | 680 | NR | 66-134 | Low Bias | | | |
| p-Isopropyltoluene | 9.8 | | " | 10.0 | 0.28 | 95.3 | 64-137 | | | | |
| 1,2,4-Trimethylbenzene | 9.5 | | " | 10.0 | 0.39 | 91.3 | 72-129 | | | | |
| 1,3,5-Trimethylbenzene | 9.8 | | " | 10.0 | ND | 97.5 | 69-126 | | | | |
| n-Butylbenzene | 45 | | " | 10.0 | 36 | 87.1 | 61-138 | | | | |
| sec-Butylbenzene | 34 | | " | 10.0 | 25 | 81.3 | 53-155 | | | | |
| tert-Butylbenzene | 9.5 | | " | 10.0 | 0.47 | 90.5 | 65-139 | | | | |
| Naphthalene | 14 | | " | 10.0 | 4.6 | 95.2 | 39-158 | | | | |
| Methyl tert-butyl ether (MTBE) | 9.9 | | " | 10.0 | ND | 98.7 | 75-128 | | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *10.5* | | *"* | *10.0* | | *105* | *69-130* | | | | |
| *Surrogate: p-Bromofluorobenzene* | *11.1* | | *"* | *10.0* | | *111* | *79-122* | | | | |
| *Surrogate: Toluene-d8* | *9.56* | | *"* | *10.0* | | *95.6* | *81-117* | | | | |

## Volatile Organic Compounds by GC/MS - Quality Control Data

## York Analytical Laboratories, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source* Result | %REC | %REC Limits | Flag | RPD | RPD Limit | Flag |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch BL60244 - EPA 5030B** | | | | | | | | | | | |
| **Matrix Spike Dup (BL60244-MSD1)** | *Source sample: 16L0105-02 (MW-52) | | | | | | | | Prepared & Analyzed: 12/06/2016 | | |
| Benzene | 26 | | ug/L | 10.0 | 17 | 98.0 | 38-155 | | 9.63 | 30 | |
| Ethyl Benzene | 31 | | " | 10.0 | 22 | 93.9 | 72-128 | | 1.39 | 30 | |
| Toluene | 15 | | " | 10.0 | 5.5 | 94.1 | 76-123 | | 2.37 | 30 | |
| o-Xylene | 13 | | " | 10.0 | 3.7 | 92.2 | 69-126 | | 2.19 | 30 | |
| p- & m- Xylenes | 22 | | " | 20.0 | 3.1 | 95.0 | 67-130 | | 1.70 | 30 | |
| Isopropylbenzene | 240 | | " | 10.0 | 220 | 129 | 66-139 | | 47.0 | 30 | Non-dir. |
| n-Propylbenzene | 400 | | " | 10.0 | 680 | NR | 66-134 | Low Bias | NR | 30 | |
| p-Isopropyltoluene | 9.8 | | " | 10.0 | 0.28 | 95.7 | 64-137 | | 0.419 | 30 | |
| 1,2,4-Trimethylbenzene | 9.8 | | " | 10.0 | 0.39 | 93.6 | 72-129 | | 2.49 | 30 | |
| 1,3,5-Trimethylbenzene | 9.8 | | " | 10.0 | ND | 98.3 | 69-126 | | 0.817 | 30 | |
| n-Butylbenzene | 44 | | " | 10.0 | 36 | 78.6 | 61-138 | | 10.3 | 30 | |
| sec-Butylbenzene | 33 | | " | 10.0 | 25 | 74.7 | 53-155 | | 8.46 | 30 | |
| tert-Butylbenzene | 9.6 | | " | 10.0 | 0.47 | 91.8 | 65-139 | | 1.43 | 30 | |
| Naphthalene | 14 | | " | 10.0 | 4.6 | 97.0 | 39-158 | | 1.87 | 30 | |
| Methyl tert-butyl ether (MTBE) | 10 | | " | 10.0 | ND | 104 | 75-128 | | 5.71 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *10.9* | | *"* | *10.0* | | *109* | *69-130* | | | | |
| *Surrogate: p-Bromofluorobenzene* | *10.2* | | *"* | *10.0* | | *102* | *79-122* | | | | |
| *Surrogate: Toluene-d8* | *9.48* | | *"* | *10.0* | | *94.8* | *81-117* | | | | |
| **Batch BL60325 - EPA 5030B** | | | | | | | | | | | |
| **Blank (BL60325-BLK1)** | | | | | | | | | Prepared & Analyzed: 12/07/2016 | | |
| Benzene | ND | 0.50 | ug/L | | | | | | | | |
| Ethyl Benzene | ND | 0.50 | " | | | | | | | | |
| Toluene | ND | 0.50 | " | | | | | | | | |
| o-Xylene | ND | 0.50 | " | | | | | | | | |
| p- & m- Xylenes | ND | 1.0 | " | | | | | | | | |
| Isopropylbenzene | ND | 0.50 | " | | | | | | | | |
| n-Propylbenzene | ND | 0.50 | " | | | | | | | | |
| p-Isopropyltoluene | ND | 0.50 | " | | | | | | | | |
| 1,2,4-Trimethylbenzene | ND | 0.50 | " | | | | | | | | |
| 1,3,5-Trimethylbenzene | ND | 0.50 | " | | | | | | | | |
| n-Butylbenzene | ND | 0.50 | " | | | | | | | | |
| sec-Butylbenzene | ND | 0.50 | " | | | | | | | | |
| tert-Butylbenzene | ND | 0.50 | " | | | | | | | | |
| Naphthalene | ND | 2.0 | " | | | | | | | | |
| Methyl tert-butyl ether (MTBE) | ND | 0.50 | " | | | | | | | | |
| Xylenes, Total | ND | 1.5 | " | | | | | | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *10.3* | | *"* | *10.0* | | *103* | *69-130* | | | | |
| *Surrogate: p-Bromofluorobenzene* | *9.62* | | *"* | *10.0* | | *96.2* | *79-122* | | | | |
| *Surrogate: Toluene-d8* | *9.41* | | *"* | *10.0* | | *94.1* | *81-117* | | | | |

## Volatile Organic Compounds by GC/MS - Quality Control Data

## York Analytical Laboratories, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source* Result | %REC | %REC Limits | Flag | RPD | RPD Limit | Flag |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch BL60325 - EPA 5030B** | | | | | | | | | | | |
| **LCS (BL60325-BS1)** | | | | | | | Prepared & Analyzed: 12/07/2016 | | | | |
| Benzene | 11 | | ug/L | 10.0 | | 112 | 85-126 | | | | |
| Ethyl Benzene | 10 | | " | 10.0 | | 105 | 80-131 | | | | |
| Toluene | 10 | | " | 10.0 | | 102 | 80-127 | | | | |
| o-Xylene | 10 | | " | 10.0 | | 100 | 78-130 | | | | |
| p- & m- Xylenes | 21 | | " | 20.0 | | 104 | 77-133 | | | | |
| Isopropylbenzene | 9.9 | | " | 10.0 | | 98.7 | 76-140 | | | | |
| n-Propylbenzene | 10 | | " | 10.0 | | 101 | 78-133 | | | | |
| p-Isopropyltoluene | 10 | | " | 10.0 | | 104 | 81-136 | | | | |
| 1,2,4-Trimethylbenzene | 10 | | " | 10.0 | | 104 | 82-132 | | | | |
| 1,3,5-Trimethylbenzene | 11 | | " | 10.0 | | 106 | 80-131 | | | | |
| n-Butylbenzene | 10 | | " | 10.0 | | 104 | 79-132 | | | | |
| sec-Butylbenzene | 9.6 | | " | 10.0 | | 96.1 | 79-137 | | | | |
| tert-Butylbenzene | 9.8 | | " | 10.0 | | 98.0 | 77-138 | | | | |
| Naphthalene | 8.9 | | " | 10.0 | | 88.7 | 70-147 | | | | |
| Methyl tert-butyl ether (MTBE) | 11 | | " | 10.0 | | 114 | 76-135 | | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *10.1* | | *"* | *10.0* | | *101* | *69-130* | | | | |
| *Surrogate: p-Bromofluorobenzene* | *10.0* | | *"* | *10.0* | | *100* | *79-122* | | | | |
| *Surrogate: Toluene-d8* | *9.36* | | *"* | *10.0* | | *93.6* | *81-117* | | | | |
| **LCS Dup (BL60325-BSD1)** | | | | | | | Prepared & Analyzed: 12/07/2016 | | | | |
| Benzene | 11 | | ug/L | 10.0 | | 114 | 85-126 | | 2.30 | 30 | |
| Ethyl Benzene | 10 | | " | 10.0 | | 104 | 80-131 | | 0.287 | 30 | |
| Toluene | 10 | | " | 10.0 | | 102 | 80-127 | | 0.295 | 30 | |
| o-Xylene | 10 | | " | 10.0 | | 100 | 78-130 | | 0.499 | 30 | |
| p- & m- Xylenes | 21 | | " | 20.0 | | 105 | 77-133 | | 0.335 | 30 | |
| Isopropylbenzene | 10 | | " | 10.0 | | 100 | 76-140 | | 1.31 | 30 | |
| n-Propylbenzene | 10 | | " | 10.0 | | 102 | 78-133 | | 1.09 | 30 | |
| p-Isopropyltoluene | 11 | | " | 10.0 | | 107 | 81-136 | | 3.42 | 30 | |
| 1,2,4-Trimethylbenzene | 11 | | " | 10.0 | | 105 | 82-132 | | 1.05 | 30 | |
| 1,3,5-Trimethylbenzene | 11 | | " | 10.0 | | 107 | 80-131 | | 1.22 | 30 | |
| n-Butylbenzene | 10 | | " | 10.0 | | 104 | 79-132 | | 0.577 | 30 | |
| sec-Butylbenzene | 9.6 | | " | 10.0 | | 96.3 | 79-137 | | 0.208 | 30 | |
| tert-Butylbenzene | 10 | | " | 10.0 | | 101 | 77-138 | | 2.72 | 30 | |
| Naphthalene | 8.6 | | " | 10.0 | | 86.5 | 70-147 | | 2.51 | 30 | |
| Methyl tert-butyl ether (MTBE) | 12 | | " | 10.0 | | 116 | 76-135 | | 1.74 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *10.3* | | *"* | *10.0* | | *103* | *69-130* | | | | |
| *Surrogate: p-Bromofluorobenzene* | *10.2* | | *"* | *10.0* | | *102* | *79-122* | | | | |
| *Surrogate: Toluene-d8* | *9.41* | | *"* | *10.0* | | *94.1* | *81-117* | | | | |

## Volatile Analysis Sample Containers

| Lab ID | Client Sample ID | Volatile Sample Container |
|---|---|---|
| 16L0105-01 | MW-51R | 40mL Clear Vial (pre-pres.) HCl; Cool to 4° C |
| 16L0105-02 | MW-52 | 40mL Clear Vial (pre-pres.) HCl; Cool to 4° C |
| 16L0105-03 | MW-53 | 40mL Clear Vial (pre-pres.) HCl; Cool to 4° C |
| 16L0105-04 | MW-47R | 40mL Clear Vial (pre-pres.) HCl; Cool to 4° C |
| 16L0105-05 | DUP | 40mL Clear Vial (pre-pres.) HCl; Cool to 4° C |
| 16L0105-06 | Trip Blank | 40mL Clear Vial (pre-pres.) HCl; Cool to 4° C |

## Notes and Definitions

| | |
|---|---|
| QM-07 | The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery. |
| J | Detected below the Reporting Limit but greater than or equal to the Method Detection Limit (MDL/LOD) or in the case of a TIC, the result is an estimated concentration. |

---

| | |
|---|---|
| * | Analyte is not certified or the state of the samples origination does not offer certification for the Analyte. |
| ND | NOT DETECTED - the analyte is not detected at the Reported to level (LOQ/RL or LOD/MDL) |
| RL | REPORTING LIMIT - the minimum reportable value based upon the lowest point in the analyte calibration curve. |
| LOQ | LIMIT OF QUANTITATION - the minimum concentration of a target analyte that can be reported within a specified degree of confidence. This is the lowest point in an analyte calibration curve that has been subjected to all steps of the processing/analysis and verified to meet defined criteria. This is based upon NELAC 2009 Standards and applies to all analyses. |
| LOD | LIMIT OF DETECTION - a verified estimate of the minimum concentration of a substance in a given matrix that an analytical process can reliably detect. This is based upon NELAC 2009 Standards and applies to all analyses conducted under the auspices of EPA SW-846. |
| MDL | METHOD DETECTION LIMIT - a statistically derived estimate of the minimum amount of a substance an analytical system can reliably detect with a 99% confidence that the concentration of the substance is greater than zero. This is based upon 40 CFR Part 136 Appendix B and applies only to EPA 600 and 200 series methods. |
| Reported to | This indicates that the data for a particular analysis is reported to either the LOD/MDL, or the LOQ/RL. In cases where the "Reported to" is located above the LOD/MDL, any value between this and the LOQ represents an estimated value which is "J" flagged accordingly. This applies to volatile and semi-volatile target compounds only. |
| NR | Not reported |
| RPD | Relative Percent Difference |
| Wet | The data has been reported on an as-received (wet weight) basis |
| Low Bias | Low Bias flag indicates that the recovery of the flagged analyte is below the laboratory or regulatory lower control limit. The data user should take note that this analyte may be biased low but should evaluate multiple lines of evidence including the LCS and site-specific MS/MSD data to draw bias conclusions. In cases where no site-specific MS/MSD was requested, only the LCS data can be used to evaluate such bias. |
| High Bias | High Bias flag indicates that the recovery of the flagged analyte is above the laboratory or regulatory upper control limit. The data user should take note that this analyte may be biased high but should evaluate multiple lines of evidence including the LCS and site-specific MS/MSD data to draw bias conclusions. In cases where no site-specific MS/MSD was requested, only the LCS data can be used to evaluate such bias. |
| Non-Dir. | Non-dir. flag (Non-Directional Bias ) indicates that the Relative Percent Difference (RPD) (a measure of precision) among the MS and MSD data is outside the laboratory or regulatory control limit. This alerts the data user where the MS and MSD are from site-specific samples that the RPD is high due to either non-homogeneous distribution of target analyte between the MS/MSD or indicates poor reproducibility for other reasons. |

If EPA SW-846 method 8270 is included herein it is noted that the target compound N-nitrosodiphenylamine (NDPA) decomposes in the gas chromatographic inlet and cannot be separated from diphenylamine (DPA). These results could actually represent 100% DPA, 100% NDPA or some combination of the two. For this reason, York reports the combined result for n-nitrosodiphenylamine and diphenylamine for either of these compounds as a combined concentration as Diphenylamine.

If Total PCBs are detected and the target aroclors reported are "Not detected", the Total PCB value is reported due to the presence of either or both Aroclors 1262 and 1268 which are non-target aroclors for some regulatory lists.

2-chloroethylvinyl ether readily breaks down under acidic conditions. Samples that are acid preserved, including standards will exhibit breakdown. The data user should take note.

Certification for pH is no longer offered by NYDOH ELAP.

Semi-Volatile and Volatile analyses are reported down to the LOD/MDL, with values between the LOD/MDL and the LOQ being "J" flagged as estimated results.

For analyses by EPA SW-846-8270D, the Limit of Quantitation (LOQ) reported for benzidine is based upon the lowest standard used for calibration and is not a verified LOQ due to this compound's propensity for oxidative losses during extraction/concentration procedures and non-reproducible chromatographic performance.

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

# Field Chain-of-Custody Record



NOTE: York's Std. Terms & Conditions are listed on the back side of this document.
This document serves as your written authorization to York to proceed with the analyses requested and your signature binds you to York's Std. Terms & Conditions.

**York Project No.** 16L0105
Revised COC 12/2/16.

## YOUR Information

Company: Langan CT Inc
Address: 555 Long Wharf Dr
New Haven CT 06511
Phone No. 203-562-5771
Contact Person: H. Gnesbach
E-Mail Address: hgnesbach@langan.com

## Report To:

Company: Same
Address:
Phone No.
Attention:
E-Mail Address:

## Invoice To:

Company: Same
Address:
Phone No.
Attention:
E-Mail Address:

## YOUR Project ID

Kings Plaza

**Purchase Order No.**
140050114

Samples from: CT ___ NY X NJ ___

## Turn-Around Time

- RUSH - Same Day ☐
- RUSH - Next Day ☐
- RUSH - Two Day ☐
- RUSH - Three Day ☐
- RUSH - Four Day ☐
- Standard(5-7 Days) ☒

## Report Type

- Summary Report ___
- Summary w/ QA Summary ___
- CT RCP Package ___
- CTRCP DQA/DUE Pkg ___
- NY ASP A Package X (HG)
- NY ASP B Package ___
- NJDEP Red. Deliv. ___

*Electronic Data Deliverables (EDD)*

- Simple Excel ___
- NYSDEC EQuIS ✓
- EQuIS (std) ___
- EZ-EDD (EQuIS) ___
- NJDEP SRP HazSite EDD ___
- GIS/KEY (std) ✓
- Other ___
- York Regulatory Comparison
- Excel Spreadsheet ___

Compare to the following Regs. (please fill in):
TOGS AWQS & GV Class GA

***Print Clearly and Legibly. All Information must be complete. Samples will NOT be logged in and the turn-around time clock will not begin until any questions by York are resolved.***

Samples Collected/Authorized By (Signature)

Hannah Gnesbach
Name (printed)

**Matrix Codes**
S - soil
Other - specify(oil, etc.)
WW - wastewater
GW - groundwater
DW - drinking water
Air-A - ambient air
Air-SV - soil vapor

| Volatiles | | Semi-Vols. | Pest/PCB/Herb | Metals | Misc. Org. | Full Lists | Misc. |
|---|---|---|---|---|---|---|---|
| 8260 full | TICs | 8270 or 625 | 8082PCB | RCRA8 | TPH GRO | Pri.Poll. | Corrosivity |
| 624 | Site Spec. | STARS list | 8081Pest | PP13 list | TPH DRO | TCL Organics | Reactivity |
| STARS list | Nassau Co. | BN Only | 8151Herb | TAL | CT ETPH | TAL Met/CN | Ignitability |
| BTEX | Suffolk Co. | Acids Only | CT RCP | CT15 list | NY 310-13 | Full TCLP | Flash Point |
| MTBE | Ketones | PAH list | App. IX | TAGM list | TPH 1664 | Full App. IX | Sieve Anal. |
| TCL list | Oxygenates | TAGM list | Site Spec. | NJDEP list | Air TO14A | Part 360-Routine | Heterotrophs |
| TAGM list | TCLP list | CT RCP list | SPLP or TCLP | Total | Air TO15 | Part 360-Baseline | TOX |
| CT RCP list | 524.2 | TCL list | TCLP Pest | Dissolved | Air STARS | Part 360-Expanded (w/ Dioxins/Furans) | BTU/lb. |
| Arom. only | 502.2 | NJDEP list | TCLP Herb | SPLP or TCLP | Air VPH | Part 360-Extended (Full List) | Aquatic Tox. |
| Halog.only | NJDEP list | App. IX | Chlordane | Indiv. Metals | Air TICs | NYCDEP Sewer | TOC |
| App.IX list | SPLP or TCLP | TCLP BNA | 608 Pest | LIST Below | Methane | NYSDEC Sewer | Asbestos |
| 8021B list | | SPLP or TCLP | 608 PCB | | Helium | TAGM | Silica |

| Sample Identification | Date/Time Sampled | Sample Matrix | Choose Analyses Needed from the Menu Above and Enter Below | Container Description(s) |
|---|---|---|---|---|
| MW-51R | 12.2.16 | GW | CP-51 VOCs | 6 VOAs (HCl preserved) |
| MW-52 (MS/MSD) | ↓ | ↓ | *please HOLD unpreserved VOAs for possible future analysis of CP-51 VOCs after lab filtering | 18 |
| MW-53 | ↓ | ↓ | ↓ | 6 |
| MW-4TR | ↓ | ↓ | ↓ | ↓ |
| DUP | ↓ | ↓ | ↓ | ↓ |
| Trip Blank | — | Aq | ↓ | 2 ↓ |

**Comments**
please cc dgranucci@langan.com on deliverables

**Preservation** Check those Applicable
4°C X Frozen ___ HCl ___ MeOH ___ HNO3 ___ H2SO4 ___ NaOH ___
ZnAc ___ Ascorbic Acid ___ Other ___

Special Instructions
Field Filtered ☐
Lab to Filter ☑

| Samples Relinquished By | Date/Time | Samples Received By | Date/Time |
|---|---|---|---|
| Hannah Gnesbach | 12216 1440 | | |
| Samples Relinquished By | Date/Time | Samples Received in LAB by | Date/Time |
| | | | 12/2/16 1447 |

**Temperature on Receipt** 4.8 °C

# APPENDIX C – DATA USABILITY REPORT (DUSR)

LANGAN
ENGINEERING & ENVIRONMENTAL SERVICES

# Technical Memorandum

**2700 Kelly Road, Suite 200 Warrington, PA 18976 T: 215.491.6500 F: 215.491.6501**
**Mailing Address: P.O. Box 1569 Doylestown, PA 18901**

**To:** David Granucci, Langan Project Engineer

**From:** Emily Strake, Langan Senior Project Chemist/Risk Assessor

**Date:** January 3, 2017

**Re:** Data Usability Summary Report
For Kings Plaza
Groundwater Samples Collected December 2016
Langan Project No.: 140080114

This memorandum presents the findings of an analytical data validation of the data generated from the analysis of groundwater samples collected in December 2016 by Langan Engineering and Environmental Services ("Langan") at the Kings Plaza site ("the Site"). The samples were analyzed by York Analytical (NYSDOH ELAP registration # 10854) for volatile organic compounds (VOCs) by the following method:

- VOCs by SW-846 Method 8260C

Table 1, below, summarizes the laboratory and client sample identification numbers, sample collection dates, and analytical parameters subject to review.

**TABLE 1: SAMPLE SUMMARY**

| *SDG* | *Lab Sample ID* | *Client Sample ID* | *Sample Date* | *Analytical Parameters* |
|---|---|---|---|---|
| 16L0105 | 16L0105-01 | MW-51R | 12/02/16 | VOCs |
| 16L0105 | 16L0105-02 | MW-52 | 12/02/16 | VOCs |
| 16L0105 | 16L0105-03 | MW-53 | 12/02/16 | VOCs |
| 16L0105 | 16L0105-04 | MW-47R | 12/02/16 | VOCs |
| 16L0105 | 16L0105-05 | DUP | 12/02/16 | VOCs |
| 16L0105 | 16L0105-06 | Trip Blank | 12/02/16 | VOCs |

## VALIDATION OVERVIEW

This data validation was performed in accordance with USEPA Region II Standard Operating Procedure, "Trace Volatile Data Validation, HW-34A; SOM02.2" (July 2015, Revision 0) and the "National Functional Guidelines for Organic Superfund Data Review" (USEPA-540R-2016-002, September 2016).

Validation includes review of the analytical data to verify that data are easily traceable and sufficiently complete to permit logical reconstruction by a qualified individual other than the originator. Items subject to review in this memorandum include holding times, sample

preservation, instrument tuning, instrument calibration, laboratory blanks, laboratory control samples, system monitoring compounds, internal standard area counts, matrix spike/spike duplicate recoveries, target compound identification and quantification, chromatograms, and overall system performance.

As a result of the review process, the following qualifiers may be assigned to the data in accordance with the USEPA's guidelines and best professional judgment:

- **R –** The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
- **J –** The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
- **UJ –** The analyte was not detected at a level greater than or equal to the reporting limit (RL); however, the reported RL is approximate and may be inaccurate or imprecise.
- **U –** The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the RL or the sample concentration for results impacted by blank contamination.
- **NJ –** The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

If any validation qualifiers are assigned these qualifiers should supersede any laboratory-applied qualifiers. Data that is not qualified as a result of this data validation is considered acceptable on the basis of the items specified for review. Data that is qualified as "R" are not sufficiently valid and technically supportable to be used for data interpretation. Data that is otherwise qualified due to minor data quality anomalies are usable, as qualified.

**QUALIFICATION SUMMARY**

Qualification of the data was not necessary.

**MAJOR DEFICIENCIES:**

Major deficiencies include those that grossly impact data quality and necessitate the rejection of results. No major deficiencies were identified.

**MINOR DEFICIENCIES:**

Minor deficiencies include anomalies that directly impact data quality and necessitate qualification, but do not result in unusable data. No minor deficiencies were identified.

**OTHER DEFICIENCIES:**

Other deficiencies include anomalies that do not directly impact data quality and do not necessitate qualification. The section below describes the other deficiencies that were identified.

**VOCs by SW-846 Method 8260C:**

MS/SD sample MW-52 displayed recoveries and RPDs outside of control limits for isopropylbenzene and n-propylbenzene. The sample concentrations were greater than 4X the spiked amount; qualification is not necessary.

**COMMENTS:**

On the basis of this evaluation, the laboratory appears to have followed the specified analytical methods with the exception of errors discussed above. If a given fraction is not mentioned above, that means that all specified criteria were met for that parameter. All of the data packages met ASP Category B requirements.

All data are considered usable, as qualified. In addition, completeness, defined as the percentage of analytical results that are judged to be valid, is 100%.

Signed:

**Emily Strake**
Senior Project Chemist/Risk Assessor

# APPENDIX B
# HEALTH AND SAFETY PLAN (HASP)

# APPENDIX B
# HEALTH AND SAFETY PLAN (HASP)

# for

## Kings Plaza Shopping Center
## 5102, 5120, & 5502 Avenue U
## Brooklyn, Kings County, New York

## NYSDEC Spill No. 98-15289

***Prepared For:***

**Brooklyn Kings Plaza LLC**
**5120 Avenue U**
**Brooklyn, New York 11234**

***Prepared By:***

**Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.**
**21 Penn Plaza**
**360 West 31st Street, 8th Floor**
**New York, New York 10001**

**Jamie P. Barr, L.E.P.**
**Senior Associate/Vice President**

**March 2019**
**140080107**

## TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## LIST OF APPENDICES

# HEALTH AND SAFETY PLAN (HASP) SUMMARY

## Emergency Contacts

Emergency contacts are listed on Table 0.1.

## Emergency Procedures

Emergency procedures are described in Section 6.

## Site-Specific Hazards and Training

Site-specific hazards are described in Section 2.

The Field Safety Officer (FSO) will be responsible for providing site-specific training to all personnel that work at the Site. This training will cover the following topics:

- Names of personnel responsible for site safety and health;
- Hazards potentially present at the Site;
- Proper use of personal protective equipment (PPE);
- Work practices by which the employee can minimize risk from hazard;
- Acute effects of compounds at the Site; and,
- Decontamination procedures.

Personnel will be required to sign and date the Site-Specific Training Form provided in Attachment B prior to working on-site.

## General Health and Safety Requirements

Personnel will be required to sign and date the Health and Safety Plan (HASP) and Work Plan Acceptance Form provided in Attachment B prior to working on-site.

## Personal Protective Equipment (PPE)

**Level D** protection will be worn for initial entry on-site and for all activities except as noted in Section 3. Level D protection will consist of:

- Standard work clothes;
- Steel-toe safety boots;
- Safety glasses or goggles must be worn when splash hazard is present;

- Nitrile outer gloves and polyvinyl chloride (PVC) or nitrile inner gloves must be worn during all sampling activities; and,
- Hardhat (must be worn during all sampling activities).

**Modified Level D** protection may be required under conditions where potential contact of the skin or clothes with significant contamination occurs. Modified Level D is the same as Level D but includes Tyvek coveralls and disposable polyethylene (PE) over-boots.

**Level C** protection, unless otherwise specified in Section 3, will consist of Level D equipment and the following additional equipment:

- Full-face or half-mask air-purifying respirator (APR);
- Combination dust/organic vapor cartridges;
- Tyvek coveralls if particulate hazards are present;
- PE-coated Tyvek coverall if liquid contamination is present;
- PVC or nitrile inner and nitrile outer gloves; and,
- 5-minute escape self-contained breathing apparatus (SCBA).

**Level B** protection, unless otherwise specified in Section 3, will consist of Level D equipment and the following additional equipment:

- Hard hat;
- Positive-pressure SCBA or positive-pressure airline and respirator with escape SCBA;
- PE-coated Tyvek coverall;
- Nitrile outer and PVC or nitrile inner gloves; and,
- Nitrile boot covers.

## Air Monitoring

A summary of the action levels and restrictions is presented on Table 0.2.

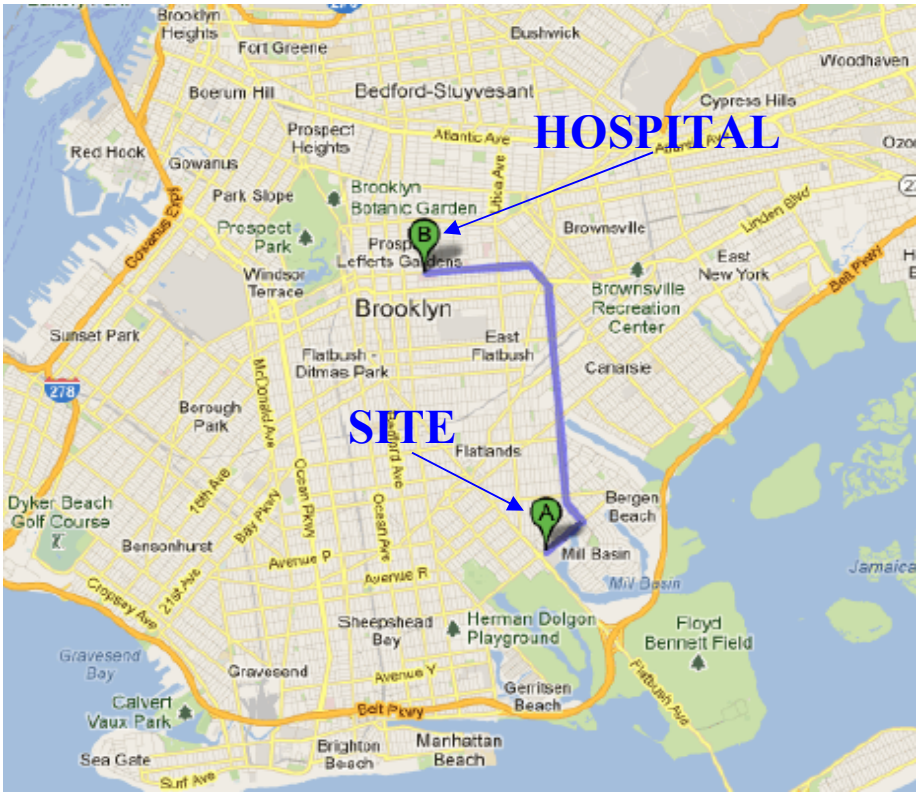
# FIGURE 1

## HOSPITAL ROUTE PLAN (University Hospital of Brooklyn)

**Site Location: 5102, 5120, and 5502 Avenue U, Brooklyn, NY**

**Hospital Location: 450 Clarkson Avenue, Brooklyn, NY**

**Emergency Room: (718) 758-8920**




**Directions to University Hospital of Brooklyn**
450 Clarkson Ave, Brooklyn, NY 11203
**4.6 mi – about 15 mins**

**A Kings Plaza Shopping Center**
5100 Kings Plaza, Brooklyn, NY 11234

| | | |
|---|---|---|
| 1. | Head **northeast** on **Avenue U** toward **E 55th St**<br>About 1 min | go 0.5 mi<br>total 0.5 mi |
| 2. | Turn left onto **Mill Ave**<br>About 1 min | go 0.3 mi<br>total 0.8 mi |
| 3. | Slight right onto **Ralph Ave**<br>About 7 mins | go 2.4 mi<br>total 3.2 mi |
| 4. | Slight left onto **Remsen Ave**<br>About 2 mins | go 0.3 mi<br>total 3.5 mi |
| 5. | Turn left onto **Clarkson Ave**<br>Destination will be on the left<br>About 4 mins | go 1.1 mi<br>total 4.6 mi |

**B University Hospital of Brooklyn**
450 Clarkson Ave, Brooklyn, NY 11203

## TABLE 0.1

## EMERGENCY CONTACTS

In the event of any situation or unplanned occurrence requiring assistance, the appropriate contact(s) should be made from the list below. For emergencies, contact should first be made with the Field Team Leader (or designee) and the FSO, who will notify emergency personnel who will then contact the appropriate response teams. This emergency contacts list must be in an easily accessible location at the Site.

| **Emergency Contacts** | **Phone Number** |
|---|---|
| Fire Department: | 911 |
| Police: | 911 |
| Dig Safely – New York:<br>(3-day notice required for utility mark-outs) | (800)-272-4480 |
| Poison Control Center: | (800) 222-1222 |
| Pollution Toxic Chemical Oil Spills: | (800) 424-8802 |

**Medical Emergency**

| | |
|---|---|
| Ambulance Service: | 911 |
| Hospital Name: | University Hospital of Brooklyn |
| Hospital Phone Number: | (718) 758-8920 |
| Hospital Address: | 450 Clarkson Avenue, Brooklyn, NY |
| Route to Hospital: | See Figure 1 |
| Travel Time From Site: | 15 minutes |

**Langan Contacts**

| | | |
|---|---|---|
| Project Director: | Jamie P. Barr, L.E.P. | (917) 882-5428 |
| Program/Project Manager: | David Granucci | (203) 710-4448 |
| Remediation Engineer: | Stewart Abrams, P.E. | (203) 314-1841 |
| Program Quality Assurance Monitor: | Ryan Wohlstrom | (203) 464-2731 |
| Langan Health & Safety Officer: | Tony Moffa | (215) 756-2523 |
| FSO/Field Team Leader: | Hannah Griesbach | (203) 800-1232 |

## TABLE 0.2

## SUMMARY OF ACTION LEVELS AND RESTRICTIONS

**Conditions for Level D:**

All areas:

- Photoionization detector (PID) readings < 25 parts per million (ppm) and benzene < 1 ppm; and/or,
- No visible fugitive dust emissions from site activities (< 150 [micrograms per cubic meter] $\mu g/m^3$).

**Conditions for Level C:**

All areas:

- Where PID readings > 25 ppm (sustained for 15 minutes in the breathing zone) to 200 ppm and benzene < 5ppm; and/or,
- Sustained visible fugitive dust emissions from site activities in excess of 150 $\mu g/m^3$ (not anticipated).

**Conditions for Level B (or retreat):**

All areas:

- Where PID readings > 500 ppm or benzene > 25 ppm; and/or,
- Visible fugitive dust emissions from site activities cloud the surrounding air and are in excess of 150 $\mu g/m^3$ (not anticipated).

# 1.0 INTRODUCTION

## 1.1 Purpose and Policy

The purpose of this Health and Safety Plan (HASP) is to establish personnel protection standards and mandatory safety practices and procedures for the implementation of the Groundwater Remediation Work Plan for the former Standard Oil parcel (also known as operable unit [OU]-3) at 5102, 5120, and 5502 Avenue U in Brooklyn, New York (the "Site"). The Site is currently subject to a stipulation agreement with New York State Department of Environmental Conservation (NYSDEC) for two open petroleum spill cases. The Groundwater Remediation Work Plan outlines the proposed groundwater remediation activities along the northern portion of OU-3 to address residual dissolved-phase petroleum impacts associated with Spill Nos. 98-15289 and 09-04813. The remediation specifically addresses impacts at, and near, monitoring well MW-52.

This HASP assigns responsibilities, establishes standard operating procedures (SOPs), and provides for contingencies that may arise while operations are being conducted during the completion of the referenced tasks. The provisions of the HASP are mandatory for all on-site personnel. Any supplemental plans used by subcontractors shall conform to this plan at a minimum. All personnel who engage in project activities must be familiar with this plan, comply with its requirements, and sign the Plan Acceptance Form (Attachment B), page number B-5, prior to working on the Site. The Plan Acceptance Form must be submitted to the Langan Field Safety Officer (FSO). In addition to this plan, all work shall be performed in accordance with all applicable federal, state, and local regulations.

## 1.2 Site Description

The Site occupies an approximately 5.9-acre area and is improved with a 1-story Lowe's Home Improvement store (Lowe's) with an associated asphalt parking lot. The Lowe's lot is at 5502 Avenue U (Block 8470, Lot 114) and bounded by Avenue U to the northwest, an adjacent shopping center (Block 8470, Lot 130) to the northeast, the Mill Basin to the southeast, and East 55$^{th}$ Street to the southwest.

## 1.3 Scope of Work

The remediation plan proposed by Langan consists of two phases: Phase One will consist of vacuum-enhanced fluid recovery (VEFR). If Phase One is unsuccessful, Phase Two will consist of a sulfate injection program (to be designed following completion of Phase One and a bench scale test). Langan will proceed with the proposed Phase One remediation plan upon receiving

written approval from NYSDEC if they agree with the phased approach. A detailed description of Phase One and Phase Two activities is provided in Langan's Groundwater Remediation Work Plan.

## 1.4 Langan Project Team Organization

Table 1.1 describes the responsibilities of Langan on-site personnel associated with this project. The names of principal personnel associated with this project are:

| | | |
|---|---|---|
| Project Director: | Jamie P. Barr, L.E.P. | (917) 882-5428 |
| Program/Project Manager: | David Granucci | (203) 464-2731 |
| Remediation Engineer: | Stewart Abrams, P.E. | (203) 314-1841 |
| Program Quality Assurance Monitor: | Ryan Wohlstrom | (203) 464-2731 |
| Langan Health & Safety Officer: | Tony Moffa | (215) 756-2523 |
| FSO/Field Team Leader: | Hannah Griesbach | (203) 800-1232 |

Langan personnel have been appropriately trained in first aid and hazardous waste safety procedures, including the operating and fitting of personal protective equipment (PPE), and are experienced with the field operations planned for this Site.

**TABLE 1.1**

**ON-SITE PERSONNEL AND RESPONSIBILITIES**

**PROJECT MANAGER –** Assumes control over site activities. Reports to upper-level management and has authority to direct response operations.

**Responsibilities:**

- Prepares and organizes the background review of the situation, the Remedial Action Work Plan (RAWP), the site-specific HASP, and the field team;
- Obtains permission for site access and coordinates activities with appropriate officials;
- Ensures that the Groundwater Remediation Work Plan is executed and on schedule;
- Briefs the field team on their specific assignments;
- Coordinates with the site Health and Safety Officer (HSO) to ensure that health and safety requirements are met;
- Prepares the final report and support files on the response activities; and,
- Serves as the liaison with public officials.

**FIELD SAFETY OFFICER (FSO) –** Advises the HSO and project manager on aspects of health and safety on-site. Stops work if operations threaten worker or public health or safety.

**Responsibilities:**

- Ensures that all necessary health and safety equipment is available on-site. Ensures that all equipment is functional;
- Periodically inspects protective clothing and equipment;
- Ensures that protective clothing and equipment are properly stored and maintained;
- Controls entry and exit at the Access Control Points;
- Coordinates health and safety program activities with the site HSO;
- Confirms each team member's suitability for work based on a physician's recommendation;
- Monitors the work parties for signs of stress, such as cold exposure, heat stress, and fatigue;
- Implements the site-specific HASP;
- Conducts periodic inspections to determine if the site-specific HASP is being followed;
- Enforces the "buddy" system;
- Knows emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department;

- Notifies, when necessary, local public emergency officials;
- Coordinates emergency medical care;
- Sets up decontamination lines and the decontamination solutions appropriate for the type of chemical contamination on the Site;
- Controls the decontamination of all equipment, personnel, and samples from the contaminated areas;
- Assures proper disposal of contaminated clothing and materials;
- Ensures that all required equipment is available;
- Advises medical personnel of potential exposures and consequences; and,
- Notifies emergency response personnel by telephone or radio in the event of an emergency.

**FIELD TEAM LEADER –** Advises on all aspects of health and safety on-site. Stops work if any operation threatens worker or public health or safety and is directly responsible for the field team and the safety of site operations.

**Responsibilities:**

- Manages field operations;
- Executes the Groundwater Remediation Work Plan and schedule;
- Enforces safety procedures;
- Coordinates with the FSO in determining protection level;
- Enforces site control;
- Documents field activities and sample collection; and,
- Serves as a liaison with public officials.

**WORK TEAM –** Operators, laborers, samplers. The work party must consist of at least two people.

**Responsibilities:**

- Safely completes the on-site tasks required to fulfill the Groundwater Remediation Work Plan;
- Complies with the site-specific HASP; and,
- Notifies the FSO or supervisor of suspected unsafe conditions.

# 2.0 RISK ANALYSIS

## 2.1 Chemical Hazards

The primary potential chemical hazard is exposure to volatile organic compounds (VOCs). Other compounds that may be encountered are site equipment fuels (gasoline, diesel, etc.) that also contain volatile components. Heavy metals such as arsenic, lead, and mercury may be present in soils, due to the presence of urban fill. Relevant properties of these compounds are outlined in Table 2.1.

Dust with chemical constituents may be generated during implementation of the Groundwater Remediation Work Plan. Therefore, air will be monitored for particulates and organic vapors continuously within the work zone and periodically at the site perimeter.

Safety Data Sheets (SDSs) for substances that will be used on-site are included in Attachment C.

# TABLE 2.1

**RELEVANT PROPERTIES OF VOLATILES, SEMI-VOLATILES, METALS, PCBS, AND PESTICIDES KNOWN OR SUSPECTED AT THE SITE**

| Compound | OSHA PEL [(1)] (ppm) | IDLH (ppm) | LEL (%) | Odor Threshold[(2)] (ppm) | Odor Character | Vapor Pressure (mm Hg) | Physical State | Detectable w/ 10.6 eV lamp PID (I.P. eV) |
|---|---|---|---|---|---|---|---|---|
| Arsenic (As) | 0.01 | 5 | NA | NA | NA | 0 (approx.) | Noncombustible Solid[(3)] | NA |
| Benzene | 1 | 500 | 1.2 | 1.5 | Sweet aromatic | 75 | Combustible Liquid | Yes |
| n-Butylbenzene | NA | NA | NA | NA | None observed | 1.03 | Colorless liquid | Yes |
| Sec-butylbenzene | NA | NA | NA | NA | None observed | 4 | Colorless liquid | Yes |
| Beryllium (Be) | 0.002 | 4 | NA | NA | NA | 0 (approx.) | Noncombustible | NA |
| Chromium (Cr) | 0.1 | 250 | NA | NA | NA | 0 (approx.) | Noncombustible Solid | NA |
| Copper (Cu) | 1 | 100 | NA | NA | NA | 1 | Noncombustible | NA |
| Ethylbenzene | 100 | 800 | 0.8 | 2.3 | Sweet aromatic | 7 | Combustible Liquid | Yes |
| Iron (Fe) | 5 | NA | NA | NA | NA | NA | Noncombustible | NA |
| Isopropylbenzene | 50 | 8,000 | 0.9 | 0.088 | Sharp aromatic | 8 | Colorless liquid | Yes |
| Lead (Pb) | 0.05 | 11 | NA | NA | NA | 0 (approx.) | Noncombustible Solid | NA |
| Magnesium (Mg) | 5 | 500 | NA | NA | NA | 0 (approx.) | Combustible Solid | NA |
| Mercury (Hg) | 0.1 | 10 | NA | NA | NA | 0 (approx.) | Noncombustible | NA |

| Compound | OSHA PEL [1] (ppm) | IDLH (ppm) | LEL (%) | Odor Threshold[2] (ppm) | Odor Character | Vapor Pressure (mm Hg) | Physical State | Detectable w/ 10.6 eV lamp PID (I.P. eV) |
|---|---|---|---|---|---|---|---|---|
| Nickel (Ni) | 1 | 10 | NA | NA | NA | 0 (approx.) | Combustible Solid[4] | NA |
| n-Propylbenzene | NA | NA | NA | NA | Aromatic | 2 | Colorless liquid | Yes |
| Toluene | 200 | 500 | 1.1 | 2.9 | Sweet aromatic | 21 | Combustible liquid | Yes |
| Xylenes (total) | 100 | 900 | 0.9 | 1 | Faint aromatic | 7 | Combustible liquid | Yes |
| Zinc (Zn) | 5 | 50 | NA | NA | NA | 0 (approx.) | Combustible solid[5] | NA |

(1) 29 Code of Federal Regulations (CFR) 1910, 30 June 1993 (8-hour time weighted average [TWA] unless otherwise specified)
(2) Association Advancing Occupational and Environmental Health (ACGIH) 1989 highest reported value of acceptable odor threshold range
(3) Slight explosive hazard if dust is exposed to flame
(4) Sponge catalyst may ignite spontaneously in the air
(5) Powder may ignite spontaneously in the air, and can continue burning under water
(OSHA) Occupational Safety and Health Administration
(PEL) Permissible Exposure Limit
(IDLH) Immediately dangerous to life or health
(LEL) Lower Explosive Limit
(eV) Electron-Volt
(PID) Photoionization Detector

## 2.3 Biological Hazards

### 2.3.1 Animals

During site operations, animals such as dogs, pigeons, seagulls, mice, and rats may be encountered. Workers will use discretion and avoid all contact with animals. Bites and scratches from dogs can be painful and if the animal is rabid, the potential for contracting rabies exists. Contact with rat and mice droppings may lead to contracting Hantavirus. Inhalation of dried pigeon droppings may lead to psittacosis; crytococcosis and histoplasmosis are also diseases associated with exposure to dried bird droppings but these are less likely to occur in this occupational setting.

### 2.3.2 Insects

Insects, including bees, wasps, hornets, mosquitoes, and spiders, may be present at this Site. Some individuals may have a severe allergic reaction to an insect bite or sting that can result in a life threatening condition. In addition, mosquito bites may lead to St. Louis encephalitis or West Nile encephalitis. Personnel that have been bitten or stung by an insect at the Site should notify the HSO or FSO immediately. The following is a list of preventive measures:

- Apply insect repellent prior to fieldwork and/or as often as needed throughout the shift;
- Wear proper protective clothing (work boots, socks, and light colored pants);
- When walking in wooded areas, to the extent possible, avoid contact with bushes, tall grass, or brush; and,
- Field personnel who may have insect allergies (e.g., bee sting) should provide this information to the HSO or FSO prior to commencing work, and will have allergy medication on-site.

The HSO or FSO will instruct the project personnel in the recognition and procedures for encountering potentially hazardous insects at the Site.

Lyme disease is caused by infection from a deer tick that carries a spirochete. During the painless tick bite, the spirochete may be transmitted into the bloodstream, which could lead to the worker contracting Lyme disease. This flu-like illness occurs out of season, commonly happening between May and October when ticks are more active. Symptoms can include a stiff neck, chills, fever, sore throat, headache, fatigue, and joint pain. Early signs may include an expanding skin rash and joint pain. If left untreated, Lyme disease can cause serious nerve or heart problems as well as a disabling type of arthritis. If personnel feel sick or have signs similar to those above, they should notify the HSO or FSO immediately.

It is recommended that personnel check themselves when in areas that could harbor deer ticks, wear light-color clothing and visually check themselves and their buddy when coming from wooded or vegetated areas. If a tick is found biting an individual, the HSO or FSO should be contacted immediately. The tick can be removed by pulling gently at the head with tweezers. The affected area should then be disinfected with an antiseptic wipe.

## 2.4 Physical Hazards

### 2.4.1 Explosion

No explosion hazards are expected for the scope of work at this Site.

### 2.4.2 Heat Stress

The use of Level C protective equipment, or greater, may create heat stress. Monitoring of personnel wearing personal protective clothing should commence when the ambient temperature is 72 °F (22.2 °C) or above. Table 2.2 presents the suggested frequency for such monitoring. Monitoring frequency should increase as ambient temperature increases or as slow recovery rates are observed. Refer to Table 2.3 below to assist in assessing when the risk for heat-related illness is likely. To use this table, the ambient temperature and relative humidity must be obtained (a regional weather report should suffice). Heat stress monitoring should be performed by the FSO, who shall be able to recognize symptoms related to heat stress.

To monitor the workers, be familiar with the following heat-related disorders and their symptoms:

- **Prickly Heat (Heat rash)**
  - Painful, itchy red rash. Occurs during sweating, on skin covered by clothing.
- **Heat Cramps**
  - Painful spasm of arm, leg, or abdominal muscles, during or after work.
- **Heat Exhaustion**
  - Headache, nausea, dizziness; cool, clammy, moist skin; heavy sweating; weak, fast pulse; shallow respiration, normal temperature.
- **Heat Fatigue**
  - Weariness, irritability, loss of skill for fine or precision work; decreased ability to concentrate; no loss of temperature control.
- **Heat Syncope (Heat Collapse)**
  - Fainting while standing in a hot environment.

- **Heat Stroke**
    - Headache, nausea, weakness, hot dry skin, fever, rapid strong pulse, rapid deep respirations, loss of consciousness, convulsions, coma. This is a life-threatening condition.
    - Do not permit a worker to wear a semi-permeable or impermeable garment when they are showing signs or symptoms of heat-related illness.

To monitor the worker, measure:

- Heart rate – Count the radial pulse during a 30-second period as early as possible in the rest period.
    - If the heart rate exceeds 100 beats per minute (bpm) at the beginning of the rest period, shorten the next work cycle by 1/3 and keep the rest period the same.
    - If the heart rate still exceeds 100 bpm at the next rest period, shorten the following work cycle by 1/3. A worker cannot return to work after a rest period until their heart rate is below 100 bpm.
- Oral temperature – Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).
    - If oral temperature exceeds 99.6 °F (37.6 °C), shorten the next work cycle by 1/3 without changing the rest period. A worker cannot return to work after a rest period until their oral temperature is below 99.6 °F (37.6 °C).
    - If oral temperature still exceeds 99.6 °F (37.6 °C) at the beginning of the next rest period, shorten the following cycle by 1/3.
    - Do not permit a worker to wear a semi-permeable or impermeable garment when oral temperature exceeds 100.6 °F (38.1 °C).

**Prevention of Heat Stress** – Proper training and preventative measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress the following steps should be taken:

- Adjust work schedules;
- Mandate work slowdowns as needed;
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided;
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods; and,

- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, e.g., 8 fluid ounces (fl oz) (0.23 liters [L]) of water must be ingested for approximately every 8 oz (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:
    - Maintain water temperature 50 to 60 °F (10 to 16.6 °C).
    - Provide small disposal cups that hold about 4 fl oz (0.1 L).
    - Have workers drink 16 fl oz (0.5 L) of fluid (preferably water or diluted drinks) before beginning work.
    - Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 L) of fluid per day are recommended, but more may be necessary to maintain body weight.
    - Train workers to recognize the symptoms of heat-related illness.

### 2.4.3 Cold-Related Illness

If work on this project begins in the winter months, thermal injury due to cold exposure can become a problem for field personnel. Systemic cold exposure is referred to as hypothermia. Local cold exposure is generally called frostbite.

**Hypothermia** – Hypothermia is defined as a decrease in the patient core temperature below 96 °F (35.6 °C). The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interference with any of these mechanisms can result in hypothermia, even in the absence of what normally is considered a "cold" ambient temperature. Symptoms of hypothermia include: shivering, apathy, listlessness, sleepiness, and unconsciousness.

**Frostbite** – Frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 20 °F (-6.67 °C). Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

**Prevention of Cold-Related Illness** – To prevent cold-related illness:

- Educate workers to recognize the symptoms of frostbite and hypothermia;
- Identify and limit known risk factors;

- Assure the availability of enclosed, heated environments on or adjacent to the Site;
- Assure the availability of dry changes of clothing;
- Assure the availability of warm drinks; and,
- Start (oral) temperature recording at the job site:
    - At the FSO or Field Team Leader's discretion, when suspicion is based on changes in a worker's performance or mental status.
    - At a worker's request.
    - As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind-chill less than 20 °F [-6.67 °C], or wind-chill less than 30 °F [-1.11 °C] with precipitation).
    - As a screening measure whenever any worker on the Site develops hypothermia.

Any person developing moderate hypothermia (a core temperature of 92 °F [33.3 °C]) cannot return to work for 48 hours.

### 2.4.4 Hand and Power Tools

In order to adjust drilling equipment and sever polyvinyl chloride (PVC) riser, personnel will utilize hand and/or power tools. The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. Ground Fault Circuit Interrupters (GFCIs) are required for power tools.

### 2.4.5 Working Near Heavy Machinery

Care should be exercised when working near heavy machinery, such as the excavators. Workers should always stay in view of the equipment operator and give equipment wide berth. Clear communication signals, including hand signals, should be established prior to commencement of work and the equipment should have a back-up alarm.

### 2.4.6 Lifting

Improper lifting and carrying of equipment and materials and shoveling soil may cause strains. Safe lifting and general material handling techniques should be exercised.

### 2.4.7 Falling Hazards

Soil material, crushed stone, tools, etc. may fall from power shovels, front-end loaders, etc. Hard hats are to be work at all times while in work zones.

### 2.4.8 Vehicle Hazards

Trucks and other work vehicles will be entering and leaving the Site during work hours. In addition, the hydraulic excavators, dump trucks, and other construction vehicles will be working throughout the Site. Care should be taken when working on-site and be aware of surroundings at all times. When working near vehicular traffic or work zones, attempt to keep eye contact with the machine operators.

### 2.4.9 Hearing Loss Prevention

Work activities during the remediation and construction activities may be conducted at locations with high noise levels from the operation of equipment. Hearing protection will be used as necessary.

### 2.4.10 Slips, Trips, and Fall Hazards

Care should be exercised when walking at the Site, especially when carrying equipment. The presence of surface debris, uneven surfaces, pits, facility equipment, and soil piles contribute to tripping hazards and fall hazards. To the extent possible, all hazards should be identified and marked on the Site, with hazards communicated to all workers in the area.

### 2.4.11 Utilities (Electrocution and Fire Hazards)

The possibility of encountering underground utilities poses fire, explosion, and electrocution hazards. All intrusive work will be preceded by notification of the subsurface work to the Dig Safely – New York. Potential adverse effects of electrical hazards include burns and electrocution, which could result in death.

## 2.5 Task Hazard Analysis

### 2.5.1 Excavation, Removal of Soil, Engineering and Institutional Controls

Identified potential issues related to work at this Site include: low levels of regulated compounds in soil and/or groundwater (e.g., VOCs and petroleum products [specifically #2 fuel oil]), and drilling/cutting with gas-powered equipment potentially generating carbon monoxide (CO) and carbon dioxide ($CO_2$) in the exhaust fumes.

### 2.5.2 Soil Removal for Site Restoration

The following hazards are associated with the removal and sampling of soil: heavy excavation equipment (impact hazard to on-foot workers), open excavations (fall and cave-in hazard), uneven land surface (slip and trip hazard), and contaminated media (chemical exposure hazard).

### 2.5.3 Soil Backfill

The backfilling of the excavated areas have similar hazards as those associated with the removal of soil.

Chemical exposure may occur as workers encounter soil and groundwater across the Site, or are exposed to products used at the Site including gasoline, diesel, and motor oil. Soil and groundwater sampling present similar potential exposure to hazards. Activities will be conducted initially in Level D but may be upgraded to Modified Level D. Although not anticipated, there will be a Level C and B contingency should pockets of contaminants be brought to the surface and breathing zone air become contaminated.

If evidence of historic or unknown contamination, such as oily materials, high PID readings, etc., is encountered during intrusive work, the FSO will determine the appropriate level of personnel protection.

**Table 2.2**
**Suggested Frequency of Physiological Monitoring**
**For Fit and Acclimated Workers[a]**

| Adjusted Temperature[b] | Normal Work Ensemble[c] | Impermeable Ensemble |
|---|---|---|
| 90 °F or above (32.2 °C) or above | After each 45 minutes of work | After each 15 minutes of work |
| 87.5 °F (30.8 – 32.2 °C) | After each 60 minutes of work | After each 30 minutes of work |
| 82.5 – 87.5 °F (28.1 – 30.8 °C) | After each 90 minutes of work | After each 60 minutes of work |
| 77.5 – 82.5 °F (25.3 – 28.1 °C) | After each 120 minutes of work | After each 90 minutes of work |
| 72.5 – 77.5 °F (22.5 – 25.3 °C) | After each 150 minutes of work | After each 120 minutes of work |

a. For work levels of 250 kilocalories/hour.
b. Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100% sunshine = no cloud cover and a sharp, distinct shadow; 0% sunshine = no shadows.)
c. A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

# Table 2.3 - HEAT INDEX

**ENVIRONMENTAL TEMPERATURE (Fahrenheit)**

| RELATIVE HUMIDITY | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | APPARENT TEMPERATURE* | | | | | | | | | | |
| **0%** | 64 | 69 | 73 | 78 | 83 | 87 | 91 | 95 | 99 | 103 | 107 |
| **10%** | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 111 | 116 |
| **20%** | 66 | 72 | 77 | 82 | 87 | 93 | 99 | 105 | 112 | 120 | **130** |
| **30%** | 67 | 73 | 78 | 84 | 90 | 96 | 104 | 113 | 123 | **135** | **148** |
| **40%** | 68 | 74 | 79 | 86 | 93 | 101 | 110 | 123 | **137** | **151** | |
| **50%** | 69 | 75 | 81 | 88 | 96 | 107 | 120 | **135** | **150** | | |
| **60%** | 70 | 76 | 82 | 90 | 100 | 114 | **132** | **149** | | | |
| **70%** | 70 | 77 | 85 | 93 | 106 | 124 | **144** | | | | |
| **80%** | 71 | 78 | 86 | 97 | 113 | **136** | | | | | |
| **90%** | 71 | 79 | 88 | 102 | 122 | | | | | | |
| **100%** | 72 | 80 | 91 | 108 | | | | | | | |

*Combined Index of Heat and Humidity…what it "feels like" to the body
Source: National Oceanic and Atmospheric Administration

How to use Heat Index:
1. Across top locate Environmental Temperature
2. Down left side locate Relative Humidity
3. Follow across and down to find Apparent Temperature
4. Determine Heat Stress Risk on chart at right

Note: Exposure to full sunshine can increase Heat Index values

| Apparent Temperature | Heat Stress Risk with Physical Activity and/or Prolonged Exposure |
|---|---|
| 90-105 | Heat Cramps or Heat Exhaustion Possible |
| 105-130 | Heat Cramps or Heat Exhaustion Likely, Heat Stroke Possible |

# 3.0 PERSONNEL PROTECTION AND MONITORING

## 3.1 Occupational Safety and Health Administration (OSHA) Training

All on-site personnel who will be actively involved in site activities and can potentially encounter hazardous waste must have completed hazardous waste operations-related training, as required by OSHA 29 CFR 1910.120. Personnel who completed this training more than 12 months prior to the start of the project must have completed an 8-hour refresher course within the past 12 months. Documentation of OSHA training for project personnel must be provided to Langan prior to starting work.

## 3.2 Site-Specific Training

The FSO will be responsible for developing a site-specific occupational hazard training program and providing training to all personnel that are to work at the Site. This training will be conducted prior to starting field work and will consist of the following topics:

- Names of personnel responsible for site safety and health;
- Hazards potentially present at the Site;
- Proper use of PPE;
- Requirements of this HASP;
- Work practices by which the employee can minimize risk from hazards. This may include a specific review of heavy equipment safety, safety during inclement weather, changes in common escape rendezvous point, site security measures, or other site-specific issues that need to be addressed before work begins;
- Safe use of engineering controls and equipment on the Site;
- Acute effects of compounds present at the Site; and,
- Decontamination procedures.

Upon completion of site-specific training, workers will sign the Site-Specific Training Form provided in Attachment B. A copy of the completed Site-Specific Training Form will be included in the project files for future reference.

## 3.3 Monitoring Requirements

Worker air monitoring and community air monitoring (as described in Section 6.4) will be conducted at the start of field work.

Fugitive dust generation that could affect site workers, site occupants, or the public may be expected due to excavation and soil disturbance activities. The FSO will visually monitor the perimeter of the work area for evidence of sustained visible emissions. Work activities will be suspended until dust levels diminish to an acceptable level if sustained emissions are observed

Air monitoring of the breathing zone will be conducted periodically or continuously during boring advancement, test pitting, and sampling activities to assure proper health and safety protection.

VOCs will be monitored with a PID in accordance with the HASP with an action level of 25 parts per million (ppm) in the absence of benzene. If the action level is exceeded and adequate ventilation cannot be provided, work will cease and the potential affected portion of the work area will be evacuated until adequate mechanical ventilation can be setup to control the hazard. Level C respiratory protection may be donned in accordance with the HASP if untrained personnel are not present and the action level is exceeded.

If air monitoring identifies the presence of VOCs during operations (not anticipated because of natural ventilation), the action levels, permissible exposure, engineering controls, and PPE specified in this HASP will be implemented. A PID (MiniRAE 3000 or equivalent) will be used to monitor for organic vapors in the breathing zone and to screen soil samples. Air monitoring results will be recorded in the field book during investigation activities and made available for review.

## 3.4 Summary of Action Levels and Restrictions

A PID, such as the MiniRae 3000 equipped with a 10.6 eV lamp, shall be used to screen for total organic vapors. All readings pertain to sustained readings for 15 minutes in the worker breathing zone. The following conditions shall apply to each level of protection:

**Conditions for Level D:**

All areas:

- PID readings < 25 ppm and benzene < 1 ppm; and/or,
- No visible fugitive dust emissions from site activities.

**Conditions for Level C:**

All areas:

- Where PID readings > 25 ppm (sustained for 15 minutes in the breathing zone) to 200 ppm and benzene < 5ppm; and/or,
- Any visible fugitive dust emissions from site activities that disturb contaminated soil.

**Conditions for Level B (or retreat):**

All areas:

- Where PID readings > 500 ppm or benzene > 25 ppm; and/or,
- Visible fugitive dust emissions from site activities cloud the surrounding air.

3.4.1 Level D and Modified Level D

Level D protection will be worn for initial entry on-site and initially for all activities. Level D protection will consist of:

- Standard work clothes;
- Steel-toe safety boots;
- Safety glasses (goggles must be worn when splash hazard is present);
- Nitrile outer gloves and PVC inner gloves must be worn during all activities requiring contact with soils; and/or,
- Hardhat (must be worn during all site activities).

Modified Level D is the same as Level D but includes Tyvek coveralls and disposable polyethylene (PE) over-boots to contact with the skin or clothes if significant contamination is present in subsurface materials.

3.4.2 Level C

The level of personal protection will be upgraded to Level C if the concentration of VOCs, which can be detected with a PID in the breathing zone, equals or exceeds the specified action limits and the contaminants of concern (COCs) have characteristic warning properties appropriate for air purifying respirators (e.g. taste, odor). Level C protection will consist of the following equipment:

- Full-face or half-mask air-purifying respirator (APR) or powered air purifier (PAPR), depending on presence and abundance of airborne toxic COCs;

- Combination high-efficiency particulate absorption (HEPA) filter/organic vapor cartridges;
- Tyvek coveralls must be worn if particulate hazard present;
- PE-coated Tyvek coveralls if liquid contamination present;
- Steel-toe safety boots;
- Nitrile outer gloves and PVC inner gloves must be worn during all activities requiring contact with soils; and/or,
- Hardhat (must be worn during all site activities).

Cartridges will be disposed at the end of each day's use.

### 3.4.3 Level B (Retreat)

If the concentration of volatile organics, which can be detected with a PID, equals or exceeds the specified action levels, all field personnel associated with the project will immediately retreat to a location upwind of the source of contamination. At this point the FSO must consult with the Langan HSO to discuss appropriate actions.

### 3.4.4 OSHA Requirements for PPE

All PPE used during the course of this field investigation must meet the following OSHA standards:

| Type of Protection | Regulation | Source |
|---|---|---|
| Eye and Face | 29 CFR 1910.133<br>29 CFR 1926.102 | ANSI Z87.1-1968 |
| Respiratory | 29 CFR 1910.134<br>29 CFR 1926.103 | ANSI Z88.1-1980 |
| Head | 29 CFR 1910.135<br>29 CFR 1926.100 | ANSI Z89.1-1969 |
| Foot | 29 CFR 1910.136<br>29 CFR 1926.96 | ANSI Z41.1-1967 |

ANSI = American National Standards Institute

Both the respirator and cartridges specified for use in Level C protection must be fit-tested prior to use in accordance with OSHA regulations (29 CFR 1910.1025; 29 CFR 1910.134).

Based on performance criteria, APRs cannot be worn under the following conditions:

- Oxygen deficiency;

- IDLH concentrations;
- High relative humidity; and,
- If contaminant levels exceed designated use concentrations.

# 4.0 WORK ZONES AND DECONTAMINATION

## 4.1 Site Work Zones

Work zones will be established if hazardous materials are encountered.

### 4.1.1 Hot Zone

Hot zones will be established within a 25-foot radius around excavation areas, where possible. Barriers will be established at the perimeter of the excavation area where the perimeter is shared with an area accessible to the public. Unprotected onlookers should be 25 feet upwind of the activities. All personnel within the hot zone must don the appropriate levels of personal protection as set forth by the FSO. It is not anticipated that Level C or higher will be required for this Site.

All personnel within the hot zone will be required to use the specified level of protection. No food, drink, or smoking will be allowed in the hot or warm zones.

### 4.1.2 Warm Zone

A warm zone will be established and utilized during the field activities. This zone will be established between the hot zone and the cold zone (discussed below), and will include the personnel and equipment necessary for decontamination of equipment and personnel exiting the hot zone. Personnel and equipment in the hot zone must pass through this zone before entering the cold zone. This zone should always be upwind of the hot zone.

### 4.1.3 Cold Zone

The cold zone will include the remaining areas of the job site. Break areas and support facilities (includes equipment storage and maintenance areas) will be in this zone. No equipment or personnel will be permitted to enter the cold zone from the hot zone without passing through the decontamination station in the warm zone. Eating, smoking, and drinking will be allowed only in this area.

## 4.2 Decontamination

Generally, any water used in decontamination procedures will be placed in containers, temporarily stored on-site, and properly characterized and disposed.

### 4.2.1 Decontamination of Personnel

Decontamination of personnel will be necessary if Level C or B protection is used, which is not anticipated based on current knowledge of the site history. Decontamination will not be necessary if only Level D protection is used. However, disposable gloves and booties used during sampling activities should be removed and bagged; personnel should be encouraged to remove clothing and shower as soon as is practicable at the end of the day. All clothing should be machine-washed. All personnel will wash hands and face prior to eating and before and after using the restroom.

### 4.2.2 Decontamination of Field Equipment

Decontamination of field equipment will be necessary for all equipment in contact with contaminated materials. Decontamination activities shall be performed in a designated area lined with PE-sheeting that is designed to collect the decontamination rinsate.

## 4.3 Remedial Activity-Derived Waste

All PPE-related remedial activity-derived waste materials (PPE, decontamination waste) will be placed in labeled containers and appropriately disposed. Stockpiling of contaminated soil is not anticipated.

## 5.0 SAMPLE SHIPMENT

### 5.1 Non-Hazardous Samples

Samples collected in this study will be classified as environmental samples.

#### 5.1.1 Environmental Samples

In general, environmental samples that are collected from soils or wells are not expected to contain high (hazardous) levels of COCs.

Sample containers must have a completed sample identification tag and the outside container must be marked "Environmental Sample". The sample tag will be legibly written and completed with an indelible pencil or waterproof ink. The information will also be recorded in a log book. At a minimum, it will include:

- Exact location of sample;
- Time and date sample was collected;
- Name of sampler witnesses (if necessary);
- Project codes, sample station number, and identifying code (if applicable);
- Type of sample (if known);
- Laboratory number (if applicable); and,
- Any other pertinent information.

Environmental samples will be packaged and shipped according to the following procedure:

1. Place sample container, properly identified and with a sealed lid, in a PE-bag, and seal bag;
2. Place sample in a fiberboard container or metal picnic cooler which has been lined with a large PE-bag;
3. Pack cooler with ice to maintain temperature of 4 °C (39.2 °F);
4. Pack with enough noncombustible, absorbent, cushioning material to minimize the possibility of the container breaking;
5. Seal large bag; and,
6. Seal or close outside container.

The appropriate side of the container must be marked "This End Up" and arrows should be drawn accordingly. No Department of Transportation (DOT) marking labeling is required. No DOT shipping papers are required. There are no DOT restrictions on mode of transportation.

## 5.2 Hazardous Samples

Hazardous materials are not anticipated at the Site and samples are anticipated to be transported to the analytical laboratory via courier service. However, should hazardous materials be encountered in samples at the Site, the following procedures will be implemented. Personnel who must complete a Hazardous Goods Airway Bill must first be DOT trained and certified every 2 years. Drummed waste samples, tank samples, sludge samples, and grossly contaminated soil samples will be shipped as DOT Hazardous Materials. The designation "Flammable Liquid" or "Flammable Solid" will be used. The samples will be transported as follows:

1. Collect sample in a 16 oz or smaller glass or PE-container with nonmetallic Teflon-lined screw cap. Allow sufficient air space (approximately 10% by volume) so container is not liquid full at 54 °C (130 °F). If collecting a solid material, the container plus contents should not exceed 1 pound (lb) net weight. If sampling for volatile organic analysis, fill volatile organic analyte (VOA) container to septum but place the VOA container inside a 16 oz or smaller container so the required air space may be provided. Large quantities, up to 3.786 L (1 gallon), may be collected if the sample's flash point is 23 °C (75 °F) or higher. In this case, the flash point must be marked on the outside container (e.g., carton, cooler), and shipping papers should state that "Flash point is 73 °F (22.8 °C) or higher."
2. Seal sample and place in a 4-millimeter (mil) thick PE-bag, one sample per bag.
3. Place sealed bag inside a metal can with noncombustible, absorbent cushioning material (e.g., vermiculite or earth) to prevent breakage, one bag per can. Pressure-close the can and use clips, tape or other positive means to hold the lid securely.
4. Mark the can with:
    - Name and address of originator;
    - "Flammable Liquid N.O.S. UN 1993";
    - (or "Flammable Solid N.O.S. UN 1325); and,
    - NOTE: UN numbers are now required in proper shipping names.
5. Place one or more metal cans in a strong outside container such as a picnic cooler or fiberboard box. Preservatives are not used for hazardous waste site samples.
6. Prepare for shipping:

    "Flammable Liquid, N.O.S. UN 1993" or "Flammable Solid, N.O.S. UN 1325"; "Cargo Aircraft Only" (if more than 1 quart net per outside package); "Limited Quantity" or "Ltd. Qty."; "Laboratory Samples"; "Net Weight ___" or "Net Volume ___" (of hazardous contents) should be indicated on shipping papers and on outside of shipping container. "This Side Up" or "This End Up" should also be on container. Sign shipper certification.

7. Stand by for possible carrier requests to open outside containers for inspection or modify packaging. It is wise to contact carrier before packing to ascertain local packaging requirements and not to leave area before the carrier vehicle (aircraft, truck) is on its way. The International Air Transport Association's Dangerous Goods regulations will need to be followed for using FedEx for the shipment of hazardous samples.

### 5.2.1 Shipping Papers

A blank Langan shipping paper should be filled out and maintained within the driver's reach, whenever a Langan employee carries hazardous materials in a vehicle in quantities above those allowed for Materials of Trade (MOTs). Such materials may include more than 8 gallons of the following:

- Gasoline (for use in a generator) UN 1203, Guide #27;
- Methanol (for use in decontamination procedures) UN 1230, Guide #28;
- Nitric Acid (for use in decontamination procedures) UN 1760, Guide #60; and,
- Hydrochloric Acid (for use in decontamination procedures) UN 1789, Guide #60.

Other materials may include the following:

- > 220 lbs of compressed Gas (Air, Compressed) (calibration gas for the PID, or Grade D breathing air for Level B work) UN 1002, Class 2.2; and,
- Other hazardous materials as defined by the DOT.

Appropriate SDSs should be maintained with the shipping papers and/or the pocket DOT Emergency Response Guidebook.

# 6.0 ACCIDENT PREVENTION AND CONTINGENCY PLAN

## 6.1 Accident Prevention

### 6.1.1 Site-Specific Training

All field personnel will receive health and safety training prior to the initiation of any site activities. The Site-Specific Training Form provided in Attachment B must be signed, dated, and returned to the Langan FSO. On a day-to-day basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. Before daily work assignments, a regular meeting should be held. Discussion should include:

- Tasks to be performed;
- Time constraints (e.g., rest breaks, cartridge changes);
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals; and,
- Emergency procedures.

### 6.1.2 Vehicles and Heavy Equipment

Working with large motor vehicles and heavy equipment could be a major hazard at this Site. Injuries can result from equipment hitting or running over personnel, impacts from flying objects, or overturning of vehicles. Vehicle and heavy equipment design and operation will be in accordance with 29 CFR, Subpart O, 1926.600 through 1926.602. In particular, the following precautions will be utilized to help prevent injuries/accidents.

- Brakes, hydraulic lines, light signals, fire extinguishers, fluid levels, steering, tires, horn, and other safety devices will be checked at the beginning of each shift.
- Large construction motor vehicles will not be backed up unless:
    - The vehicle has a reverse signal alarm audible above the surrounding noise level; or,
    - The vehicle is backed up only when an observer signals that it is safe to do so.
- Heavy equipment or motor vehicle cable will be kept free of all nonessential items, and all loose items will be secured.
    - Large construction motor vehicles and heavy equipment will be provided with necessary safety equipment (such as seat belts, roll-over protection, emergency shut-off in case of roll-over, backup warning lights and audible alarms).

- Blades and buckets will be lowered to the ground and parking brakes will be set before shutting off any heavy equipment or vehicles.

## 6.2 Spill Control Plan

All personnel must take every precaution to minimize the potential for spills during site operations. Any spill shall be reported immediately to the FSO. Spill control apparatus (sorbent materials) will be on-site. All materials used for the cleanup of spills will be containerized and labeled separately from other wastes.

## 6.3 Contingency Plan

### 6.3.1 Emergency Procedures

In the event that an emergency develops on-site, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on-site.
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

General emergency procedures and specific procedures for personal injury, chemical exposure and radiation exposure, are described below.

### 6.3.2 Chemical Exposure

If a member of the field crew demonstrates symptoms of chemical exposure the procedures outlined below should be followed:

- Another team member (buddy) should remove the individual from the immediate area of contamination. The buddy should communicate to the Field Team Leader (via voice and hand signals) of the chemical exposure. The Field Team Leader should contact the appropriate emergency response agency;
- Precautions should be taken to avoid exposure of other individuals to the chemical;
- If the chemical is on the individual's clothing, the chemical should be neutralized or removed if it is safe to do so;
- If the chemical has contacted the skin, the skin should be washed with copious amounts of water;

- In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes; and/or,
- All chemical exposure incidents must be reported in writing to the Langan HSO. The FSO or Field Team Leader is responsible for completing the accident report.

### 6.3.3 Personal Injury

In case of personal injury at the Site, the following procedures should be followed:

- Another team member (buddy) should signal the Field Team Leader that an injury has occurred;
- A field team member trained in first aid can administer treatment to an injured worker;
- The victim should then be transported to the nearest hospital or medical center. If necessary, an ambulance should be called to transport the victim;
- For less severe cases, the individual can be taken to the site dispensary;
- The Field Team Leader or FSO is responsible for making certain that an Accident Report Form is completed. This form is to be submitted to the Langan HSO. Follow-up action should be taken to correct the situation that caused the accident; and/or,
- Any incident (near miss, property damage, first aid, medical treatment, etc.) must be reported.

A first-aid kit and blood-borne pathogens kit will be kept on-site during the field activities.

### 6.3.4 Evacuation Procedures

- The Field Team Leader will initiate evacuation procedures by signaling to leave the Site;
- All personnel in the work area should evacuate the area and meet in the common designated area;
- All personnel suspected to be in or near the contract work area should be accounted for and the whereabouts or missing persons determined immediately; and,
- The Field Team Leader will then give further instruction.

### 6.3.5 Procedures Implemented in the Event of a Major Fire, Explosion, or Emergency

- Notify the paramedics and/or fire department, as necessary;
- Signal the evacuation procedure previously outlined and implement the entire procedure;
- Isolate the area;
- Stay upwind of any fire;

- Keep the area surrounding the problem source clear after the incident occurs; and,
- Complete accident report for and distribute to appropriate personnel.

## 6.4 Community Air Monitoring Plan (CAMP)

Community air monitoring will be conducted in compliance with the Community Air Monitoring Plan (CAMP) outlined below.

Monitoring for total organic vapors (TOV) and particulates will be conducted during all ground intrusive activities (e.g., soil excavation and stockpiling). Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background concentrations. TOVs will be monitored at the downwind perimeter of the hot zone with a PID equipped with a 10.6 eV lamp. Monitoring equipment will be capable of calculating 15-minute running average concentrations.

The following actions will be taken based on TOV levels measured:

- If TOV levels exceed 5 ppm above background for the 15-minute average at the perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring;
- If TOV levels at the downwind perimeter of the hot zone persist at levels in excess of 5 ppm above 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 TOV level 200 feet downwind of the hot 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 above background for the 15-minute average; and/or,
- If the TOV level is above 25 ppm at the perimeter of the hot zone, activities will be shutdown.

The following actions will be taken based on visible dust emissions:

- 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 no visible dust is migrating from the work area;
- If, after implementation of dust suppression techniques, dust is still observed to be leaving the work area, work will be stopped and a re-evaluation of activities initiated. Work

will resume provided that dust suppression measures and other controls are successful in preventing visible dust migration; and/or,
- In order to minimize the generation of dust, water will be sprayed on any areas of the Site where dust could be generated.

### 6.4.1 Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the hot zone, boring, well installation, and test pit activities will be halted or vapor suppression controls will be employed, and monitoring continued. When work shut-down occurs, downwind air monitoring as directed by the FSO will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

If the organic vapor level decreases below 5 ppm above background, sampling and boring and well installation can resume, provided:

- The organic vapor level 200 feet downwind of the hot zone or half the distance to the nearest residential or commercial structure, whichever is less, is below 1 ppm over background; and,
- More frequent intervals of monitoring, as directed by the FSO, are conducted.

### 6.4.2 Major Vapor Emission

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work site, or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted or odor controls must be implemented.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the hot zone, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20-Foot Zone).

If either of the following criteria is exceeded in the 20-Foot Zone, then the Major Vapor Emission Response Plan shall automatically be implemented.

- Sustained organic vapor levels approaching 5 ppm above background for a period of more than 30 minutes; and/or,
- Organic vapor levels greater than 5 ppm above background for any time period.

### 6.4.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

1. The local police authorities will immediately be contacted by the FSO and advised of the situation;
2. Frequent air monitoring will be conducted at 30 minute intervals within the 20-Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the FSO; and,
3. All emergency contacts will go into effect as appropriate.

## 6.5 Documentation

For emergencies involving personnel injury and/or exposure, the FSO will complete and submit the Accident Report Form within 48 hours of the incident. The form is attached in Attachment B.

# ATTACHMENT A

## Air Monitoring Equipment Calibration and Maintenance

All monitoring instruments must be calibrated and maintained in accordance with the manufacturer's manual. Calibration and on-site maintenance records will be kept in the field log book. The operator must understand the limitations and possible sources of error for each instrument. It is important that the operator checks that the instrument responds properly to the substances it was designed to monitor. Air quality monitoring equipment, including photoionization detectors (PIDs) must be calibrated at least once each day. The specific instructions for calibration and maintenance provided for each instrument should be followed.

# ATTACHMENT B

## Forms for Health and Safety Related Activity

Note: The Occupational Safety and Health Administration (OSHA) Job Safety and Health Protection Poster must be posted prominently during field activities. The following page is an example of the poster to be used in the field. The actual poster must be an 11-inch x 17-inch size version of this page. The OSHA 300 Log of injuries and illnesses is maintained in the home office of each Langan employee.

# You Have a Right to a Safe and Healthful Workplace.

# IT'S THE LAW!

- You have the right to notify your employer or OSHA about workplace hazards. You may ask OSHA to keep your name confidential.
- You have the right to request an OSHA inspection if you believe that there are unsafe and unhealthful conditions in your workplace. You or your representative may participate in the inspection.
- You can file a complaint with OSHA within 30 days of discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act.*
- You have a right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violation.
- Your employer must correct workplace hazards by the date indicated on the citation and must certify that these hazards have been reduced or eliminated.
- You have the right to copies of your medical records or records of your exposure to toxic and harmful substances or conditions.
- Your employer must post this notice in your workplace.

The *Occupational Safety and Health Act of 1970 (OSH Act),* P.L. 91-596, assures safe and healthful working conditions for working men and women throughout the Nation. The Occupational Safety and Health Administration, in the U.S. Department of Labor, has the primary responsibility for administering the *OSH Act.* The rights listed here may vary depending on the particular circumstances. To file a complaint, report an emergency, or seek OSHA advice, assistance, or products, call 1-800-321-OSHA or your nearest OSHA office: • Atlanta (404) 562-2300 • Boston (617) 565-9860 • Chicago (312) 353-2220 • Dallas (214) 767-4731 • Denver (303) 844-1600 • Kansas City (816) 426-5861 • New York (212) 337-2378 • Philadelphia (215) 861-4900 • San Francisco (415) 975-4310 • Seattle (206) 553-5930. Teletypewriter (TTY) number is 1-877-889-5627. To file a complaint online or obtain more information on OSHA federal and state programs, visit OSHA's website at **www.osha.gov**. If your workplace is in a state operating under an OSHA-approved plan, your employer must post the required state equivalent of this poster.

## 1-800-321-OSHA

## www.osha.gov

**U.S. Department of Labor** • **Occupational Safety and Health Administration** • **OSHA 3165**

**LANGAN** **ACCIDENT REPORT FORM**



Project Name:_____

**Injured or Ill Employee**

1. Name _____ Social Security #_____
   (First) (Middle) (Last)
2. Home Address _____
   (No. and Street) (City or Town) (State and Zip)
3. Age _____ 4. Sex: Male ( ) Female ( )
5. Occupation _____
   (Specific job title, not the specific activity employee was performing at time of injury)
6. Department _____
   (Enter name of department in which injured person is employed, even though they may have been temporarily working in another department at the time of injury)

**Employer**

7. Name _____
8. Mailing Address _____
   (No. and Street) (City or Town) (State and Zip)
9. Location (if different from mailing address):_____
   _____

**The Accident or Exposure to Occupational Illness**

10. Place of accident or exposure _____
    (No. and Street) (City or Town) (State and Zip)
11. Was place of accident or exposure on employer's premises? _____(Yes/No)
12. What was the employee doing when injured?_____
    _____
    (Be specific - was employee using tools or equipment or handling material?)
    _____
13. How did the accident occur? _____
    _____
    _____
    (Describe fully the events that resulted in the injury or occupational illness. Tell what happened and how. Name objects and substances involved Give details on all factors that led to accident. Use separate sheet if needed)
14. Time of accident: _____
15. Date of injury or initial diagnosis of occupational illness _____

16. WITNESS TO ACCIDENT

| (Name) | (Affiliation) | (Phone No.) |
|---|---|---|
| (Name) | (Affiliation) | (Phone No.) |
| (Name) | (Affiliation) | (Phone No.) |

**Occupational Injury or Occupational Illness**

17. Describe the injury or illness in detail; indicate part of body affected.

18. Name the object or substance that directly injured the employee. (For example, object that struck employee; the vapor or poison inhaled or swallowed; the chemical or radiation that irritated the skin; or in cases of strains, hernias, etc., the object the employee was lifting, pulling, etc.)

19. Did the accident result in employee fatality? _____ (Yes or No)
20. Number of lost workdays ____/restricted workdays _____ resulting from injury or illness?

**Other**

21. Did you see a physician for treatment? _____ (Yes or No) _____ (Date)
22. Name and address of physician _____

(No. and Street) (City or Town) (State and Zip)

23. If hospitalized, name and address of hospital _____

(No. and Street) (City or Town) (State and Zip)

Date of report _____ Prepared by _____

Official position _____

**Project Health and Safety Plan and Work plan Acceptance Form**

**(For Langan employees only)**

I have read and agree to abide by the contents of the Work Plan and Health and Safety Plan for the following project:

| | |
|---|---|
| (Project Title) | (Project Number) |

Furthermore, I have read and am familiar with the work plan or proposal that describes the field work to be conducted and the procedures to be utilized in the conduct of this work.

| Name (print) | Signature | Date |
|---|---|---|
| | | |
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| | | |

Place in project Health and Safety File as soon as possible

**Site-Specific Health and Safety Training**

(For all Langan and subcontract employees on Site)

I hereby confirm that site-specific health and safety training has been conducted by the site health and safety officer that included:

- Names of personnel responsible for site safety and health
- Safety, health, and other hazards at the Site
- Proper use of personal protective equipment (PPE)
- Work practices by which the employee can minimize risk from hazards
- Safe use of engineering controls and equipment on the Site
- Acute effects of compounds at the Site
- Decontamination procedures

For the following project:

| _____ | _____ |
|---|---|
| (Project Title) | (Project Number) |

| Name (print) | Signature | Date |
|---|---|---|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

Place in project Health and Safety File as soon as possible

# ATTACHMENT C
## Safety Data Sheets
**(Provided on CD)**

- Arsenic (As)
- Benzene
- n-Butylbenzene
- Sec-butylbenzene
- Beryllium (Be)
- Chromium (Cr)
- Copper (Cu)
- Ethylbenzene
- Iron (Fe)
- Isopropylbenzene
- Lead (Pb)
- Magnesium (Mg)
- Mercury (Hg)
- Nickel (Ni)
- n-Propylbenzene
- Toluene
- Xylenes (total)
- Zinc (Zn)

# ATTACHMENT D

## Standard Safe Work Practices

1) Eating, drinking, chewing tobacco, smoking and carrying matches or lighters is prohibited in a contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.
2) Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surfaces (i.e., ground, etc.).
3) All field crew members should make use of their senses to alert them to potentially dangerous situations in which they should not become involved; i.e., presence of strong and irritating or nauseating odors.
4) Prevent, to the extent possible, spills. In the event that a spillage occurs, contain liquid if possible.
5) Field crew members shall be familiar with the physical characteristics of investigations, including:
    - Wind direction
    - Accessibility to associates, equipment, vehicles
    - Communication
    - Hot zone (areas of known or suspected contamination)
    - Site access
    - Nearest water sources
6) All wastes generated during activities on-site should be disposed of as directed by the project manager or his on-site representative.
7) Protective equipment as specified in the section on personnel protection will be utilized by workers during the initial site reconnaissance, and other activities.

Employees shall follow procedures to avoid at-risk behaviors that could result in an incident.

# APPENDIX C
# QUALITY ASSURANCE PROJECT PLAN (QAPP)

# APPENDIX C
# QUALITY ASSURANCE PROJECT PLAN (QAPP)

# for

## Kings Plaza Shopping Center
## 5102, 5120, & 5502 Avenue U
## Brooklyn, Kings County, New York

## NYSDEC Spill No. 98-15289

***Prepared For:***

**Brooklyn Kings Plaza LLC**
**5120 Avenue U**
**Brooklyn, New York 11234**

***Prepared By:***

**Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.**
**21 Penn Plaza**
**360 West 31st Street, 8th Floor**
**New York, New York 10001**

**Jamie P. Barr, L.E.P.**
**Senior Associate/Vice President**

**March 2019**
**Langan Project No.: 140080107**

## TABLE OF CONTENTS

## LIST OF FIGURES



## ATTACHMENTS

# 1.0 PROJECT DESCRIPTION

## 1.1. Introduction and Site Description

This Quality Assurance Project Plan (QAPP) was prepared on behalf of Brooklyn Kings Plaza LLC for the former Standard Oil parcel (also known as operable unit [OU]-3) at 5102, 5120, and 5502 Avenue U in Brooklyn, New York (hereinafter referred to as the "Site"). This QAPP supports the Groundwater Remediation Work Plan, which provides additional site information and data collected previously by Langan.

This QAPP specifies the sampling procedures to be followed and the analytical methods to be used to ensure that data from the proposed investigation at the Site are precise, accurate, representative, comparable, and complete.

The Site occupies an approximately 5.9-acre area and is improved with a 1-story Lowe's Home Improvement store (Lowe's) with an associated asphalt parking lot. The Lowe's lot is at 5502 Avenue U (Block 8470, Lot 114) and bounded by Avenue U to the northwest, an adjacent shopping center (Block 8470, Lot 130) to the northeast, the Mill Basin to the southeast, and East 55$^{th}$ Street to the southwest.

## 1.2. Project Objectives

The main objective of the Groundwater Remediation Work Plan is to reduce benzene, toluene, ethylbenzene, and xylene (BTEX) and total volatile organic compound (VOC) concentrations at MW-52 to levels appropriate for natural attenuation.

## 1.3. Scope of Work

The scope of work is described in detail in the Groundwater Remediation Work Plan. The Groundwater Remediation Work Plan scope consists of two phases: Phase One will consist of vacuum-enhanced fluid recovery (VEFR). If Phase One is unsuccessful, Phase Two will consist of a sulfate injection program (to be designed following completion of Phase One and a bench scale test). Langan will proceed with the proposed Phase One remediation plan upon receiving written approval from New York State Department of Conservation (NYSDEC) if they agree with the phased approach.

## 1.4. Data Quality Objectives and Processes

Data quality objectives (DQOs) are qualitative and quantitative statements to help ensure that data of known and appropriate quality are obtained during the project. DQOs for sampling activities are determined by evaluating five factors:

- Data Needs and Uses: The types of data required and how the data will be used after it is obtained.
- Parameters of Interest: The types of chemical or physical parameters required for the intended use.
- Level of Concern: Levels of constituents, which may require remedial actions or further investigations.
- Required Analytical Level: The level of data quality, data precision, and quality assurance/quality control (QA/QC) documentation required for chemical analysis.
- Required Detection Limits: The detection limits necessary based on the above information.

The QA/QC objectives for all measurement data include:

- **Precision** – an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Field sampling precision will be determined by analyzing coded duplicate samples and analytical precision will be determined by analyzing internal QC duplicates and matrix spike duplicates.
- **Accuracy** – a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern. Sampling accuracy will be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy will be assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), internal standards, laboratory method blanks, instrument calibration, and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks. For soil vapor or air samples, analytical accuracy will be assessed by examining the percent recoveries that are added to each sample, internal standards, laboratory method blanks, and instrument calibration.
- **Representativeness** – expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is dependent upon the adequate design of the sampling program and will be satisfied by ensuring that the scope of work is followed and that specified sampling and analysis techniques are used. Representativeness in the laboratory is ensured by compliance to nationally-recognized analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory's possession. This is accomplished by following all applicable methods, laboratory-issued standard operating procedures (SOPs), the laboratory's Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.

- **Completeness** – the percentage of measurements made which are judged to be valid. Completeness will be assessed through data validation. The QC objective for completeness is generation of valid data for at least 90% of the analyses requested.
- **Comparability** – expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured using several procedures, including standard methods for sampling and analysis, instrument calibrations, using standard reporting units and reporting formats, and data validation.
- **Sensitivity** – the ability of the instrument or method to detect target analytes at the levels of interest. The project manager will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection.

Each of the above objectives is discussed in detail in Section 3.

## 2.0 PROJECT ORGANIZATION

Site management will be overseen by Langan on behalf of Brooklyn Kings Plaza LLC. Langan will oversee the requirements of the Groundwater Remediation Work Plan as approved by the NYSDEC. The analytical services will be performed by York Analytical Laboratories, Inc. (York) of Stratford, Connecticut, New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certification #10854.

Key contacts for this project are as follows:

| | |
|---|---|
| Brooklyn Kings Plaza LLC:<br>Site Owner | Mr. Aladdin Ghafari, VP Environmental<br>Telephone: (310) 899-6387<br>Email: Aladdin.ghafari@macerich.com |
| Langan Project Director:<br>Consults on project elements and reviews reports prior to submittal to NYSDEC | Mr. Jamie P. Barr, L.E.P.<br>Telephone: (917) 882-5428<br>Email: jbarr@langan.com |
| Langan Program/Project Manager:<br>Manages the investigation on a day-to-day basis and coordinates report deliverables | Mr. David Granucci<br>Telephone: (203) 784-3052<br>Email: rwohlstrom@langan.com |
| Langan Project Executive/Quality Assurance<br>Reviews reports prior to submittal to NYSDEC | Mr. Stewart Abrams, P.E.<br>Telephone: (609) 282-8017<br>Email: sabrams@langan.com |
| Langan Field Safety Officer<br>Manages and inspects field equipment, responsible for decontamination procedures | Ms. Hannah Griesbach<br>Telephone: (203) 800-1232<br>Email: hgriesbach@langan.com |
| Langan Field Team Leader<br>Executes work plan, and documents field activities and sample collection | Mr. David Granucci<br>Telephone: (203) 710-4448<br>Email: dgranucci@langan.com |
| Laboratory Contractor (York):<br>Analyze project samples and provides NYSDEC category ASP B deliverables | Mr. Rich August<br>Telephone: (203) 598-9829<br>Email: raugust@yorklab.com |
| Quality Assurance Officer (QAO)<br>Coordinates with laboratory and reviews and interprets lab results and Data Usability Summary Reports (DUSR) | Emily Strake, Langan<br>Telephone: (215) 491-6526<br>Email: estrake@langan.com |

Resumes of key contacts and laboratory statement of qualifications are provided in Attachment A.

# 3.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OBJECTIVES FOR MEASUREMENT OF DATA

The QA/QC objectives for all measurement data include precision, accuracy, representativeness, completeness, comparability, and sensitivity. These objectives are defined in following subsections. Variances from the QA objectives at any stage of the investigation will result in the implementation of appropriate corrective measures and an assessment of the impact of corrective measures on the usability of the data.

## 3.1. Precision

Precision is a measure of the degree to which two or more measurements are in agreement. Field precision is assessed through the collection and measurement of field duplicates. Laboratory precision and sample heterogeneity also contribute to the uncertainty of field duplicate measurements. This uncertainty is taken into account during the data assessment process. For field duplicates, results less than 2x the reporting limit (RL) meet the precision criteria if the absolute difference is less than ±2x the RL. For results greater than 2x the RL, the acceptance criteria is a relative percent difference (RPD) of $\leq$ 50% (soil and canister air), and < 30% (groundwater). RLs and method detection limits (MDLs) are provided in Attachment B.

## 3.2. Accuracy

Accuracy is the measurement of the reproducibility of the sampling and analytical methodology. It should be noted that precise data may not be accurate data. For the purpose of this QAPP, bias is defined as the constant or systematic distortion of a measurement process, which manifests itself as a persistent positive or negative deviation from the known or true value. This may be due to (but not limited to) improper sample collection, sample matrix, poorly calibrated analytical or sampling equipment, or limitations or errors in analytical methods and techniques.

Accuracy in the field is assessed through the use of field blanks and through compliance to all sample handling, preservation, and holding time requirements. All field blanks should be non-detect (ND) when analyzed by the laboratory. Any contaminant detected in an associated field blank will be evaluated against laboratory blanks (preparation or method) and evaluated against field samples collected on the same day to determine potential for bias. Trip blanks are not required for non-aqueous matrices but are planned for non-aqueous matrices where high concentrations of VOCs are anticipated.

Laboratory accuracy is assessed by evaluating the percent recoveries of matrix spike/matrix spike duplicate (MS/MSD) samples, laboratory control samples (LCS), surrogate compound recoveries, and the results of method preparation blanks. MS/MSD, LCS, and surrogate percent recoveries will be compared to either method-specific control limits or laboratory-derived control limits.

Sample volume permitting, samples displaying outliers should be reanalyzed. All associated method blanks should be ND when analyzed by the laboratory.

### 3.3. Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. Representativeness is dependent upon the adequate design of the sampling program and will be satisfied by ensuring that the scope of work is followed and that specified sampling and analysis techniques are used. This is performed by following applicable SOPs and this QAPP. All field technicians will be given copies of appropriate documents prior to sampling events and are required to read, understand, and follow each document as it pertains to the tasks at hand.

Representativeness in the laboratory is ensured by compliance to nationally-recognized analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory's possession. This is performed by following all applicable analytical methods, laboratory-issued SOPs, the laboratory's QA Manual, and this QAPP. The laboratory is required to be properly certified and accredited.

### 3.4. Completeness

Laboratory completeness is the ratio of the total number of samples analyzed and verified as acceptable compared to the number of samples submitted to the fixed-base laboratory for analysis, expressed as a percent. Three measures of completeness are defined:

- Sampling completeness, defined as the number of valid samples collected relative to the number of samples planned for collection;
- Analytical completeness, defined as the number of valid sample measurements relative to the number of valid samples collected; and,
- Overall completeness, defined as the number of valid sample measurements relative to the number of samples planned for collection.

Air, soil vapor, soil, and groundwater data will meet a 90% completeness criterion. If the criterion is not met, sample results will be evaluated for trends in rejected and unusable data. The effect of unusable data required for a determination of compliance will also be evaluated.

### 3.5. Comparability

Comparability expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Requiring traceability of all analytical standards and/or source materials to the United States Environmental Protection Agency (USEPA) or National Institute of Standards and Technology (NIST);
- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable);
- Using standard reporting units and reporting formats including the reporting of QC data;
- Performing a complete data validation on a representative fraction of the analytical results, including the use of data qualifiers in all cases where appropriate; and,
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

### 3.6. Sensitivity

Sensitivity is the ability of the instrument or method to detect target analytes at the levels of interest. The project director will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection and QC acceptance limits that meet established performance criteria. Concurrently, the project director will select the level of data assessment to ensure that only data meeting the project DQOs are used in decision-making.

Field equipment will be used that can achieve the required levels of detection for analytical measurements in the field. In addition, the field sampling staff will collect and submit full volumes of samples as required by the laboratory for analysis, whenever possible. Full volume aliquots will help ensure achievement of the required limits of detection and allow for reanalysis if necessary. The concentration of the lowest level check standard in a multi-point calibration curve will represent the reporting limit.

Analytical methods and QA parameters associated with the sampling program are presented in Attachment C. The frequency of associated field blanks and duplicate samples will be based on the recommendations listed in the Division of Environmental Remediation (DER)-10, and as described in Section 5.3.

Site-specific MS/MSD samples will be prepared and analyzed by the analytical laboratory by spiking an aliquot of submitted sample volume with analytes of interest. Additional sample volume is not required by the laboratory for this purpose. An MS/MSD analysis will be analyzed

at a rate of one out of every 20 samples, or one per analytical batch. MS/MSD samples are only required for soil and groundwater samples.

# 4.0 SAMPLING PROGRAM QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

## 4.1. Introduction

The monitoring program describes the measures for evaluating the overall performance and effectiveness of the remedy. This section presents sample container preparation procedures, sample preservation procedures, sample holding times, and field QC sample requirements. The sampling will be conducted as described in the Groundwater Remediation Work Plan.

## 4.2. Sample Container Preparation and Sample Preservation

Sample containers will be properly washed and decontaminated prior to their use by either the analytical laboratory or the container vendor to the specifications required by the USEPA. Copies of the sample container QC analyses will be provided by the laboratory for each container lot used to obtain samples. The containers will be labeled and the appropriate preservatives will be added. The types of containers are shown in Attachment C.

Soil samples from borings will be collected from dedicated acetate or polyvinylchloride liners extracted from a decontaminated Macro-Core® barrel. Non-disposable, down-hole drilling equipment and sampling apparatus will be decontaminated between locations with Alconox and water. Soil samples from end points will be collected either by hand or from polystyrene certified sterile sampling scoops from excavated sidewalls and excavated bases. When handling soil samples, field personnel will wear nitrile gloves that will be replaced after each sample.

Groundwater samples will be collected in general accordance with the USEPA's Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. After well development, groundwater samples will be collected with a submersible pump and/or dedicated polyethylene tubing after physical and chemical parameters (e.g., temperature, dissolved oxygen, oxygen reduction potential, turbidity) stabilize. If one is necessary, the pump will be decontaminated with Alconox and water between wells. Field personnel will wear nitrile gloves while collecting and handling groundwater samples.

Groundwater sampling for per- and poly-fluoroalkyl substances (PFAS) will be collected in accordance with EPA Method 537 Field Sampling Guidelines. PFAS samples will be collected first in High Density Polyethylene (HDPE)/polypropylene containers using sampling equipment either made with stainless steel, HDPE, or polypropylene. Food and beverages will be prohibited near the sampling equipment. Additionally, no cosmetics, moisturizers, hand cream, sun screen or clothing materials containing Gore-Tex™ or Tyvek® will be worn during sampling.

Samples shall be preserved according to the preservation techniques given in Attachment C. Preservatives will be added to the sample bottles by the laboratory prior to their shipment in

sufficient quantities to ensure that proper sample pH is met. Following sample collection, the sample bottles should be placed on ice in the shipping cooler, cooled to 4 °C with ice or "blue ice", and delivered to the laboratory within 48 hours of collection. Blue ice will not be used to cool PFAS samples. Chain-of-custody (COC) procedures are described in Section 5.

### 4.3. Special Considerations for Per- and Poly-fluoroalkyl Substance (PFAS) Sample Collection

The following special considerations apply to the collection of groundwater samples for PFAS analysis to prevent cross-contamination:

- Field equipment will not contain Teflon®
- All sampling material will be made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books will be used
- No plastic clipboards, binders, or spiral hard cover notebooks will be used
- No adhesives will be used
- No sharpies or permanent markers will be used; ball point pens are acceptable
- Aluminum foil will not be used
- PFAS samples will be kept in a separate cooler from other sampling containers
- Coolers will be filled only with regular ice

PFAS compound sampling protocol is provided in Attachment D.

### 4.4. Per- and Poly-fluoroalkyl Substance (PFAS) Target Analyte List

DER has developed a PFAS target analyte list. At a minimum, the laboratory will report the following PFAS target compounds:

| Group | Analyte Name | Abbreviation | CAS # |
|---|---|---|---|
| Perfluoroalkyl Carboxylates | Perfluorobutanoic acid | PFBA | 375-22-4 |
| | Perfluoropentanoic acid | PFPeA | 2706-90-3 |
| | Perfluorohexanoic acid | PFHxA | 307-24-4 |
| | Perfluoroheptanoic acid | PFHpA | 375-85-9 |
| | Perfluorooctanoic acid | PFOA | 335-67-1 |
| | Perfluorononanoic acid | PFNA | 375-95-1 |
| | Perfluorodecanoic acid | PFDA | 335-76-2 |

| Group | Analyte Name | Abbreviation | CAS # |
|---|---|---|---|
| Perfluoroalkyl carboxylates | Perfluoroundecanoic acid | PFUA/PFUdA | 2058-94-8 |
| | Perfluorododecanoic acid | PFDoA | 307-55-1 |
| | Perfluorotridecanoic acid | PFTriA/PFTrDA | 72629-94-8 |
| | Perfluorotetradecanoic acid | PFTA/PFTeDA | 376-06-7 |
| Perfluoroalkyl sulfonates | Perfluorobutanesulfonic acid | PFBS | 375-73-5 |
| | Perfluorohexanesulfonic acid | PFHxS | 355-46-4 |
| | Perfluoroheptanesulfonic acid | PFHpS | 375-92-8 |
| | Perfluorooctanessulfonic acid | PFOS | 1763-23-1 |
| | Perfluorodecanesulfonic acid | PFDS | 335-77-3 |
| Fluorinated Telomer Sulfonates | 6:2 Fluorotelomer sulfonate | 6:2 FTS | 27619-97-2 |
| | 8:2 Fluorotelomer sulfonate | 8:2 FTS | 39108-34-4 |
| Perfluorooctane-sulfonamides | Perfluroroctanesulfonamide | FOSA | 754-91-6 |
| Perfluorooctane-sulfonamidoacetic acids | N-methyl perfluorooctanesulfonamidoacetic acid | N-MeFOSAA | 2355-31-9 |
| | N-ethyl perfluorooctanesulfonamidoacetic acid | N-EtFOSAA | 2991-50-6 |

### 4.5. Sample Holding Times

The sample holding times for organic and inorganic parameters are given in Attachment C and must be in accordance with the NYSDEC Analytical Services Protocol (ASP) requirements. The NYSDEC ASP holding times must be strictly adhered to by the laboratory. Any holding time exceedances will be reported to Langan.

### 4.6. Field Quality Control (QC) Samples

To assess field sampling and decontamination performance, two types of "blanks" will be collected and submitted to the laboratory for analyses. In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates and MS/MSDs. The blanks will include:

a. Trip Blanks – A trip blank will be prepared before the sample containers are sent by the laboratory. The trip blank will consist of a 40-milliter (mL) volatile organic analyte (VOA) vial containing distilled, deionized (DI) water, which accompanies the other water sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of samples for Part 375 volatiles analysis to assess any contamination from sampling and transport, and internal laboratory procedures.
b. Field Blanks – Field blanks will be taken at a minimum frequency of one per 20 field samples of soil and groundwater. Field blanks are used to determine the effectiveness of the decontamination procedures for sampling equipment. The field blank will consist of a sample of PFAS-free, DI, distilled water provided by the laboratory that has passed through a decontaminated bailer, tubing, or other sampling apparatus. It is usually collected as a last step in the decontamination procedure, prior to taking an environmental sample. The field blank may be analyzed for all or some of the parameters of interest.
c. Coded Field Duplicate – To determine the representativeness of the sampling methods, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise.
d. MS/MSDs – MS/MSD samples (MS/MSD for organics; MS and laboratory duplicate for inorganics) will be taken at a frequency of one pair per 20 field samples (groundwater). These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes. The percent recoveries and RPDs are given in Tables 1 and 2.

# 5.0 SAMPLE TRACKING AND CUSTODY

## 5.1. Introduction

This section presents sample custody procedures for both the field and laboratory. Implementation of proper custody procedures for samples generated in the field is the responsibility of field personnel. Both laboratory and field personnel involved in the COC and transfer of samples will be trained as to the purpose and procedures prior to implementation.

Evidence of sample traceability and integrity is provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 1. A sample is considered to be in a person's custody if the sample is:

- In a person's possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with Custody Seals so that no one can tamper with it after having been in physical custody; or,
- In a secured area which is restricted to authorized personnel.

## 5.2. Field Sample Custody

A COC record (Figure 2) accompanies the sample containers from selection and preparation at the laboratory, during shipment to the field for sample containment and preservation, and during return to the laboratory. Duplicate copies of the COC must be completed for each sample set collected.

The COC lists the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The COC also lists a unique description of every sample bottle in the set. If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample.

The REMARKS space on the COC is used to indicate if the sample is a MS/MSD or any other sample information for the laboratory. Since they are not specific to any one sample point, trip and field blanks are indicated on separate rows. Once all bottles are properly accounted for on the form, a sampler will write his or her signature and the date and time on the first RELINQUISHED BY space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper air bill number on the top of the COC. Mistakes will be crossed out with a single line in ink and initialed by the author.

One copy of the COC is retained by sampling personnel (notations identifying blind duplicate samples will be added to this copy of the COC but not the others that will go to the laboratory) and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the samples signs their name across the seal. The seal is taped, and the cooler is wrapped tightly with clear packing tape. It is then relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier. The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the project manager, and the samples will not be analyzed.

**FIGURE 1**
**SAMPLE CUSTODY**

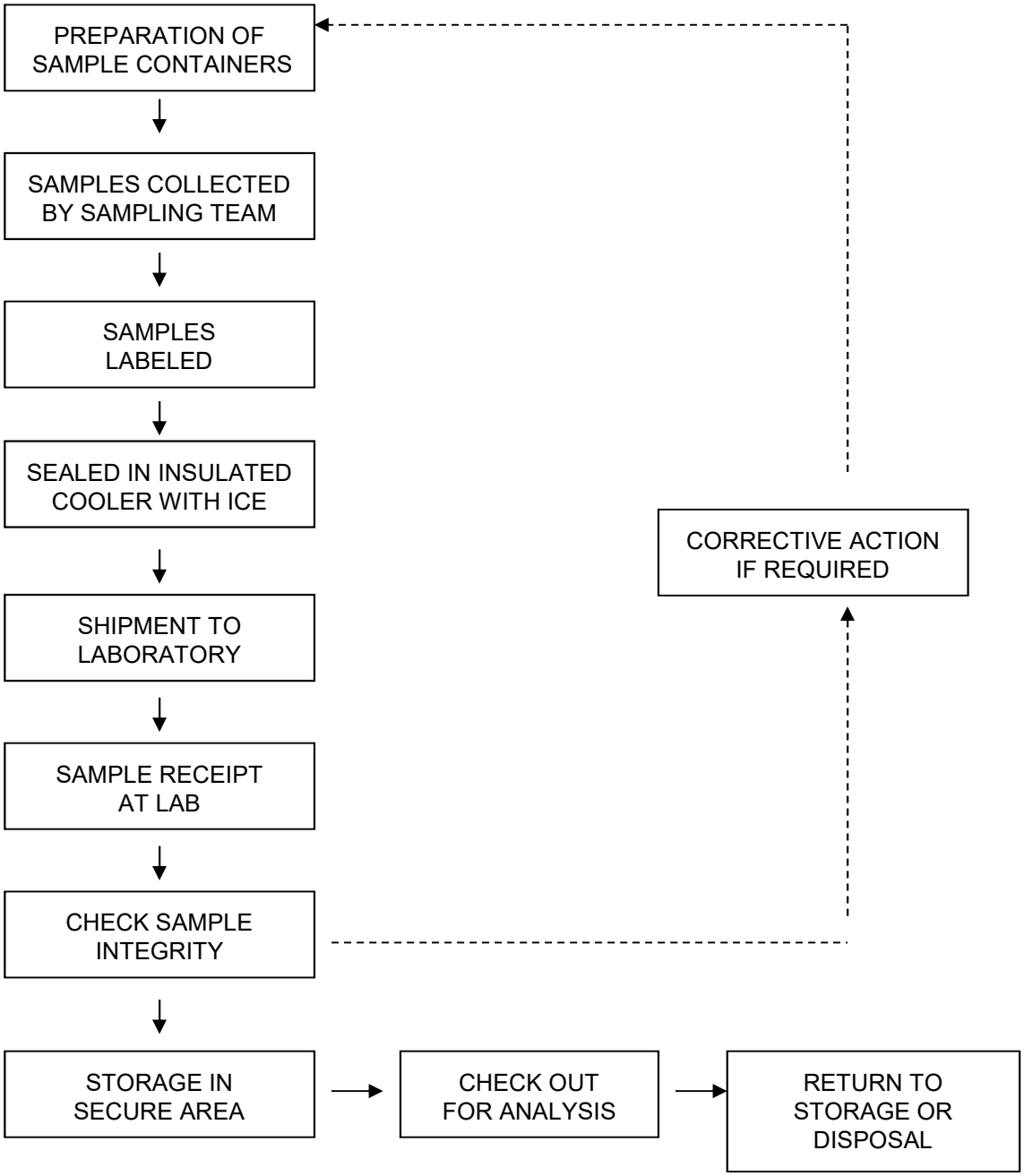

**FIGURE 2**
**CHAIN-OF-CUSTODY RECORD**

Langan
Engineering and Environmental Services

## CHAIN OF CUSTODY RECORD / ANALYSIS REQUEST

PAGE ____ OF ____

Proj. Name: | Proj. No:
Auth. By:
Site Location: | Phone No:
Sampled By:
Company:

| Sample Number | Location | Depth | Date | Time | Matrix | Grab Comp. | Inorg/PHC Preserve. | No. of Cont. | ANALYSIS REQUESTED | | | | | | | | | | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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Metals Filtered (Yes/No)? _____ Total No. of Containers: _____
Aq. VOAs Pres. (Yes/No)? _____
Rush T/A, Report format, Contingent analysis: _____

| | Relinquished By: | DATE: | Received By: |
|---|---|---|---|
| (1) | Company: | TIME: | Company: |
| (2) | Relinquished By: | DATE: | Received By: |
| | Company: | TIME: | Company: |
| (3) | Relinquished By: | DATE: | Received By: |
| | Company: | TIME: | Company |
| (4) | Relinquished By: | DATE: | Received By: |
| | Company: | TIME: | Company |

Laboratory Name & Address: _____

## 5.3. Laboratory Sample Custody

The project manager or Field Team Leader will notify the laboratory of upcoming field sampling activities, and the subsequent shipment of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The following laboratory sample custody procedures will be used:

- The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check cooler temperature, check the original COC documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record and record the date and time received.
- Care will be exercised to annotate any labeling or descriptive errors. In the event of discrepant documentation, the laboratory will immediately contact the project manager or Field Team Leader as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming COC procedure.
- The samples will be stored in a secured area at a temperature of approximately 4 °C until analyses commence.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control.
- A copy of the tracking record will accompany the laboratory report and will become a permanent part of the project records.

## 6.0 FIELD INSTRUMENT CALIBRATION AND MAINTENANCE

A photoionization detector (PID) will be used during the sampling activities to evaluate work zone action levels, collect pre- and post-sample readings for air samples, screen soil samples, and collect monitoring well headspace readings. Field calibration and/or field checking of the PID will be the responsibility of the field team leader and the site Health Safety Officer (HSO), and will be accomplished by following the procedures outlined in the operating manual for the instrument. At a minimum, field calibration and/or field equipment checking will be performed once daily prior to use. Field calibration will be documented in the field notebook. Entries made into the logbook regarding the status of field equipment will include the following information:

- Date and time of calibration
- Type of equipment serviced and identification number (such as serial number)
- Reference standard used for calibration
- Calibration and/or maintenance procedure used
- Other pertinent information

A water quality meter (YSI 6820 or similar) will be used during purging of groundwater to measure pH, specific conductance, temperature, dissolved oxygen (DO), turbidity, and oxidation-reduction potential (ORP) every 5 minutes. A portable turbidity meter (LaMotte or similar) may also be used to measure turbidity. Water-quality meters will be calibrated and certified by the equipment rental company prior to field use. Standardized field calibration procedures and calibration checks will be performed as necessary and the results documented each time.

Equipment that fails calibration or becomes inoperable during use will be removed from service and segregated to prevent inadvertent utilization. The equipment will be properly tagged to indicate that it is out of calibration. Such equipment will be repaired and recalibrated to the manufacturer's specifications by qualified personnel. Equipment that cannot be repaired will be replaced.

Off-site calibration and maintenance of field instruments will be conducted as appropriate throughout the duration of project activities. All field instrumentation, sampling equipment and accessories will be maintained in accordance with the manufacturer's recommendations and specifications and established field equipment practice. Off-site calibration and maintenance will be performed by qualified personnel. A logbook will be kept to document that established calibration and maintenance procedures have been followed. Documentation will include both scheduled and unscheduled maintenance.

# 7.0 DATA REDUCTION, VALIDATION, AND REPORTING

## 7.1. Introduction

Data collected during the monitoring will be reduced and reviewed by the laboratory QA personnel, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the USEPA SW-846 and subsequent updates. The data package provided by the laboratory will contain all items specified in the analytical methodology (Attachment C) appropriate for the analyses to be performed, and be reported in standard format.

The completed copies of the COC records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

## 7.2. Data Reduction

The ASP Category B data packages and an electronic data deliverable (EDD) will be provided by the laboratory after receipt of a complete sample delivery group. The project manager will immediately arrange for archiving the results and preparation of result tables. These tables will form the database for assessment of the site contamination condition.

Each EDD must be formatted using a Microsoft Windows operating system and the NYSDEC data deliverable format for the Environmental Quality Information System (EQuIS). To avoid transcription errors, data will be loaded directly into the American Standard Code for Information Interchange (ASCII) format from the laboratory information management system (LIMS). If this cannot be accomplished, Langan should be notified via letter of transmittal indicating that manual entry of data is required for a particular method of analysis. All EDDs must also undergo a QC check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

The project associate or project manager will maintain close contact with the QA reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA review has been completed, the project manager may direct the team leaders or others to initiate and finalize the analytical data assessment.

## 7.3. Data Validation

Data validation will be performed in accordance with the USEPA validation guidelines for organic and inorganic data review. Validation will include the following:

- Verification of QC sample results;
- Verification of the identification of sample results (both positive hits and NDs);
- Recalculation of 10% of all investigative sample results; and,
- Preparation of DUSRs.

A DUSR will be prepared and reviewed by the QAO before issuance. The DUSR will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and COC procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. A detailed assessment of each sample delivery group (SDG) will follow. For each of the organic analytical methods, the following will be assessed:

- Holding times;
- Instrument tuning;
- Instrument calibrations;
- Blank results;
- System monitoring compounds or surrogate recovery compounds (as applicable);
- Internal standard recovery results;
- MS/MSD results;
- Target compound identification;
- Chromatogram quality;
- Pesticide cleanup (if applicable);
- Compound quantitation and reported detection limits;
- System performance; and,
- Results verification.

For each of the inorganic compounds, the following will be assessed:

- Holding times;
- Calibrations;
- Blank results;
- Interference check sample;
- Laboratory check samples;
- Duplicates;
- MS results;
- Furnace atomic absorption analysis QC;
- Instrument-specific quality control procedures (ICP) serial dilutions; and,
- Results verification and reported detection limits.

Based on the results of data validation, the validated analytical results reported by the laboratory will be assigned one of the following usability flags:

- "U" – ND; the associated number indicates the approximate sample concentration necessary to be detected significantly greater than the level of the highest associated blank;
- "UJ" – ND; quantitation limit may be inaccurate or imprecise;
- "J" – Analyte is present; reported value may be associated with a higher level of uncertainty than is normally expected with the analytical method;
- "N" – Tentative identification; analyte is considered present in the sample;
- "R" – Unreliable result; data is rejected or unusable; analyte may or may not be present in the sample; and,
- No Flag – Result accepted without qualification.

### 7.4. Reporting

Upon receipt of validated analytical results, NYSDEC format EDD, compatible with EQuIS, will be prepared and submitted to the NYSDEC.

# 8.0 QUALITY ASSURANCE (QA) PERFORMANCE AND SYSTEMS AUDITS

## 8.1. Introduction

QA audits may be performed by the project quality assurance group under the direction and approval of the QAO. These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate quality assurance management, the QAO may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

## 8.2. System Audits

System audits may be performed by the QAO or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory QC procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the project manager requests, additional audits may occur.

## 8.3. Performance Audits

The laboratory may be required to conduct an analysis of Performance Evaluation (PE) samples or provide proof that PE samples submitted by the USEPA or a state agency have been analyzed within the past 12 months.

## 8.4. Formal Audits

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that QA requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be in noncompliance shall be identified at exit interviews conducted with the involved management.

Non-compliances will be logged and documented through audit findings, which are attached to and are a part of the integral audit report. These audit finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The project manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the project manager within 15 days of completion of the audit. Serious deficiencies will be reported to the project manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAO prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

# 9.0 CORRECTIVE ACTION

## 9.1. Introduction

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

## 9.2. Procedure Description

When a significant condition adverse to quality is noted at the Site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, project manager, Field Team Leader and involved contractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When QA requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;
- As a result of laboratory/field comparison studies; and,
- As required by USEPA SW-846, and subsequent updates, or by the NYSDEC ASP.

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the Site, laboratories, or contractor locations. Activities or documents ascertained to be noncompliant with QA requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the task manager.

Personnel assigned to QA functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 3 or similar). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the project manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close-out action. The project manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

**FIGURE 3**

| **CORRECTIVE ACTION REQUEST** |
|---|
| Number: _____ Date: _____ |
| TO: _____<br>You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by _____ |
| CONDITION: |
| REFERENCE DOCUMENTS: |
| RECOMMENDED CORRECTIVE ACTIONS: |
| _____ _____ _____ _____ _____ _____<br>Originator Date Approval Date Approval Date |
| RESPONSE |
| CAUSE OF CONDITION |
| CORRECTIVE ACTION<br>(A) RESOLUTION<br>(B) PREVENTION<br>(C) AFFECTED DOCUMENTS |
| C.A. FOLLOWUP:<br>CORRECTIVE ACTION VERIFIED BY: _____ DATE:_____ |

## 10.0 REFERENCES


- NYSDEC. Division of Environmental Remediation. DER-10/Technical Guidance for Site Investigation and Remediation, dated May 3, 2010.
- NYSDOH. Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006.
- USEPA, 2014. "Test Method for Evaluating Solid Waste," Update V dated July 2014 U.S. Environmental Protection Agency, Washington, D.C.
- USEPA, 2015. Region II Standard Operating Procedure (SOP) #HW-34, "Trace Volatile Data Validation" (July 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II
- USEPA, 2015. Region II SOP #HW-35A, "Semivolatile Data Validation" (June 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II
- USEPA, 2015. Region II SOP #HW-36A, "Pesticide Data Validation" (June 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II
- USEPA, 2015. Region II SOP #HW-37A, "PCB Aroclor Data Validation" (June 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II
- USEPA 2015. Region II SOP #HW-3a, "ICP-AES Data Validation" (July 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II
- USEPA 2014. Hazardous Waste Support Section. Analysis of Volatile Organic Compounds in Air Contained in Canisters by Method TO-15. SOP No. HW-31, Revision 6, dated June 2014.
- USEPA 2017. National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, EPA-540-R-2017-002, January 2017.
- USEPA 2017b. National Functional Guidelines for Superfund Inorganic Methods Data Review, Office of Superfund Remediation and Technology Innovation, EPA-540-R-201 7-001, January 2017.

# ATTACHMENT A
# RESUMES

# Hannah Griesbach, EIT

**Staff Engineer**

## 5 years with Langan

Ms. Griesbach has worked on numerous environmental and geotechnical projects for industrial, commercial, residential, and public facilities in several states including Connecticut, New York, New Jersey, Massachusetts, and Florida. She has experience with permitting and compliance tasks associated with projects in Connecticut and New York regulatory programs.

Ms. Griesbach has conducted Phase I Environmental Site Assessments (ESA) and Phase II/III Site Investigations (SI). She has provided oversight for environmental and geotechnical soil boring and test pit excavations. She is familiar with conducting subsurface boring investigations, test pit excavations and possesses field sampling experience including soil, sediment, soil vapor, surface water, and groundwater.

Ms. Griesbach conducted Phase II investigation activities including soil, groundwater, and soil vapor sampling at the NYSDEC BCP Fashion Outlets of Niagara Falls Expansion project. Additionally, she provided technical assistance during the preparation of a site specific health and safety plan, remedial action work plan, and the final engineering report. During implementation of the remedial design, she provided full-time oversight including performance of the CAMP (real-time air monitoring for VOCs and particulate levels), non-hazardous and hazardous waste disposal, field inspections, and daily, weekly, and monthly reporting.

Ms. Griesbach has acted as a Design/Field Engineer for the King's Plaza Mall site in Brooklyn, NY, for the past 3 years. Responsibilities include assisting with the preparation of the remedial action work plan, monthly progress reports, and the design of a sub-slab depressurization system. Additional responsibilities include waste classification and delineation soil sampling, and groundwater sampling.

Ms. Griesbach acted as Remedial Field Engineer assisting with the remedial design and installation of a geosynthetic membrane capping system for historic hazardous waste dumping areas at the Former Remington Rand site in Middletown, CT. Field activities included contractor coordination, weekly reporting, and full-time field oversight of excavation and off-site disposal of hot-spot areas, installation of geosynthetic liner system, installation of an asphalt cap, and community air monitoring. Post-remediation activities include preparation of a groundwater monitoring plan, remedial action reporting, regulatory meetings, site management, and sub-slab depressurization system monitoring.

Ms. Griesbach is responsible for the technical execution of projects and associated report and plan generation. This includes the knowledge and use of several programs such as AutoCAD, GIS, gINT, and Bluebeam.

## RELEVANT EXPERIENCE

Fashion Outlets of Niagara Falls Expansion – BCP Site – Niagara Falls, NY
Enclave on 241st – BCP Site – Bronx, NY
363 Bond Street – BCP Site – New York, NY
Former Remington Rand Factory – Consent Order Clean-up – Middletown, CT
Ryder Facilities – Transfer Act Properties – Bridgeport, East Lyme, Hartford, CT

### Education

Lafayette College:
B.S. Civil Engineering (2009-2013)

Villanova University: M.S. Water Resources and Environmental Engineering (2016-Present)

### License's/Accreditations

40 Hour OSHA – HAZWOPER Certification
10 Hour OSHA – Construction Safety and Health Certification
Licensed Asbestos and Lead Inspector – CT

LANGAN

# David Granucci

**Senior Staff Engineer**

## 6 years in the industry ~ 6 years with Langan

Mr. Granucci has a strong background in environmental engineering and six years of regulatory and consulting experience. During his employment with Langan, Mr. Granucci has worked on numerous environmental and geotechnical projects for industrial, commercial, residential, and public facilities in several states including Connecticut, New York, New Jersey, Massachusetts, and Pennsylvania. He has experience with permitting and compliance tasks associated with Connecticut and New York regulatory programs.

Mr. Granucci has conducted Phase I Environmental Site Assessments (ESA), Phase II/III Site Investigations (SI) and remedial actions. He has experience designing remedial actions including capping, excavations, sub slab depressurization systems, and administrative closure options. He has provided oversight for environmental and geotechnical soil boring and test pit excavations. He is familiar with conducting subsurface boring investigations, test pit excavations and possesses field sampling experience including soil, sediment, soil vapor, and groundwater.

Mr. Granucci is responsible for the technical execution of projects and associated report and plan generation. This includes the knowledge and use of several programs such as AutoCAD, GIS, gINT, and Microsoft Office.

### Selected Projects

Former Remington Rand Factory – Middletown, CT
AutoZone, Various Locations in the US
Collegiate School New Building Project, New York, NY
Stop and Shop Fueling, Various Locations in the US
The Shops at Atlas Park, Glendale, NY
Fashion Outlets of Niagara, Niagara, NY
Lowe's, Various Locations in the US

**Education**

University of Connecticut, Bachelor of Science: Civil Engineering
University of Connecticut, Master of Science: Environmental Engineering

LANGAN

# Ryan J. Wohlstrom, EIT

**Senior Project Engineer**
**Environmental Engineering & Project Management**

## 10 years in the industry ~ 7 years with Langan

Mr. Wohlstrom is an environmental engineer whose practice involves site investigation and remediation, environmental site assessments, in-situ remedial technology, sub-slab depressurization system design, emergency response, environmental and geotechnical site investigations, and health and safety monitoring. He has experience with projects in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup, Voluntary Cleanup and Spill Programs and New York City Department of Environmental Protection (NYCDEP) "E" Designated and New York City Brownfield Cleanup Program sites. He has extensive experience in soil and groundwater investigation and remediation, design of in-situ chemical oxidation and enhanced bioremediation strategies, Phase I Site Assessments, Phase II site investigations, UST Closures, NYSDEC spill closure, remedial excavation oversight and excavation and off-site treatment and/or disposal of contaminated soils.

### Selected Projects

Columbia University, Manhattanville Development, New York, NY
Brooklyn Bridge Park Development, Brooklyn, NY
Collegiate School Development Project, New York, NY
New York City School Construction Authority, Boroughs of New York City, NY
Kings Plaza Shopping Center, Brooklyn, NY
Sheepshead Bay Development, Brooklyn, NY
1676 Third Avenue Brownfield Cleanup Program (BCP) Site, New York, NY
Fashion Outlets of Niagara Falls BCP Site, Town of Niagara, NY
Goethals Bridge Development, New York, NY
Gateway Estates Phase II, Brooklyn, NY
Hudson Yards, Terra Firma Development, New York, NY
29 Flatbush Avenue BCP Site, Brooklyn, NY
Former Artistic Brass Facility, South Gate, CA
165 Huguenot Street, New Rochelle, NY
Archer Towers 2 Development, Jamaica, NY
101 Lincoln Avenue, Bronx, NY

### Education

B.S., Engineering
Roger Williams University

### Professional Registration

Engineer-in-Training (EIT)

OSHA 29 CFR 1910.120 Certification (HAZWOPER)

LANGAN

# Emily G. Strake

**Senior Project Chemist/Risk Assessor**
**Human Health Risk Assessment**
**Chemical Data Validation**

## 18 years in the industry

Ms. Strake has experience in environmental chemistry, risk assessment, auditing, and quality assurance experience. Ms. Strake has extensive experience in environmental data validation, focused on ensuring laboratory deliverables follow specific guidelines as described by regulatory agencies and the analytical methods employed. In addition, she has experience in EQuIS chemical database management. She also has a broad range of environmental field experience and maintains current OSHA HAZWOPER certification. Ms. Strake is experienced in auditing laboratory and field-sampling activities for compliance with Quality Assurance Project Plans (QAPPs), the National Environmental Laboratory Accreditation Conference Standards Quality Systems manual, and applicable USEPA Guidance. Ms. Strake has also audited on-site laboratories in support of groundwater treatment operations and implemented corrective actions. Her responsibilities include writing reports on the value of laboratory work, writing/editing QAPPs for clients and project-specific sites, peer reviewing colleague's work, and mentoring staff within the office. She has also served as the Quality Assurance officer for several long-term projects, responsible for the achievement of all forms of Quality Control/Quality Assurance by onsite personnel relating to sampling, analysis, and data evaluation.

### Selected Project

- Major League Soccer's San Jose Earthquakes Stadium, Santa Clara, CA
- Bedford Union Armory, NY
- PECO/Exelon, Various Locations
- Central Chemical CERCLA Site, MD
- Regency, Philadelphia, PA
- 300 West 122$^{nd}$ Street, NY
- DOW Chemical, Various Locations
- Avon, Rye, NY
- 363 and 365 Bond Street, NY
- Sunoco Refineries, Various Locations
- Honeywell, Highland Park, NJ
- 215 North 10$^{th}$ Street, NY
- Atlas Park, NY
- 1525 Bedford Avenue, NY
- Ryder, Hartford, CT
- Rohm and Haas, Philadelphia, PA

### Education

MBA
The University of Scranton

B.S., Chemistry
Cedar Crest College

### Professional Licenses

Board Certified Environmental Professional (CEP)

### Training

40 hr. OSHA HAZWOPER Training/Nov 2002

8 hr. HAZWOPER Supervisor/June 2004

8 hr. OSHA HAZWOPER Refresher/2013

### Affiliations

The Society for Risk Analysis

Interstate Technology and Regulatory Council

# Jamie P. Barr, LEP

**Senior Associate**
**Geological Engineer**

## 18 years in the industry ~ 14 years with Langan

Mr. Barr is a Geological Engineer with over eighteen years of diversified environmental, civil, and geotechnical experience that includes environmental regulatory compliance/negotiation, remedial system design, permitting, public/community outreach, feasibility studies, Phase I/II/III environmental site assessments, construction management, geotechnical investigations, site/civil design, stormwater management, and master planning. Mr. Barr manages Langan's Environmental Engineering has experience coordinating and negotiating with regulatory agencies in Connecticut, New York, New Jersey, Illinois, California, Indiana, and Massachusetts. Mr. Barr has extensive experience with projects in the Connecticut Property Transfer Program, New York State and City Brownfield Cleanup Programs, as well as the USEPA Superfund Program. Mr. Barr served as a co-chair on a committee formed by the CTDEEP for the transformation of the Connecticut regulations, and currently serves as an officer on the Board of Directors for New Haven Manufacturers Association and the advisory board for Connecticut Brownfield Cleanup initiative at the University of Connecticut. Mr. Barr's specialties include brownfield redevelopment, transfer act compliance, remediation system design, environmental site assessment, construction management, and real estate due diligence.

## Selected Projects

AutoZone Store, Various Locations in the US
Lowe's Home Improvement, Various Locations in the Northeast
Stop and Shop Fueling Facility, Various Locations in the Northeast
Fashion Outlets of Niagara, Niagara, NY
John Jay College Expansion, New York, NY
The Shops at Atlas Park, Glendale, NY
Enclave on 241st, Bronx, NY
Hudson Yards, Terra Firma Development, New York, NY
Sheepshead Bay Development, Brooklyn, NY

### Education

B.S., Geological Engineering
University of New Brunswick

### Professional Registration

Licensed Environmental Professional – CT #511

### Affiliations

New Haven Manufacturers Association (Secretary)

Connecticut Building Congress

Environmental Professionals of CT

National Brownfield Association

Environmental Business Association

Association of Professional Engineers and Geoscientists of New Brunswick

Trailwood Capital Advisors

Paley Advisors

LANGAN

# John D. Plante, P.E.

**Managing Principal / Vice President**
**Site Development / Design**
**Transportation / Traffic Engineering**

## 33 years in the industry ~ 19 years with Langan

Mr. Plante has over 33 years of civil engineering consulting experience specializing in site development, permitting, transportation, traffic analysis and value engineering. He has been responsible for the engineering design and preparation of contract documents for a wide variety of projects. He has served as both project engineer and project manager for site development and transportation infrastructure projects for public and private clients. He specializes in urban, mixed-use development and the complex engineering and regulatory challenges they present. Project manager responsibilities have included the supervision of multi-disciplined teams of engineers in the execution of projects from the due diligence/planning stage through approvals and construction. He is the executive responsible for the management of and operations of the firm's New Haven, Connecticut office. John was appointed to the Connecticut General Assembly's Shoreline Preservation Task Force, which is tackling climate change's impacts on the state's residents, infrastructure and economy. He is also a member to the Steering Committee for the Urban Land Institute (ULI) in Connecticut

## Selected Projects

AutoZone Store, Various Locations in the US
Lowe's Home Improvement, Various Locations in the Northeast
Stop and Shop Fueling Facility, Various Locations in the Northeast
Target, Various Locations in the US
Fashion Outlets of Niagara, Niagara, NY
The Shops at Atlas Park, Glendale, NY
Enclave on 241st, Bronx, NY
Hudson Yards, Terra Firma Development, New York, NY
Sheepshead Bay Development, Brooklyn, NY

### Education

UMass – Dartmouth, B.S. Civil Eng.

### Professional Registration

Professional Engineer – CT, MA, NY, RI, VT, ME, NH

### Affiliations

International Council of Shopping Centers

Urban Land Institute – CT Steering Committee

American Society of Civil Engineers

Institute of Transportation Engineers

Connecticut Building Congress – IPC Committee

NAIOP

AIA – Associate Member

LANGAN


www.yorklab.com

# Statement of Qualifications

**120 Research Drive**
**Stratford, CT**
**06615**

**50 Gedney Street**
**Nyack, NY**
**10960**

**94 Planten Avenue**
**Prospect Park, NJ**
**07508**

**132-02 89th Avenue**
**Richmond Hill, NY**
**11418**

**800-306-YORK (9675)**
**www.yorklab.com**
**clientservices@yorklab.com**

# Table of Contents

# I. INTRODUCTION

York Analytical Laboratories, Inc. (YORK) is an owner-operated, full service, NELAC accredited, independent analytical laboratory. With comprehensive licenses in New York, New Jersey, Connecticut & Pennsylvania for water, wastewater, soil, solid waste, hazardous waste and air, YORK supports regulated activities under the applicable local, state and federal environmental guidelines.

With roots in air monitoring that predate the creation of the U.S. Environmental Protection Agency (EPA), YORK has evolved into one of the premier full-service environmental laboratories in the Northeast.

YORK's diverse client base includes consulting engineers, municipalities, city and state agencies, industry end-users and manufacturers, construction companies, and property management companies.

A best-in-class client service offering is the driving force behind YORK's success… which is providing clients the sample analyses data they need, when they need it, and in the required format.

YORK's operations are designed to deliver results in an expedited time frame with 5-day standard negotiated turnaround time and reliable next-day/two-day rush results for our clientele.

YORK's in-house courier service is available to make office and site pick-ups/drop-offs with one-day prior notice throughout New York, New Jersey and Connecticut.

YORK continuously invests in its systems and staff to ensure the ever-changing market and regulatory demands can be met.

Clients that tour our flagship Connecticut lab get a firm sense of the quality of people and care that YORK is so commended for.

For more information about YORK -- including additional details on our staff, copies of YORK's newsletter, instructional videos and pictures of the lab please visit our website at www.yorklab.com. Archives of our newsletter are available on the YORK TALK tab of our home page.

# II. SERVICES

**YORK is one of the few owner-operated laboratories in the Northeast to provide expert in-house analysis for all environmental matrices in support of the following guidelines or regulations:**

- **CT RSR/RCP**
- **NYSDEC DER-10 (Formerly STARS and TAGM, Part 375)**
- **NJDEP (N.J.A.C. Title 7)**
- **Resource Conservation and Recovery Act (RCRA)**
- **Clean Water Act and CERCLA/SARA (Superfund)**
- **Land Transfer Regulations**
- **Clean Air Act (Compendium Methods TO-10A, TO-13, TO-15)**

Analytical data is used for many purposes including: compliance with regulatory requirements, determination of the presence, concentration and movement of potentially hazardous materials in the environment, potential effects on determination of protection required for individuals, and possible actions necessary for the disposal or treatment of hazardous materials.

The extensive experience and 24/7 availability of its seasoned professionals allows YORK to provide clients with invaluable technical support related to regulatory programs, project planning, and data interpretation. The YORK team, which is comprised heavily of industry veterans with 15 to 20+ years of experience, knows what it takes to ensure successful results and provides senior level attention to clients.

YORK has developed a Quality System, which defines day-to-day operations in the laboratory through the execution of comprehensive Standard Operating Procedures and Policies. This program is fully documented, endorsed by company management, and available for review in the YORK Quality Systems Manual and related Standard Operating Procedures.

**YORK's Quality System aims to ensure data for any application is of known quality and conforms to the requirements of specific protocols. Key elements that drive the program are:**

- Maintain an effective ongoing quality control program, which measures and verifies laboratory performance.
- Meet data requirements for accuracy, precision, recovery and completeness through strict adherence to SOPs, which reflect approved methodologies.
- Recognize and provide corrective actions for any factors that affect data quality.
- Maintain complete records of sample submittal, client communications, laboratory performance, and completed analyses and support data to provide data quality verification.

**Electronic Data Deliverables (EDDs)**

YORK's Laboratory Information Management System (LIMS) provides the power to create a broad array of standard and custom electronic deliverables packages including EQuIS, EZ-EDD, NJDEP and NYSDEC Environmental Information Management System (EIMS) EQuIS among more than 100 other formats from simple excel to more complex staged EDDs.

These EDDs are designed to meet specific regulatory requirements on in-house requirements for client projects.

## Air Testing

During the late 1980s through mid-1990s YORK was involved in analyzing thousands of ambient air samples in urban environments for VOCs and SVOCs using EPA compendium methods [TO-14A and TO-13]. Since the late 1990s, YORK provides VOC analysis by EPA Compendium Methods for numerous public and private clients.

Since 2012, there has been a resurgence in air monitoring including indoor air quality, sub-slab soil vapor and soil vapor extraction wells analysis in support of regulatory initiatives such as NYSDEC DER-10 and other city and agency-driven guidelines. Soil Vapor Intrusion (SVI) studies have taken hold and are being mandated in many commercial property transfers. Closed sites are being reopened to examine SVI potential.

These initiatives have raised the bar for air VOC analysis in the sense that the limits of detection required to meet regulatory needs are on the order of 0.25 - 1.0 ug/m3 (0.05 to 0.5 ppbv depending upon the compound of interest). These lower detection limits have created analytical challenges for laboratories in terms of instrument operating parameters, sampling system integrity and reporting requirements.

**YORK has made significant investments to meet these regulatory requirements and provide turnkey solutions for client programs including soil vapor, landfill gas, geoprobe samples, and ambient air:**

- Increased inventory of inert Summa passivated Silonite canisters
- Sample flow controllers to meet any requested sampling intervals (1 - 24 hours)
- Automated Summa Canister Cleaning systems
- Three Stage microscale purge/trap systems for sample introduction into GC/MS systems for TO-15 analyses
- Multiple Gas Chromatography/Mass Spectrometry (GC/MS) Systems including simultaneous SCAN/SIM Agilent 7890GC/5975C-MS systems
- Strategic partnering with instrument manufacturers to maximize technical parameters

- LIMS system to produce a myriad of fully automated Electronic Data Deliverables (EDDs) including: EQuIS, EZ-EDD, NJDEP and NYSDEC Environmental Information Management System (EIMS) EQuIS among more than 100 other formats from simple excel to more complex staged EDDs.
- Fully automated data packages for validation including NYSDEC ASP B-like, CTDEP RCP, and EPA CLP-like, etc.

## Web Access (YORK DataPORT)

Real-time technical reports, EDDs, Chains of Custody, and invoices are available to clients via password protected web-based access. In addition, YORK's web access program - DataPORT - provides

additional custom features that help clients prepare for projects and present data to clients, such as functionality for generating Regulatory Comparison EDDs, and bottle and preservation requirements.

**Courier Service**

YORK takes great pride in the effectiveness of its courier service, which reliably and predictably covers New York State south of Albany, including all boroughs of NYC and Long Island, central and northern New Jersey, eastern Pennsylvania and all of Connecticut.

YORK's best-in-class, in-house team of couriers pick-up samples and drop-off bottles/coolers/canisters at client offices or job site locations. Most requests can be handled with just one day notice and can be scheduled easily through our website and mobile site. This automated courier system allows clients to submit requests for deliveries and pick-ups from their computers and mobile phones directly into our schedule.

**Turnaround Time**

YORK understands that time is of the essence when it comes to client sample results. Rush priority services - including same day and next day - are available upon request.

# III. Certifications

YORK is a NELAC accredited laboratory and maintains comprehensive certifications in various states including: Connecticut, New York, New Jersey & Pennsylvania.

| | |
|---|---|
| ▪ State **of Connecticut** | **No. PH-0723 (Stratford,CT)** |
| ▪ **State of Connecticut** | **No. PH-0721 (Queens,NY)** |
| ▪ **State of New York (NELAC)** | **No.10854 (Stratford,CT)** |
| ▪ **State of New York (NELAC)** | **No.12058 (Queens,NY)** |
| ▪ **State of New Jersey** | **No. CT-005 (Stratford,CT)** |
| ▪ **State of New Jersey** | **No. NY-037 (Queens, NY)** |
| ▪ **State of Pennsylvania** | **No. 68-0440 (Stratford,CT)** |

YORK's certifications support analysis of air, water, wastewater, soil, solid, and hazardous waste for:

- Volatiles
- Semi-volatiles (BNA)
- Pesticides/PCBs/Herbicides
- Metals
- Other conventional parameters

YORK is a certified prequalified laboratory for the New York City School Construction Authority (NYC SCA).

Full copies of YORK's certifications are available upon request.

# IV. Project Experience

YORK serves engineering consulting firms, major municipalities, utilities and industry, without geographical limitations. Some of the clients YORK has provided for include:

Consulting Engineers/Remediation Firms

- AECOM/Metcalf & Eddy
- AKRF
- Arcadis
- Chazen Companies
- Clean Harbors
- Connecticut Tank Removal
- Fuss & O'Neill
- Gannett-Fleming
- GEI
- GeoInsight
- GHD (Conestoga-Rovers)
- GZA
- Kiewit Construction
- Langan Environmental
- Leggette Brashears and Graham
- Lehrer, McGovern, Bovis
- Lenard Engineering
- Liro Group
- Malcolm Pirnie
- Miller Environmental
- Moran Environmental Recovery
- Moretrench
- Roux
- STV
- TRC Environmental
- Tyree Company
- VHB/Freudenthal & Elkowitz
- Woodard & Curran

Municipalities

- CT DEP
- CT DOT
- Hartford Metropolitan District
- Long Island Railroad/MTA
- Metro- North Railroad/MTA
- NYC DDC
- NYC DEP
- NYC OER
- NYC SCA

Industry/Agencies

- Chemtura/Crompton Manufacturing Corp. (Uniroyal Chemical)
- Clairol, Inc.
- Cytec, Inc.
- General Motors
- IBM

Universities

- Columbia University
- New York University
- Princeton University
- SUNY / CUNY
- University of Bridgeport
- Yale University

Utilities

- Central Hudson Gas and Electric
- Connecticut-American Water Co
- Consolidated Edison, New York
- Niagara Mohawk Power Corp
- Northeast Utilities
- Orange & Rockland
- PSE&G

Listed below is a cross section of representative projects, which illustrate our capabilities to handle multi-discipline projects dealing with simple to complex matrices.

- Railroad client - Full analytical support for SPDES permits, groundwater remediation systems, RIFS programs, and emergency response support.

- CT-based (20-person consulting firm) - Full support analyses for Brownfields Redevelopment projects for Stop & Shop and Rite-Aid.

- NYC agency in conjunction with large multi-office remediation firm - Multi-year ambient air study involving sampling and analysis of 1,000 samples for airborne particulate (PM10), metals, sulfate, and volatile organics using SUMMA canisters

- International manufacturer with CT facility - Developed a direct aqueous injection GC/MS/SIM Method for the determination of methyl carbamate in river water to determine plume of contamination down to a 5 ppb lower limit detection.

- NJ disposal facility - Comprehensive sampling and analysis program to characterize raw landfill gas for volatiles, semi volatiles, pesticides and PCBs.

- International services company with office in Hudson Valley - Performed analyses of groundwater and industrial effluents throughout a major manufacturing facility. Analyses included volatiles, semi-volatiles, metals and TOC.

- Joint venture and NYC agency - Provided analytical support for a major underground storage tank decommissioning program in the five boroughs of NYC. Analysis includes volatiles, semi-volatiles, metals, TCLP parameters, and geoprobe gas analysis. All analytical work done with NYSDEC ASP Category A and B deliverables.

- Joint venture and NYC agency - Conducted numerous analyses in support of multiyear/ multi-New York City borough petroleum-impacted sites. Required ASP B deliverables.

- Hudson Valley municipality - Conducted odor study involving compound identification using GC/MS techniques.

- International manufacturer with NJ facility - Weekly analysis of wastewater treatment plant effluent for conventional parameters.

- Various state agencies and utilities - Master services agreement to provide on-call laboratory services for multiple facilities.

- Global consulting firm - Analysis of groundwater, soil and building materials for volatiles, PCBs and metals at a major Bridgeport, CT chemical facility. Project required EPA Level III deliverables.

- Global consulting firm - Task order contract for analysis support for U.S Army facility. Project involved analysis of wastes, soil and groundwater with ASP B deliverables.

- Global consulting firm - YORK provided hundreds of analyses of soil and water in support of major land transfer project. Analyses involved 4 hour turn-around for QA/QC deliverables.

- Numerous consulting/engineering firms - Analysis of landfill wells, monitoring wells, soils and surface waters for regulated parameters in support of Superfund activities as well as routine state requirements (i.e. NYCRR Part 360).

- NYC SCA - YORK was on front line for expedited analysis for lead in drinking water with a dozen NYC SCA consultants.

# V. Facilities

Located two miles from the Bridgeport/Long Island Ferry in Stratford, CT to provide for immediate access for the NY/CT/NJ tri-state area, the 13,000 sq. ft. laboratory is fully equipped to address analysis of all environmental matrices. Separate laboratory environments are provided for volatiles, sample preparation, and sample control to minimize potential for cross-contamination.

In 2004, YORK moved its main laboratory from Stamford, CT to Stratford which allowed for the construction and modification of a new building with a laboratory layout that provides for current and future needs. This move enabled YORK to double its capacity over the next few years with a million dollars of new instrumentation and equipment.

Instrumentation laboratories are segregated by discipline (organics analysis, sample preparation, wet chemistry and atomic spectroscopy) and are provided with separate recirculating air conditioning systems, and positive pressure environments to further protect client samples from common laboratory solvents (methylene chloride, acetone, and hexane) used in extractions.

In 2012, YORK added a Client Service Center in Prospect Park, NJ at one of the state's new disposal facilities (PPARK) which has allowed for local clients, as well as clients traveling in and out of New York City via New Jersey, to drop off samples / pickup supplies, and even use our facility to meet with some of their own clients. This location is open and available for our clients' use 24/7 with refrigerated lock boxes. To learn about how to use this facility to your advantage, email us at clientservices@yorklab.com or give us a call at 203-325-1371.

In 2015, through New York State's START-UP NY program YORK partnered with SUNY/Rockland Community College to open a new facility in Nyack, NY at the base of the Tappan Zee Bridge. This new executive headquarters provides YORK's first physical footprint in New York State, and created new opportunities with SUNY/RCC students.

In 2016, YORK added a state-of-the-art laboratory in the heart of Queens, NY to submerge ourselves into the rapidly evolving landscape that is the NYC environmental field. Located a few blocks from LIRR's major hub, Jamaica Station, and specifically designed to be free from common (and pesty) lab contaminants resulting from the extractions process, such as Acetone and Methylene Chloride, this facility serves as NYC's first ever laboratory to be NELAC certified to analyze for TO-15 air samples as well as VOA in soil and water.

# VI. Major Equipment & Instrumentation

YORK maintains all analytical instrumentation and support equipment necessary to provide analysis in support of client needs. A substantial inventory of stock chemicals, gases, commercially purchased standards, glassware and other items needed for analysis. YORK is continuously evaluating and investing in new equipment and instrument. Some major items in use at YORK include:

- Accelerated Solvent Extraction Systems (ASE), Dionex, and Buciti
- Archon VOC Auto Sampling Systems
- Autoanalyzer, SKALAR flow injection-Nitrate, Nitrite, o-Phosphate, Ammonia, TKN
- Automated Mercury Analyzers (Milestone DMA-80)
- Cold Vapor Mercury /Hydride System (Buck Scientific 403)
- Gas Chromatography (HP 5890 ECD,FID ALS 7673 , HP ChemStation)
- Gas Chromatography (HP 5890 dual ECD dual ALS7673 ,HP ChemStation), numerous
- Gas Chromatography (HP 5890II,G.S.V.FPD,TCD)
- Gas Chromatography (Perkin Elmer Autosystem 2000 FID/ECD)
- Encom Evolution and Tekmar Purge & Trap Systems
- Gas Chromatograph/Mass Spectrometer/Data Systems (HP 5890 II/5971 & 5972/ 5973 / ChemStation) 14 systems
- Gas Chromatograph/Mass Spectrometer/Data Systems (HP 5890 II/5970/w/ ALS 7673
- Gas Concentration System/Interface TO-14A/15-ENTECH 7200 with 16 position ALS tree
- Gas Dilution System (Environics Model 2000)
- Inductively Coupled Plasma/Mass Spectrometer (Perkin Elmer ELAN 9000)
- Inductively Coupled Plasma/Mass Spectrometer (Perkin Elmer NexION 2000)
- Inductively Coupled Plasma (PE-Optima 7300 Dual View)
- Ion Chromatograph Dionex ICS 1100 with AS-DV Chromeleon 7 software
- LIMS System (Promium Element/SQL Server)
- Sample Concentrator, TurboVap systems (Biotage/Zymark VAP II), numerous
- Spectrophotometers, SPEC 20D+ systems
- TCLP Extraction Apparati-2, multiple systems
- Total Organic Carbon Analyzer, SKALAR
- Water purification system -Ion Exchange, Carbon, Reverse Osmosis-Hydro Systems

# VII. Key Personnel Qualifications

**Michael J. Beckerich**, Senior Vice-President
Michael manages business operations and client relations. Michael brings a unique background in client service from his time at some of the world's leading pharmaceutical companies that helps YORK sustain and grow a best-in-class service offering. A proactive industry zealot, Michael provides YORK's clients with insightful perspective on marketplace dynamics. He was responsible for crisis management at the highest level, acted as media spokespeople for Johnson & Johnson, and provided counsel to numerous companies on technical and policy issues at public hearings in Washington DC. Michael earned a B.A. in political science from Villanova University.

**Benjamin Gulizia**, Laboratory Director

Ben is a versatile and well-experienced industry veteran who has played a significant role at a number of successful laboratories including TestAmerica, Environmental Testing and Certification Corporation, HydroLogic, and Enseco. As YORK's Laboratory Director, Ben is responsible for all day-to-day laboratory activities, including data generation, staff management and training, reporting and quality oversight. Ben joined YORK in 2013 after nine years as Laboratory Director at TestAmerica Savannah, one of the largest commercial environmental sample facilities in the U.S. Ben graduated from Georgetown College with a B.S. in Biology.


**Robert Q. Bradley**, Senior Scientist & Director of Special Projects
Since YORK's inception, Bob has been the driving force behind its strong and steady growth and is one of the foremost analytical sample analyses experts in the Northeast. Bob designed the entire framework of the new laboratory and has built a staff and operations that is the cornerstone of YORK's reputation.
With more than 30 years of laboratory management and hands-on experience, Bob has the ability to perform and train staff on all aspects of the laboratory operations and business. Among other key areas, he is an expert in the evaluation, selection and cost control of analytical procedures developed and used in the laboratory, and the establishment and maintenance of quality control and quality assurance programs for analytical methods. Bob graduated from Georgetown University with both a B.S. and M.S. in Chemistry.

**Aaron Patak**, Quality Assurance Officer
Aaron has just under 10 years experience in the environmental sector covering positions in laboratory analysis, QA/QC procedures, and consulting. As YORK's Quality Manager, Aaron is intimately engaged in all new regulations and quality standards, including NELAC and ISO-17025 requirements. In addition to client reports, he is responsible for YORK's Quality Systems, including internal audits and all corrective action follow-up. A graduate of Stony Brook University, he holds a B.S. degree in Biology.

**Joseph Weikel**, Laboratory Technical Manager

Joe leads the fastest growing aspect of YORK's business - leveraging the power of computer systems and instrumentation to deliver more flexible and better data sets. With 20 years of industry experience, Joe is YORK's first Laboratory Technical Manager with a focus on maximizing the versatility and power of the company's laboratory information management systems (LIMS). Joe was an on-site implementer of laboratory systems for a leading west coast-based environmental LIMS company and worked as a software engineer for Philips Medical Systems. In addition to his computer and technical skills, Joe managed a full service west coast environmental lab. Joe graduated from the University of Washington with a degree in chemistry.

**Larry Singh**, Laboratory Technical Director (Queens Facility)

Larry joined the YORK team in 2014, bringing with him over 25 years of experience in the environmental laboratory industry. Larry specialized in organics analysis throughout his career at multiple NY-based environmental laboratories and worked his way from technician into management.. His vast knowledge and experience in that department made him an obvious selection to be the face of our new air analysis/VOA laboratory in Queens, NY. Larry graduated from Concordia College with a B.S. in Environmental Science.

**Lidya Gulizia**, Project Management Director

Lidya joined YORK in 2013 after 10 years as a senior project leader with one of the country's largest laboratory networks. Lidya also held senior responsibilities as Quality Assurance Officer at a prominent California-based analytical lab and as the Quality Assurance Manager at engineering pioneer, Geraghty & Miller, in NJ. In addition, Lidya spent time as an independent Data Validation Specialist, as well as a GC analyst and Extractions chemist. Lidya's extraordinary knowledge of regulations, analytical methods and process related to meeting data quality objectives provides YORK's senior team tremendous depth and offers clients a unique value-add for their projects. Lidya graduated from Rutgers University with a B.S. in Biology.

**Rich August**, Client Services Director

Rich has an unprecedented level of experience that allows him to provide clients with meaningful and timely guidance related to planning, implementation and review of sample analysis projects. With more than twenty-five years of experience, Rich began his career on the bench and progressed through a variety of key roles in managing the laboratory. His first-hand lab experience coupled with an intimate knowledge of the regulatory complexities surrounding sample analyses give him the breadth and depth to provide clients with answers they can always count on. Rich graduated from Southern Connecticut State University with a B.S. in Biology and has completed Master's studies in environmental science from the University of New Haven.

**Jill Duhancik**, Client Services Director
Jill joined YORK as the laboratory's reporting team leader. Her experience in a similar role at one of the nation's largest environmental laboratory chains provides Jill with a broad base of experience and technical skills to continue advancing YORK's reporting/data transfer process. Her "can-do" attitude has made Jill both a client favorite and an important team manager at the lab. Jill graduated St. Joseph College with a B.S. in both Biology and Environmental Sciences.

**Patty Werner-Els**, Client Services Director
Patty Werner-Els joins YORK as a Client Services Director with a focus on New York City and Long Island. With more than 25 years in the environmental laboratory industry, Patty most recently served Chief Science Officer at a NYC-based water treatment company, and as President of a Long Island-based environmental laboratory, where she grew with increasing responsibilities from the bench to the front office. Patty is a graduate of Fairleigh Dickinson University.

**Dennis Young**, Client Services & NJ Facility Manager
Dennis Young is YORK's first New Jersey-based Client Services Manager. His 17 years of experience as a field operator and project manager with several of the industry's most respected consulting and engineering firms provides a unique resource to the YORK team. Dennis' field sampling experience includes ground and surface water, soil, and sub-slab & indoor air. He maintains his OSHA 40-hour HAZWOPER and OSHA 10-hour Construction Safety & Health certifications, and is a New Jersey N-2 licensed industrial wastewater operator. Dennis is a graduate of Rutgers University.

# ATTACHMENT B
# LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

# York Analytical Laboratories, Inc.

## Analytical Method Information

### Volatile Organic Compounds by GC/MS

**Volatile Organics, NJDEP/TCL/Part 375 List in Water (EPA 8260C)** Units: **ug/L**

| Analyte | CAS# | MDL | Reporting Limit | Matrix Spike | | Blank Spike / LCS | |
|---|---|---|---|---|---|---|---|
| | | | | %R | RPD | %R | RPD |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | 0.20 | 0.50 ug/L | 45 - 161 | 30 | 82 - 126 | 30 |
| 1,1,1-Trichloroethane | 71-55-6 | 0.20 | 0.50 ug/L | 70 - 146 | 30 | 78 - 136 | 30 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 0.20 | 0.50 ug/L | 74 - 121 | 30 | 76 - 129 | 30 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane ( | 76-13-1 | 0.20 | 0.50 ug/L | 21 - 217 | 30 | 54 - 165 | 30 |
| 1,1,2-Trichloroethane | 79-00-5 | 0.20 | 0.50 ug/L | 59 - 146 | 30 | 82 - 123 | 30 |
| 1,1-Dichloroethane | 75-35-3 | 0.20 | 0.50 ug/L | 54 - 146 | 30 | 82 - 129 | 30 |
| 1,1-Dichloroethylene | 75-35-4 | 0.20 | 0.50 ug/L | 44 - 165 | 30 | 68 - 138 | 30 |
| 1,2,3-Trichlorobenzene | 526-73-8 | 0.20 | 0.50 ug/L | 40 - 161 | 30 | 76 - 136 | 30 |
| 1,2,3-Trichloropropane | 96-18-4 | 0.20 | 0.50 ug/L | 74 - 127 | 30 | 77 - 128 | 30 |
| 1,2,4-Trichlorobenzene | 120-82-1 | 0.20 | 0.50 ug/L | 41 - 161 | 30 | 76 - 137 | 30 |
| 1,2,4-Trimethylbenzene | 95-63-6 | 0.20 | 0.50 ug/L | 72 - 129 | 30 | 82 - 132 | 30 |
| 1,2-Dibromo-3-chloropropane | 96-12-8 | 0.20 | 0.50 ug/L | 31 - 151 | 30 | 45 - 147 | 30 |
| 1,2-Dibromoethane | 106-96-4 | 0.20 | 0.50 ug/L | 75 - 125 | 30 | 83 - 124 | 30 |
| 1,2-Dichlorobenzene | 95-50-1 | 0.20 | 0.50 ug/L | 63 - 122 | 30 | 79 - 123 | 30 |
| 1,2-Dichloroethane | 107-06-2 | 0.20 | 0.50 ug/L | 68 - 131 | 30 | 73 - 132 | 30 |
| 1,2-Dichloropropane | 78-87-5 | 0.20 | 0.50 ug/L | 77 - 121 | 30 | 78 - 126 | 30 |
| 1,3,5-Trimethylbenzene | 108-67-8 | 0.20 | 0.50 ug/L | 69 - 126 | 30 | 80 - 131 | 30 |
| 1,3-Dichlorobenzene | 541-73-1 | 0.20 | 0.50 ug/L | 74 - 119 | 30 | 86 - 122 | 30 |
| 1,4-Dichlorobenzene | 106-46-7 | 0.20 | 0.50 ug/L | 70 - 124 | 30 | 85 - 124 | 30 |
| 1,4-Dioxane | 123-91-1 | 40 | 80 ug/L | 10 - 310 | 30 | 10 - 349 | 30 |
| 2-Butanone | 78-93-3 | 0.20 | 0.50 ug/L | 10 - 193 | 30 | 49 - 152 | 30 |
| 2-Hexanone | 591-78-6 | 0.20 | 0.50 ug/L | 53 - 133 | 30 | 51 - 146 | 30 |
| 4-Methyl-2-pentanone | 108-10-1 | 0.20 | 0.50 ug/L | 38 - 150 | 30 | 57 - 145 | 30 |
| Acetone | 67-64-1 | 1.0 | 2.0 ug/L | 13 - 149 | 30 | 14 - 150 | 30 |
| Acrolein | 107-02-8 | 0.20 | 0.50 ug/L | 10 - 195 | 30 | 10 - 153 | 30 |
| Acrylonitrile | 107-13-1 | 0.20 | 0.50 ug/L | 37 - 165 | 30 | 51 - 150 | 30 |
| Benzene | 71-43-2 | 0.20 | 0.50 ug/L | 38 - 155 | 30 | 85 - 126 | 30 |
| Bromochloromethane | 74-97-5 | 0.20 | 0.50 ug/L | 75 - 121 | 30 | 77 - 128 | 30 |
| Bromodichloromethane | 75-27-4 | 0.20 | 0.50 ug/L | 70 - 129 | 30 | 79 - 128 | 30 |
| Bromoform | 75-25-2 | 0.20 | 0.50 ug/L | 66 - 136 | 30 | 78 - 133 | 30 |
| Bromomethane | 74-83-9 | 0.20 | 0.50 ug/L | 30 - 158 | 30 | 43 - 168 | 30 |
| Carbon disulfide | 75-15-0 | 0.20 | 0.50 ug/L | 10 - 138 | 30 | 68 - 146 | 30 |
| Carbon tetrachloride | 56-23-5 | 0.20 | 0.50 ug/L | 71 - 146 | 30 | 77 - 141 | 30 |
| Chlorobenzene | 108-90-7 | 0.20 | 0.50 ug/L | 81 - 117 | 30 | 88 - 120 | 30 |
| Chloroethane | 75-00-3 | 0.20 | 0.50 ug/L | 51 - 145 | 30 | 65 - 136 | 30 |
| Chloroform | 67-66-3 | 0.20 | 0.50 ug/L | 80 - 124 | 30 | 82 - 128 | 30 |
| Chloromethane | 74-87-3 | 0.20 | 0.50 ug/L | 16 - 163 | 30 | 43 - 155 | 30 |
| cis-1,2-Dichloroethylene | 156-59-2 | 0.20 | 0.50 ug/L | 76 - 125 | 30 | 83 - 129 | 30 |
| cis-1,3-Dichloropropylene | 10061-01-5 | 0.20 | 0.50 ug/L | 58 - 131 | 30 | 80 - 131 | 30 |
| Cyclohexane | 110-82-7 | 0.20 | 0.50 ug/L | 70 - 130 | 30 | 63 - 149 | 30 |
| Dibromochloromethane | 124-48-1 | 0.20 | 0.50 ug/L | 71 - 129 | 30 | 80 - 130 | 30 |
| Dibromomethane | 74-95-3 | 0.20 | 0.50 ug/L | 76 - 120 | 30 | 72 - 134 | 30 |
| Dichlorodifluoromethane | 75-71-8 | 0.20 | 0.50 ug/L | 30 - 147 | 30 | 44 - 144 | 30 |
| Ethyl Benzene | 100-41-4 | 0.20 | 0.50 ug/L | 72 - 128 | 30 | 80 - 131 | 30 |
| Hexachlorobutadiene | 87-68-3 | 0.20 | 0.50 ug/L | 34 - 166 | 30 | 67 - 146 | 30 |
| Isopropylbenzene | 98-82-8 | 0.20 | 0.50 ug/L | 66 - 139 | 30 | 76 - 140 | 30 |
| Methyl acetate | 79-20-9 | 0.20 | 0.50 ug/L | 10 - 200 | 30 | 51 - 139 | 30 |
| Methyl tert-butyl ether (MTBE) | 1634-04-4 | 0.20 | 0.50 ug/L | 75 - 128 | 30 | 76 - 135 | 30 |
| Methylcyclohexane | 108-87-2 | 0.20 | 0.50 ug/L | 70 - 130 | 30 | 72 - 143 | 30 |
| Methylene chloride | 75-09-2 | 1.0 | 2.0 ug/L | 57 - 128 | 30 | 55 - 137 | 30 |
| n-Butylbenzene | 104-51-8 | 0.20 | 0.50 ug/L | 61 - 138 | 30 | 79 - 132 | 30 |
| n-Propylbenzene | 103-65-1 | 0.20 | 0.50 ug/L | 66 - 134 | 30 | 78 - 133 | 30 |
| o-Xylene | 95-47-6 | 0.20 | 0.50 ug/L | 69 - 126 | 30 | 78 - 130 | 30 |
| p- & m- Xylenes | 179601-23-1 | 0.50 | 1.0 ug/L | 67 - 130 | 30 | 77 - 133 | 30 |
| p-Isopropyltoluene | 99-87-6 | 0.20 | 0.50 ug/L | 64 - 137 | 30 | 81 - 136 | 30 |
| sec-Butylbenzene | 135-98-8 | 0.20 | 0.50 ug/L | 53 - 155 | 30 | 79 - 137 | 30 |
| Styrene | 100-42-5 | 0.20 | 0.50 ug/L | 69 - 125 | 30 | 67 - 132 | 30 |
| tert-Butyl alcohol (TBA) | 75-65-0 | 0.50 | 1.0 ug/L | 10 - 130 | 30 | 25 - 162 | 30 |
| tert-Butylbenzene | 98-06-6 | 0.20 | 0.50 ug/L | 65 - 139 | 30 | 77 - 138 | 30 |
| Tetrachloroethylene | 127-18-4 | 0.20 | 0.50 ug/L | 64 - 139 | 30 | 82 - 131 | 30 |
| Toluene | 108-88-3 | 0.20 | 0.50 ug/L | 76 - 123 | 30 | 80 - 127 | 30 |
| trans-1,2-Dichloroethylene | 156-60-5 | 0.20 | 0.50 ug/L | 79 - 131 | 30 | 80 - 132 | 30 |
| trans-1,3-Dichloropropylene | 10061-02-6 | 0.20 | 0.50 ug/L | 55 - 130 | 30 | 78 - 131 | 30 |
| Trichloroethylene | 79-01-6 | 0.20 | 0.50 ug/L | 53 - 145 | 30 | 82 - 128 | 30 |
| Trichlorofluoromethane | 75-69-4 | 0.20 | 0.50 ug/L | 61 - 142 | 30 | 67 - 139 | 30 |
| Vinyl Chloride | 75-01-4 | 0.20 | 0.50 ug/L | 31 - 165 | 30 | 58 - 145 | 30 |
| Xylenes, Total | 1330-20-7 | 0.60 | 1.5 ug/L | | | | |

**Volatile Organics, NJDEP/TCL/Part 375 List in Soil (EPA 8260C)** Units: **ug/kg**

| Analyte | CAS# | MDL | Reporting Limit | Matrix Spike | | Blank Spike / LCS | |
|---|---|---|---|---|---|---|---|
| | | | | %R | RPD | %R | RPD |
| 1,1,1-Trichloroethane | 630-20-6 | 2.5 | 5.0 ug/kg | 42 - 145 | 30 | 71 - 137 | 30 |
| 1,1,2,2-Tetrachloroethane | 71-55-6 | 2.5 | 5.0 ug/kg | 16 - 167 | 56 | 79 - 129 | 30 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane ( | 79-34-5 | 2.5 | 5.0 ug/kg | 11 - 160 | 31 | 58 - 146 | 30 |
| 1,1,2-Trichloroethane | 76-13-1 | 2.5 | 5.0 ug/kg | 44 - 145 | 40 | 83 - 123 | 30 |
| 1,1-Dichloroethane | 79-00-5 | 2.5 | 5.0 ug/kg | 46 - 142 | 36 | 75 - 130 | 30 |
| 1,1-Dichloroethylene | 75-35-3 | 2.5 | 5.0 ug/kg | 30 - 153 | 31 | 64 - 137 | 30 |
| 1,2,3-Trichlorobenzene | 75-35-4 | 2.5 | 5.0 ug/kg | 10 - 157 | 47 | 81 - 140 | 30 |
| 1,2,3-Trichloropropane | 526-73-8 | 2.5 | 5.0 ug/kg | 38 - 155 | 48 | 81 - 126 | 30 |
| 1,2,4-Trichlorobenzene | 96-18-4 | 2.5 | 5.0 ug/kg | 10 - 151 | 52 | 80 - 141 | 30 |
| 1,2,4-Trimethylbenzene | 120-82-1 | 2.5 | 5.0 ug/kg | 10 - 170 | 242 | 84 - 125 | 30 |
| 1,2-Dibromo-3-chloropropane | 95-63-6 | 2.5 | 5.0 ug/kg | 36 - 138 | 54 | 74 - 142 | 30 |
| 1,2-Dibromoethane | 96-12-8 | 2.5 | 5.0 ug/kg | 40 - 142 | 39 | 86 - 123 | 30 |
| 1,2-Dichlorobenzene | 106-96-4 | 2.5 | 5.0 ug/kg | 10 - 147 | 52 | 85 - 122 | 30 |
| 1,2-Dichloroethane | 95-50-1 | 2.5 | 5.0 ug/kg | 48 - 133 | 32 | 71 - 133 | 30 |
| 1,2-Dichloropropane | 107-06-2 | 2.5 | 5.0 ug/kg | 47 - 141 | 37 | 81 - 122 | 30 |
| 1,3,5-Trimethylbenzene | 78-87-5 | 2.5 | 5.0 ug/kg | 10 - 150 | 62 | 82 - 126 | 30 |
| 1,3-Dichlorobenzene | 108-67-8 | 2.5 | 5.0 ug/kg | 10 - 144 | 51 | 84 - 124 | 30 |
| 1,4-Dichlorobenzene | 541-73-1 | 2.5 | 5.0 ug/kg | 10 - 160 | 52 | 84 - 124 | 30 |
| 1,4-Dioxane | 106-46-7 | 50 | 100 ug/kg | 10 - 191 | 196 | 10 - 228 | 30 |
| 2-Butanone | 123-91-1 | 2.5 | 5.0 ug/kg | 10 - 189 | 67 | 58 - 147 | 30 |
| 2-Hexanone | 78-93-3 | 2.5 | 5.0 ug/kg | 10 - 181 | 60 | 70 - 139 | 30 |
| 4-Methyl-2-pentanone | 591-78-6 | 2.5 | 5.0 ug/kg | 10 - 166 | 47 | 72 - 132 | 30 |
| Acetone | 108-10-1 | 5.0 | 10 ug/kg | 10 - 196 | 150 | 36 - 155 | 30 |
| Acrolein | 67-64-1 | 5.0 | 10 ug/kg | 10 - 192 | 128 | 10 - 238 | 30 |
| Acrylonitrile | 107-02-8 | 2.5 | 5.0 ug/kg | 13 - 161 | 48 | 66 - 141 | 30 |
| Benzene | 107-13-1 | 2.5 | 5.0 ug/kg | 43 - 139 | 64 | 77 - 127 | 30 |
| Bromochloromethane | 71-43-2 | 2.5 | 5.0 ug/kg | 38 - 145 | 30 | 74 - 129 | 30 |
| Bromodichloromethane | 74-97-5 | 2.5 | 5.0 ug/kg | 38 - 147 | 37 | 81 - 124 | 30 |
| Bromoform | 75-27-4 | 2.5 | 5.0 ug/kg | 29 - 156 | 51 | 80 - 136 | 30 |
| Bromomethane | 75-25-2 | 2.5 | 5.0 ug/kg | 10 - 166 | 42 | 32 - 177 | 30 |
| Carbon disulfide | 74-83-9 | 2.5 | 5.0 ug/kg | 10 - 131 | 36 | 10 - 136 | 30 |
| Carbon tetrachloride | 75-15-0 | 2.5 | 5.0 ug/kg | 35 - 145 | 31 | 66 - 143 | 30 |
| Chlorobenzene | 56-23-5 | 2.5 | 5.0 ug/kg | 21 - 154 | 32 | 86 - 120 | 30 |
| Chloroethane | 108-90-7 | 2.5 | 5.0 ug/kg | 15 - 160 | 40 | 51 - 142 | 30 |
| Chloroform | 75-00-3 | 2.5 | 5.0 ug/kg | 47 - 142 | 29 | 76 - 131 | 30 |
| Chloromethane | 67-66-3 | 2.5 | 5.0 ug/kg | 10 - 159 | 31 | 49 - 132 | 30 |
| cis-1,2-Dichloroethylene | 74-87-3 | 2.5 | 5.0 ug/kg | 42 - 144 | 30 | 74 - 132 | 30 |
| cis-1,3-Dichloropropylene | 156-59-2 | 2.5 | 5.0 ug/kg | 18 - 159 | 39 | 81 - 129 | 30 |
| Cyclohexane | 10061-01-5 | 2.5 | 5.0 ug/kg | 70 - 130 | 30 | 70 - 130 | 30 |
| Dibromochloromethane | 110-82-7 | 2.5 | 5.0 ug/kg | 10 - 179 | 41 | 10 - 200 | 30 |
| Dibromomethane | 124-48-1 | 2.5 | 5.0 ug/kg | 47 - 143 | 41 | 83 - 124 | 30 |
| Dichlorodifluoromethane | 74-95-3 | 2.5 | 5.0 ug/kg | 10 - 145 | 34 | 28 - 158 | 30 |
| Ethyl Benzene | 75-71-8 | 2.5 | 5.0 ug/kg | 11 - 158 | 42 | 84 - 125 | 30 |
| Hexachlorobutadiene | 100-41-4 | 2.5 | 5.0 ug/kg | 10 - 158 | 45 | 83 - 133 | 30 |
| Isopropylbenzene | 87-68-3 | 2.5 | 5.0 ug/kg | 10 - 162 | 57 | 81 - 127 | 30 |
| Methyl acetate | 79-20-9 | 2.5 | 5.0 ug/kg | 10 - 149 | 64 | 41 - 143 | 30 |
| Methyl tert-butyl ether (MTBE) | 1634-04-4 | 2.5 | 5.0 ug/kg | 42 - 152 | 47 | 74 - 131 | 30 |
| Methylcyclohexane | 108-87-2 | 2.5 | 5.0 ug/kg | 70 - 130 | 30 | 70 - 130 | 30 |
| Methylene chloride | 75-09-2 | 5.0 | 10 ug/kg | 28 - 151 | 49 | 57 - 141 | 30 |
| n-Butylbenzene | 104-51-8 | 2.5 | 5.0 ug/kg | 10 - 162 | 96 | 80 - 130 | 30 |
| n-Propylbenzene | 103-65-1 | 2.5 | 5.0 ug/kg | 10 - 155 | 56 | 74 - 136 | 30 |
| o-Xylene | 95-47-6 | 2.5 | 5.0 ug/kg | 10 - 158 | 51 | 83 - 123 | 30 |
| p- & m- Xylenes | 179601-23-1 | 5.0 | 10 ug/kg | 10 - 156 | 47 | 82 - 128 | 30 |
| p-Isopropyltoluene | 99-87-6 | 2.5 | 5.0 ug/kg | 10 - 147 | 60 | 85 - 125 | 30 |
| sec-Butylbenzene | 135-98-8 | 2.5 | 5.0 ug/kg | 10 - 157 | 56 | 83 - 125 | 30 |
| Styrene | 100-42-5 | 2.5 | 5.0 ug/kg | 13 - 171 | 39 | 86 - 126 | 30 |
| tert-Butyl alcohol (TBA) | 75-65-0 | 2.5 | 5.0 ug/kg | 34 - 179 | 35 | 70 - 130 | 30 |
| tert-Butylbenzene | 98-06-6 | 2.5 | 5.0 ug/kg | 10 - 160 | 79 | 80 - 127 | 30 |
| Tetrachloroethylene | 127-18-4 | 2.5 | 5.0 ug/kg | 30 - 167 | 33 | 80 - 129 | 30 |
| Toluene | 108-88-3 | 2.5 | 5.0 ug/kg | 21 - 160 | 50 | 85 - 121 | 30 |
| trans-1,2-Dichloroethylene | 156-60-5 | 2.5 | 5.0 ug/kg | 29 - 153 | 30 | 72 - 132 | 30 |
| trans-1,3-Dichloropropylene | 10061-02-6 | 2.5 | 5.0 ug/kg | 18 - 155 | 30 | 78 - 132 | 30 |
| Trichloroethylene | 79-01-6 | 2.5 | 5.0 ug/kg | 24 - 169 | 30 | 84 - 123 | 30 |
| Trichlorofluoromethane | 75-69-4 | 2.5 | 5.0 ug/kg | 35 - 142 | 30 | 62 - 140 | 30 |
| Vinyl Chloride | 75-01-4 | 2.5 | 5.0 ug/kg | 12 - 160 | 35 | 52 - 130 | 30 |
| Xylenes, Total | 1330-20-7 | 7.5 | 15 ug/kg | | | | |

| Surrogates | CAS# | True Value | %R |
|---|---|---|---|
| 1,2-Dichloroethane-d4 | 17060-07-0 | 50 ug/L | 77-125 |
| Toluene-d8 | 2037-26-5 | 50 ug/L | 85-120 |
| p-Bromofluorobenzene | 460-00-4 | 50 ug/L | 76-130 |
| | | | |
| **Internal Standards** | **CAS#** | **True Value** | **%R** |
| Fluorobenzene | 462-06-6 | 50 ug/L | 50-200 |
| Chlorobenzene-d5 | 3114-55-4 | 50 ug/L | 50-200 |
| 1,2-Dichlorobenzene-d4 | 2199-69-1 | 50 ug/L | 50-200 |

# ATTACHMENT C
# ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE

**ATTACHMENT C**
**ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE**

| Matrix Type | Field Parameters | Laboratory Parameters | Analytical Methods | Sample Preservation | Sample Container Volume and Type | Sample Hold Time | Field Duplicate Samples | Equipment Blank Samples | Trip Blank Samples | Ambient Air Samples | MS/MSD Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Groundwater** | Temperature, Turbidity, pH, ORP, Conductivity | Part 375 and TCL VOCs | EPA 8260C | Cool to 4°C; HCl to pH <2; no headspace | Three 40-mL VOC vials with Teflon® -lined cap | Analyze within 14 days of collection | 1 per 20 samples (minimum 1) | 1 per 20 samples (minimum 1) | 1 per Shipment of VOC samples | NA | 1 per 20 samples |
| | | Part 375 and TCL SVOCs | EPA 8270D and 8270D with SIM | Cool to 4°C | Two 1-Liter Amber Glass | 7 days to extract; 40 days after extraction to analysis | | | NA | | |
| | | 1,4-Dioxane as SVOC | EPA 8270D With SIM | Cool to 4°C | Two 1-Liter Amber Glass | 7 days to extract; 40 days after extraction to analysis | | | | | |
| | | Part 375 and TCL Pesticides | EPA 8081B | Cool to 4°C | Two 1-Liter Amber Glass | 7 days to extract; 40 days after extraction to analysis | | | | | |
| | | PCBs | EPA 8082A | Cool to 4°C | | | | | | | |
| | | PFAS | EPA 537M | Cool to 4°C; Trizma | Three 25--mL HDPE or polypropylene container | 14 days to extract; 28 days after extraction to analysis | | | | | |
| | | Part 375 and TAL Metals | EPA 6010C, 6020A, 7470A | Cool to 4°C; $HNO_3$ to pH <2 | 250 mL plastic | 6 months, except Mercury 28 days | | | | | |
| | | Hexavalent Chromium | EPA 7196A | Cool to 4°C | 250 mL plastic | 24 Hours | | | | | |
| | | Cyanide | EPA 9012B/SM4500 C/E | NaOH plus 0.6g ascorbic acid | 250 mL plastic | 14 days to extract; 28 days after extraction to analysis | | | | | |
| **Soil** | Total VOCs via PID | Part 375 and TCL VOCs | EPA 8260C | Cool to 4°C | Two 40-mL VOC Vials with 5mL $H_2O$, one with MeOH or 3 Encore Samplers (separate container for % solids) | Analyze within 14 days of collection | 1 per 20 samples (minimum 1) | 1 per 20 samples (minimum 1) | 1 per Shipment of VOC samples | NA | 1 per 20 samples |
| | | Part 375 and TCL SVOCs | EPA 8270D and 8270D with SIM | Cool to 4°C | 4 oz. jar* | 14 days to extract; 40 days after extraction to analysis | | | NA | | |
| | | Part 375 and TCL Pesticides | EPA 8081B | Cool to 4°C | 4 oz. jar* | 14 days to extract; 40 days after extraction to analysis | | | | | |
| | | PCBs | EPA 8082A | Cool to 4°C | | | | | | | |
| | | Part 375 and TAL Metals | EPA 6010C, 7471B | Cool to 4°C | 2 oz. jar* | 6 months, except Mercury 28 days | | | | | |
| | | Percent Solids | SM 2540G | | | NA | | NA | | | NA |
| **Soil Gas** | Total VOCs via PID | TO-15 Listed VOCs | EPA TO-15 | Ambient Temperature | 6-Liter Summa Canister | Analyze within 30 days of collection | 1 per 20 samples (minimum 1) | 1 per 20 samples (minimum 1) | NA | 1 per 10 samples | NA |
| **Indoor Air** | Total VOCs via PID | TO-15 Listed VOCs | EPA TO-15 | Ambient Temperature | 6-Liter Summa Canister | Analyze within 30 days of collection | 1 per 20 samples (minimum 1) | 1 per 20 samples (minimum 1) | NA | 1 per 10 samples | NA |

Notes:
ORP - Oxidation-Reduction Potential
VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls
PFAS - Perfluoro Alkylated Substances
SIM - Selected Ion Monitoring
HCl - Hydrochloric Acid
$HNO_3$ - Nitric Acid
MeOH - Methanol
NaOH - Sodium Hydroxide
*Can be combined in one or more 8 oz. jars

# ATTACHMENT D
# PERFLUORINATED COMPOUND SAMPLING PROTOCOL

# Collection of Groundwater Samples for Perfluorooctanoic Acid (PFOA) and Perfluorinated Compounds (PFCs) from Monitoring Wells Sample Protocol

**Samples collected using this protocol are intended to be analyzed for perfluorooctanoic acid (PFOA) and other perfluorinated compounds by Modified (Low Level) Test Method 537.**

**The sampling procedure used must be consistent with the NYSDEC March 1991 SAMPLING GUIDELINES AND PROTOCOLS**
http://www.dec.ny.gov/regulations/2636.html with the following materials limitations.

At this time acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE) and polypropylene. Additional materials may be acceptable if proven not to contain PFCs. **NOTE: Grunfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps).** All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse should be considered for equipment that does come in contact with PFC materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and "plumbers thread seal tape" contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 500 mL HDPE or polypropylene bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at 4 ± 2º Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples.

Collect one field duplicate for every sample batch, not to exceed 20 samples.

Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category A or B) and an electronic data deliverable.

# EPA 537 Field Sampling Guidelines

Sampling for PFAAs via EPA 537 can be challenging due to the prevalence of these compounds in consumer products. The following guidelines are strongly recommended when conducting sampling.

**Reference-NHDES https://www.des.nh.gov/organization/divisions/waste/hwrb/documents/pfc-stakeholder-notification-20161122.pdf**

## Field Clothing and PPE

- No clothing or boots containing Gore-TexTM
- All safety boots made from polyurethane and PVC
- No materials containing Tyvek®
- Do not use fabric softener on clothing to be worn in field
- Do not used cosmetics, moisturizers, hand cream, or other related products the morning of sampling
- Do not use unauthorized sunscreen or insect repellant (see reference above for acceptable products)

## Sample Containers

- All sample containers made of HDPE or polypropylene
- Caps are unlined and made of HDPE or polypropylene

## Wet Weather (as applicable)

Wet weather gear made of polyurethane and PVC only

## Equipment Decontamination

- "PFC-free" water on-site for decontamination of sample equipment. No other water sources to be used.
- Only Alconox and Liquinox can be used as decontamination materials

## Food Considerations

- No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

## Other Recommendations

Sample for PFCs first! Other containers for other methods may have PFCs present on their sampling containers

## Field Equipment

- Must not contain Teflon® (aka PTFE) or LDPE materials
- All sampling materials must be made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books can be used
- No plastic clipboards, binders, or spiral hard cover notebooks can be used
- No adhesives (i.e.Post-It Notes) can be used
- Sharpies and permanent markers not allowed; regular ball point pens are acceptable
- Aluminum foil must not be used
- Keep PFC samples in separate cooler, away from sampling containers that may contain PFCs
- Coolers filled with regular ice only. Do not use chemical (blue) ice packs.

# EPA Method 537 (PFAS) Sampling Instructions

Please read instructions entirely prior to sampling event.

*Sampler must wash hands before wearing nitrile gloves in order to limit contamination during sampling.

Each sample set* requires a set of containers to comply with the method as indicated below.
*sample set is composed of samples collected from the same sample site and at the same time.

| Container Count | Container Type | Preservative |
|---|---|---|
| 3 Sampling Containers - Empty | 250 mL container | Pre preserved with 1.25 g Trizma |
| Reagent Water for Field Blank use | 250 mL container | Pre preserved with 1.25 g Trizma |
| 1 Field Blank (FRB) Container - Empty | 250 mL container | Unpreserved |

**** Sampling container must be filled to the neck. For instructional purposes a black line has been drawn to illustrate the required fill level for each of the 3 Sample containers****

Field blanks are recommended and the containers have been provided, please follow the instructions below.

**Field Blank Instructions:**

1. Locate the Reagent Water container from the bottle order. The Reagent Water container will be prefilled with PFAS-free water and is preserved with Trizma.
2. Locate the empty container labeled “Field Blank”.
3. Open both containers and proceed to transfer contents of the “Reagent Water” container into the “Field Blank” container.
4. If field blanks are to be analyzed, they need to be noted on COC, and will be billed accordingly as a sample.

**Both the empty Reagent Water container and the filled Field Blank container must be returned to the laboratory along with the samples taken.**

**Sampling Instructions:**

1. Each sampling event requires 3 containers to be filled to the neck of the provided containers for each sampling location.
2. Before sampling, remove faucet aerator, run water for 5 min, slow water to flow of pencil to avoid splashing and fill sample containers to neck of container (as previously illustrated) and invert 5 times.
3. Do not overfill or rinse the container.
4. Close containers securely. Place containers in sealed ZipLoc bags, and in a separate cooler (no other container types).
5. Ensure Chain-of-Custody and all labels on containers contain required information.Place sample, Field Blank and empty Reagent Blank containers in ice filled cooler (do not use blue ice) and return to the laboratory. Samples should be kept at 4°C ±2. Samples must not exceed 10°C during first 48 hours after collection. Hold time is 14 days.

Please contact your project manager with additional questions or concerns.

# Groundwater Sampling for Emerging Contaminants

February 2018

Issue: NYSDEC has committed to analyzing representative groundwater samples at remediation sites for emerging contaminants (1,4-dioxane and PFAS) as described in the below guidance.

## Implementation

NYSDEC project managers will be contacting site owners to schedule sampling for these chemicals. Only groundwater sampling is required. The number of samples required will be similar to the number of samples where "full TAL/TCL sampling" would typically be required in a remedial investigation. If sampling is not feasible (e.g., the site no longer has any monitoring wells in place), sampling may be waived on a site-specific basis after first considering potential sources of these chemicals and whether there are water supplies nearby.

Upon a new site being brought into any program (i.e., SSF, BCP), PFAS and 1,4-dioxane will be incorporated into the investigation of groundwater as part of the standard "full TAL/TCL" sampling. Until an SCO is established for PFAS, soil samples do not need to be analyzed for PFAS unless groundwater contamination is detected. Separate guidance will be developed to address sites where emerging contaminants are found in the groundwater. The analysis currently performed for SVOCs in soil is adequate for evaluation of 1,4-dioxane, which already has an established SCO.

## Analysis and Reporting

Labs should provide a full category B deliverable including preparation of a DUSR.

The work plan should explicitly describe analysis and reporting requirements.

PFAS sample analysis: Samples should be analyzed by an environmental laboratory certified by ELAP to use EPA method 537 or ISO 25101. ELAP does not currently offer certification for PFAS analysis of non-drinking water samples (including groundwater, soil and sediment), so there is no requirement to use an ELAP certified method. The preferred method is the modified EPA Method 537. Labs have been able to achieve reporting limits for PFOA and PFOS of 2 ng/l (part per trillion). If labs are not able to achieve similar reporting limits, the NYSDEC project manager will make case-by-case decisions as to whether the analysis can meet the needs for the specific site.

PFAS sample reporting: DER has developed a PFAS target analyte list (below) with the intent of achieving reporting consistency between labs for commonly reportable analytes. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. This list may be updated in the future as new information is learned and as labs develop new capabilities. If lab and/or matrix specific issues are encountered for any particular compounds, the NYSDEC project manager will make case-by-case decisions as to whether particular analytes may be temporarily or permanently discontinued from analysis for each site. Any technical lab issues should be brought to the attention of a NYSDEC chemist.

Some sampling using this full PFAS target analyte list is needed to understand the nature of contamination. It may also be critical to differentiate PFAS compounds associated with a site from other sources of these chemicals. Like routine refinements to parameter lists based on investigative findings, the full PFAS target analyte list may not be needed for all sampling intended to define the extent of

contamination. Project managers may approve a shorter analyte list (e.g., just the UCMR3 list) for some reporting on a case by case basis.

1,4-Dioxane Analysis and Reporting: The method detection limit (MDL) for 1,4-dioxane should be no higher than 0.28 µg/l (ppb). ELAP offers certification for both EPA Methods 8260 and 8270. In order to get the appropriate detection limits, the lab would need to run either of these methods in "selective ion monitoring" (SIM) mode. DER is advising PMS to use 8270, since this method provides a more robust extraction procedure, uses a larger sample volume, and is less vulnerable to interference from chlorinated solvents (we acknowledge that 8260 has been shown to have a higher recovery in some studies).

## Full PFAS Target Analyte List

| | | | |
|---|---|---|---|
| Perfluoroalkyl sulfonates | **Perfluorobutanesulfonic acid** | **PFBS** | **375-73-5** |
| | **Perfluorohexanesulfonic acid** | **PFHxS** | **355-46-4** |
| | Perfluoroheptanesulfonic acid | PFHpS | 375-92-8 |
| | **Perfluorooctanessulfonic acid** | **PFOS** | **1763-23-1** |
| | Perfluorodecanesulfonic acid | PFDS | 335-77-3 |
| Perfluoroalkyl carboxylates | Perfluorobutanoic acid | PFBA | 375-22-4 |
| | Perfluoropentanoic acid | PFPeA | 2706-90-3 |
| | Perfluorohexanoic acid | PFHxA | 307-24-4 |
| | **Perfluoroheptanoic acid** | **PFHpA** | **375-85-9** |
| | **Perfluorooctanoic acid** | **PFOA** | **335-67-1** |
| | **Perfluorononanoic acid** | **PFNA** | **375-95-1** |
| | Perfluorodecanoic acid | PFDA | 335-76-2 |
| | Perfluoroundecanoic acid | PFUA/PFUdA | 2058-94-8 |
| | Perfluorododecanoic acid | PFDoA | 307-55-1 |
| | Perfluorotridecanoic acid | PFTriA/PFTrDA | 72629-94-8 |
| | Perfluorotetradecanoic acid | PFTA/PFTeDA | 376-06-7 |
| Fluorinated Telomer Sulfonates | 6:2 Fluorotelomer sulfonate | 6:2 FTS | 27619-97-2 |
| | 8:2 Fluorotelomer sulfonate | 8:2 FTS | 39108-34-4 |
| Perfluorooctane-sulfonamides | Perfluroroctanesulfonamide | FOSA | 754-91-6 |
| Perfluorooctane-sulfonamidoacetic acids | N-methyl perfluorooctanesulfonamidoacetic acid | N-MeFOSAA | 2355-31-9 |
| | N-ethyl perfluorooctanesulfonamidoacetic acid | N-EtFOSAA | 2991-50-6 |

Bold entries depict the 6 original UCMR3 chemicals