145-65 WOLCOTT STREET
BROOKLYN, NEW YORK
NYSDEC BCP ID: C224256

REMEDIAL INVESTIGATION WORK PLAN

SUBMITTED TO:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7016

PREPARED FOR:

145-65 Wolcott St. Realty Corp.
109 Southampton Place North
Venice, Florida 34298

PREPARED BY:

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PWGC Project Number: IOV1701

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P.W. GROSSER CONSULTING, INC.
PROJECT No. IOV 1701
New York State Department of Environmental Conservation
Brownfield Site No. C224256

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PWGC
Strategic Environmental Engineering Solutions

CERTIFICATION

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

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.

6/25/18
Date

Signature

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

1.0 INTRODUCTION

P.W. Grosser Consulting, Inc. (PWGC) has prepared this Remedial Investigation Work Plan (RIWP) to outline procedures and a scope of work intended to delineate subsurface impacted areas of concern at the property located at 145-65 Wolcott Street, Brooklyn, New York 11231.

The Applicant, 145-65 Wolcott St. Realty Corp., has been accepted into the New York State Department of Environmental Conservation's (NYSDEC) Brownfield Cleanup Program (BCP) as a volunteer as set forth in a Brownfield Cleanup Agreement (BCA) dated February 21, 2018 (Site No. C224256). As such, the proposed Remedial Investigation (RI) is intended to delineate potential areas of concern within the property boundary.

1.1 Project Background

A Phase I Environmental Site Assessment (ESA) and Phase II ESA were conducted at the site in 2015 by Volumetric Techniques, Ltd. of Bayport, New York (VTL). The Phase I ESA identified various industrial and commercial uses of the site. The Phase II ESA identified elevated concentrations of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals in on-site subsurface soils.

1.2 Previous Investigations

PWGC has reviewed the following environmental reports related to the site.

1.2.1 ESA Report (02/09/2015)

Prepared by: Volumetric Techniques, LTD (VTL)

VTL conducted a Phase I ESA and Phase II ESA in February 2015. During the subsurface investigation, historic urban fill material was observed in the subsurface down to groundwater.

The soil samples that were collected were analyzed for VOCs, SVOCs, and metals. VOCs, SVOCs, and metals were detected in multiple samples in excess of the Cleanup Objectives specified in NYCDEC 6 NYCRR Part 375.

The NYSDEC Petroleum Bulk Storage Database indicated that six USTs and two ASTs are listed for the site. Four 550-gallon USTs and one 6,000-gallon UST are closed in place. One 6,000-gallon UST was removed. Two 275-

gallon ASTs are in service. Groundwater samples indicated elevated concentrations of SVOCs and metals exceeding the NYSDEC AWQS.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Description

The Site is identified as Kings County Section 30207, Block 547, Lots 1, 24 and 23. The Site is improved with a warehouse and two portable office trailer buildings. The remainder of the Site is paved parking area. The entire property is approximately 1.8 acres in area.

The site is currently inactive and has recently been utilized for bus storage and maintenance activities. The property is zoned M2-1 manufacturing and is surrounded by similarly-zoned properties. The surrounding properties are mostly utilized for industrial uses, with some commercial office space and residential uses.

A Vicinity Map is included as **Figure 1**. A Site Plan is included as **Figure 2**.

2.2 Site History

The environmental Site history is detailed in a combined Phase I / Phase II Environmental Site Assessment (ESA) Report prepared by Volumetric Techniques, Ltd. (VTL) dated February 9, 2015 (VTL). The summary of the property's environmental history detailed below is based upon the findings of the VTL ESA.

Certified Environmental Site Assessment (VTL), February 9, 2015

The Site consists of 1.8 acres over three adjacent tax lots. The Site encompasses approximately ¾ of a city block and is bound by Wolcott Street to the northeast, Conover Street to the southeast, Dikeman Street to the southwest and Ferris Street to the northwest. There are several adjacent property lots in the south corner of the block that are not included as part of this Site. The property is improved with a 30,000 ft^2 garage structure built in the early 1900s and two portable office structures, each approximately 500 ft^2. The remainer of the site is paved parking.

The garage structure has a maintenance pit, and electric lifts and contains offices on the second floor. The property has recently been used for school bus maintenance and storage.

As part of the VTL ESA, soil samples and groundwater samples from 20 borings throughout the site were collected in February and March 2015. No soil vapor samples were collected.

During the subsurface investigation, historic urban fill material (i.e. wood, coal/bituminous ash, tars, concrete, brick, resins) were observed in the subsurface down to groundwater.

The soil samples that were collected were analyzed for VOCs, SVOCs, and metals. The samples were compared the NYSDEC Unrestricted Use Soil Clean-Up Objectives (UUSCO) and Commercial Use Soil Clean-Up Objectives (CUSCO). Laboratory analysis showed each soil sample contained one or more analytes that exceeded UUSCOs. Multiple VOCs, SVOCs, and metals were also detected in multiple samples in excess of the CUSCO.

The northeast corner of the site showed exceedances in VOCs, SVOCs, and metals. Some of these exceedances included, but were not limited to, benzo(a)anthracene, chrysene, indeno(1,2,3 -cd)pyrene, toluene, acetone, arsenic, lead, and chromium. The southeast corner of the site showed exceedances in n-propylbenzene, lead, and chromium. The **Figure 2** illustrates the location of previous soil sample locations along with exceedances of VOCS, SVOCs, and metals in excess of UUSCOs.

In addition, a sample collected 2 feet below surface of a storm drain culvert on the east side of the rear yard also had elevated VOCs, SVOCS, and metals that exceeded UUSCOs.

During the investigation, evidence of up to eight ASTs and USTs were noted including a 6,000-gallon diesel fuel tank, five-gallon gasoline containers, a former cosmoline tank, and several 275-gallon waste oil tanks. It has been reported that many, if not all, of these tanks have been removed. No tank closure reports have been provided.

The groundwater samples that were collected were analyzed for VOCs, SVOCs, and metals and were compared to the New York State Ambient Water Quality Standards (AWQS). VOC, SVOCs, and metals were detected in multiple samples at the site in concentrations exceeding the AWQS. The **Figure 2** illustrates the location of previous soil and groundwater sample locations.

2.3 Regional Geology/Hydrogeology

The geologic setting of western Long Island is well documented and consists of crystalline bedrock composed of schist and gneiss overlain by layers of unconsolidated deposits. Immediately overlying the bedrock is the Raritan Formation, consisting of the Lloyd sand confined by the Raritan Clay Member. The Lloyd sand is an aquifer and

consists of discontinuous layers of gravel, sand, sandy and silty clay, and solid clay. The Raritan Clay is a solid and silty clay with few lenses of sand and gravel; abundant lignite and pyrite; and gray, red or white in color.

Above the Raritan Clay lies the Magothy Formation. The Magothy Aquifer consists of layers of fine to coarse sand of moderate to high permeability, with inter-bedded lenses of silt and clay of low permeability resulting in areas of preferential horizontal flow. Therefore, this aquifer generally becomes more confined with depth. The Magothy Aquifer is overlain by the Jameco and Upper Glacial Aquifer systems. The Upper Glacial Aquifer is the water table aquifer at this location and is comprised of medium to coarse sand and gravel with occasional thin lenses of fine sand and brown clay. This aquifer extends from the land surface to the top of the Magothy and, therefore, is hydraulically connected to the Magothy Aquifer.

2.4 Site Geology/Hydrogeology

Based upon the USGS Depth to Water Viewer, the depth to groundwater beneath the site is estimated at approximately 10 feet below ground surface. Based upon a review of the USGS Groundwater Conditions on Long Island, New York in 2010, groundwater flow appears to be toward the northwest.

2.5 Site Features

The project site elevation is approximately 10 feet above mean sea level, and is generally level. The site is developed with a warehouse and two portable office buildings. The remainder of the site is paved parking. There are no exposed areas of vegetation.

2.6 Current and Future Site Use

The site is currently vacant. No significant changes in use of the site are planned for the near future. The goal of the cleanup at the site is to achieve Track 1 status. However, it is understood that the project may achieve Track 2 or Track 4.

3.0 STANDARDS, CRITERIA, AND GUIDANCE (SCGS)

Based on previous investigation at the site, the primary chemicals of potential concern (COPC) to be encountered at the site are VOCs, SVOCs, and metals related to the former site usage as a manufacturing facility.

Applicable regulations at NYSDEC 6 NYCRR Part 375 provide Soil Cleanup Objectives (SCOs) based upon future site use. In addition, Track 3 (restricted use with modified soil cleanup objectives) and Track 4 (restricted use with site-specific cleanup objectives) cleanup options can include complete removal of contaminated soils using site-specific soil objectives, partial removal with surface capping, in situ treatment, and Institutional Controls and/or Engineering Controls to prevent exposure of workers and future inhabitants to COPCs. In addition, groundwater protection values will be used for soil contamination that is in the groundwater. For the purposes of this project, soil results will be compared to the lower of the Groundwater Protection Value SCOs and Restricted Use SCOs.

Groundwater sample results will be compared to the AWQS as specified in the Technical Operation and Guidance Series (TOGS 1.1.1) Ambient Water Quality Standards and Guidance Values.

Sub Slab Soil Vapor, Indoor Air, and Outdoor Air results will be compared to the matrices and guidance values specified in NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (2006).

4.0 OBJECTIVES, SCOPE, AND RATIONALE

The primary objectives of the work detailed in this plan are to collect the information and field data necessary to address data gaps pertaining to on-site issues. The scope of work includes the following tasks:

1. Geophysical investigation
2. Characterization of potential areas of concern
3. Delineation of on-site soil impact
4. Characterization of on-site groundwater
5. Confirmation of site-specific groundwater flow direction
6. Characterization of on-site soil vapor intrusion
7. On-site and off-site qualitative human health exposure evaluation

4.1 Geophysical Investigation

In order to determine if subsurface anomalies are present at the site, a geophysical investigation of the entire subject property, where accessible, will be performed.

4.1.1 Electromagnetic Survey

The electromagnetic (EM) method uses the principle of electromagnetic induction to measure the variability of electrical conductivity of subsurface materials and the presence of buried metal objects. Significant contrasts in the electrical properties between non-indigenous materials and surrounding soil enable accurate delineation of buried waste materials, fill, and air spaces. The large EM response to metal makes this technique particularly well-suited to identifying buried metal objects such as underground storage tanks (USTs), metallic wastes, buried drums, pipelines, reinforced building foundations, or other metal components of buried structures. It is, however, equally sensitive to metal objects on the ground surface, and it is important to take careful field notes that indicate the position of surface metal to avoid misinterpretation.

A Geonics EM-61 high-resolution time domain metal detector, or equivalent, will be used to conduct the first phase of the investigation. The EM-61 is used to detect both ferrous and non-ferrous metals buried in the upper 10 feet of the subsurface. A powerful transmitter generates a pulsed primary magnetic field, which induces eddy currents in nearby metal objects. The decay of these currents is measured by upper and lower receiver coils mounted in the coil assembly. The responses are recorded and displayed by an integrated data logger as

two-channel information. The bottom channel is more sensitive to metallic objects in the shallow (upper few feet) subsurface, and the differential response is more sensitive to metal objects from 3 to 10 feet below ground surface. The EM-61 can detect a single 55-gallon drum at a depth of more than 10 feet beneath the instrument, yet it is relatively insensitive to interference from nearby surface metal such as fencing, buildings, and automobiles. The instrument is pulled along the ground surface by a single operator, and measurements are collected at desired intervals along the ground surface. The terrain at the site may limit the areas where the EM-61 survey can be completed.

A survey of the area will also be performed using a hand held split-box metal detector (Fisher Model TW-6). The TW-6 is a split-box electromagnetic metal detector that is very sensitive to near surface ferrous metal objects and is very useful in detecting the surface expression of subsurface ferrous objects. This instrument is commonly used to identify buried storage tanks and other metallic objects.

Anomalies detected during the EM surveys will be marked on the ground and further investigated using ground-penetrating radar (GPR).

4.1.2 Ground Penetrating Radar Survey

The GPR survey will be performed in areas of anomalies detected by the EM survey. The GPR method is based upon the transmission of repetitive, radio-frequency EM pulses into the subsurface. When the transmitted energy of a wave contacts an interface of dissimilar electrical character, part of the energy is returned to the surface in the form of a reflected signal. This reflected signal is detected by a receiving transducer and is displayed on the screen of the GPR unit and is recorded on the internal hard drive.

The received GPR response remains constant as long as the electrical contrast between media is present and constant. Lateral or vertical changes in the electrical properties of the subsurface result in equivalent changes in the GPR responses. The system records a continuous image of the subsurface by plotting two-way travel time of the reflected EM pulse versus distance traveled along the ground surface. Two-way travel time values are then converted to depth using known soil velocity functions. Each radar profile will be examined for characteristic GPR signatures that may indicate the presence of buried targets.

Following the geophysical survey, exploratory test pits or soil borings may be conducted in the vicinity of anomalies in order to determine their nature. A contingency plan will be prepared and submitted to the NYSDEC to properly address anomalies which are determined to be USTs, including residual petroleum spills which may have occurred. State and City records will also be searched prior to the start of the field investigation to obtain additional information which may be available regarding UST permits, records of installation, and records of closure.

4.2 Characterization of Potential Areas of Concern

Previous investigations have identified historic urban fill material (i.e. wood, coal/ bituminous ash, tars, concrete, brick, resins) in the subsurface down to ground water, ASTs, existing abandoned USTs, former tank areas, and the area of the tar-like substance. Potential source areas will be delineated as part of this remedial investigation. In addition, an adequate number and type of samples will be collected and analyzed to perform a sufficient and accurate characterization of the entire site and a qualitative exposure assessment offsite.

Sampling will be performed in accordance with the Division of Environmental Remediation (DER) DER-10 Technical Guidance for Site Investigation and Remediation, May 2010.

4.3 Soil Delineation

Soil sampling will be performed in accordance with the DER-10 Technical Guidance for Site Investigation and Remediation, May 2010.

To further characterize subsurface conditions, soil borings will be installed throughout the property. A minimum of eighteen borings will be installed. Boring locations will be focused near areas in which elevated VOCs, SVOCs, and metals were detected during previous investigations, in the area of the tar-like substance, in current, former, and potential tank areas, and where samples were not previously collected. The collected data will be used to aid in the off-site exposure assessment, help characterize soils for disposal, determine the remediation and closure strategy for tanks, and to quantify the levels of contamination at potential depths for redevelopment excavation. Proposed soil boring locations are illustrated in **Figure 2**.

Soil borings will be performed utilizing a Geoprobe® direct-push drill rig outfitted with a macro-core sampler and dedicated acetate liners. Drilling methods will be capable of penetrating standard concrete slabs, fill material, and the tar-like substance to achieve depths necessary to delineate the areas of concern. Soils will be collected

continuously from ground surface to below the water table. Soils will be field-screened for the presence of VOCs using a photo-ionization detector (PID). Should VOC impact be identified, the boring will be extended vertically and the terminal boring depth will be determined based upon PID response and field observations in order to fully delineate soil contamination vertically.

Soil samples will be collected continuously from each soil boring. Samples which exhibit elevated PID responses will be submitted for laboratory analysis. Samples collected at 0 to 2 feet below grade (excluding building foundation/asphalt pavement sub-base material) will be submitted for laboratory analysis, as will the sample interval from directly above the water table, approximately 6 to 8 feet below grade. Soil samples will be analyzed for VOCs by USEPA Method 8260, SVOCs by USEPA Method 8270, Pesticides/PCBs by USEPA Method 8081/8082metals by USEPA Method 6010/7471, and total petroleum hydrocarbons (TPH) by USEPA Method 8015. All soil samples collected for VOCs will be discrete samples (non-composite and non-homogenous) to minimize volatilization.

4.4 Characterization of On-Site Groundwater

Groundwater sampling will be performed in accordance with the DER-10 Technical Guidance for Site Investigation and Remediation, May 2010.

To further characterize groundwater quality beneath the site, eleven permanent groundwater monitoring wells will be installed and sampled and vertical profile sampling will be performed at four locations. Proposed groundwater sampling locations are identified on **Figure 2**.

4.5 Groundwater Monitoring Wells

In order to determine site specific groundwater flow direction and monitor groundwater quality, groundwater monitoring wells will be installed on-site. Proposed monitoring well locations are illustrated in **Figure 2.**

Monitoring wells will be installed in accordance with the DER-10 Technical Guidance for Site Investigation and Remediation, May 2010.

A rotary drill rig and/or Geoprobe® (or equivalent) direct push drill rig outfitted for rotary drilling will be used to install the wells with hollow-stem augers using standard drilling methods. Drilling methods will be capable of penetrating concrete, fill material, and the tar-like substance to achieve depths necessary to delineate the areas of concern. The wells will be constructed of two-inch diameter, schedule 40 PVC casing and screen with 0.010 inch slot. The wells will be constructed with a 10-foot screen section and riser to grade unless precluded by hydrogeologic conditions. The well annulus will be filled with #2 morie sand, or equivalent, to two feet above the well screen. The screen will be set with seven (7) feet into and three (3) feet above the water table at the time of installation. A two-foot fine sand layer will be installed above the screen followed by a two-foot bentonite seal. Above the bentonite layer, the annulus around the well will be filled with a cement/bentonite grout. A concrete surface pad (2 feet by 2 feet by 6-inch) will be installed. The wells will be finished with flush mount curb boxes. Monitoring well construction diagrams will be developed for each of the monitoring wells.

4.5.1 Monitoring Well Development and Sampling

No less than 48 hours after installation, the newly installed monitoring wells will be developed by over-pumping to restore the hydraulic properties of the aquifer. Well development will continue until the turbidity of the groundwater is less than or equal to 50 Nephelometric Turbidity Units (NTUs), or when pH, temperature, and conductivity measurements stabilize. Stabilization is considered achieved when three consecutive readings of these field parameters are within five percent of each other over a period of 15 minutes. Monitoring well development water will be containerized for off-site disposal.

Groundwater samples will be collected in compliance with the United States Environmental Protection Agency (USEPA) Low-flow Groundwater Purging and Sampling Procedure (USEPA, 1998). Groundwater samples will be analyzed for VOCs by USEPA Method 8260, SVOCs (including 1,4-dioxane) by USEPA Method 8270, Pesticides/PCBs by USEPA Method 8081/8082, metals by USEPA Method 6010/7471 (both filtered and unfiltered), and perfluoro-alkyl substances (PFAS) by isotope dilution method 537.

4.5.2 Monitoring Well Survey

The monitoring well casing tops will be surveyed to a relative datum for the purposes of determining site-specific groundwater flow direction and gradient. This information will be utilized on groundwater contour maps generated for the Remedial Investigation/Alternatives Analysis Report.

4.6 Vertical Profile Sampling

Four temporary vertical profile wells will be installed using a direct-push drill rig (Geoprobe®, or equivalent) fitted with a four-foot, stainless steel, sealed screen sampler (Geoprobe® Screen Point Sampler, or equivalent). Drilling methods will be capable of penetrating concrete, fill material, and the tar-like substance to achieve depths necessary to delineate the areas of concern. At each vertical profile location, samples will be collected at 10-foot intervals beginning at the water table interface and extending to the terminal depth of the vertical profile. Proposed vertical profile locations are illustrated in **Figure 2.**

At each sample interval, the screen point sampler will be opened so that the four-foot screen is exposed, and a groundwater sample will be collected. Following sample collection, the sampling screen will be recovered and decontaminated prior to reinstallation at the next sample interval. This process will continue to a depth of 80 feet bgs. Groundwater samples will be collected in compliance with the United States Environmental Protection Agency (USEPA) Low-flow Groundwater Purging and Sampling Procedure (USEPA, 1998).

Based on the observed depth to groundwater beneath the site (approximately ten feet bgs), and the reported depth of contamination on adjacent sites, PWGC anticipates collecting a minimum of eight samples from each vertical profile well: 9 to 13 feet, 16 to 20 feet, 26 to 30 feet, 36 to 40 feet, 46 to 50 feet, 56 to 60 feet, 66 to 70 feet, and 76 to 80 feet.

Groundwater samples will be analyzed for VOCs by USEPA Method 8260, SVOCs (including 1,4-dioxane) by USEPA Method 8270, Pesticides/PCBs by USEPA Method 8081/8082, metals by USEPA Method 6010/7471 (both filtered and unfiltered), and perfluoro-alkyl substances (PFAS) by isotope dilution method 537.

4.7 Vapor Intrusion Evaluation

A soil vapor intrusion investigation will be conducted within and surrounding the building. Work related to the vapor intrusion evaluation will be conducted in accordance with the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (2006). Sub-slab vapor, soil vapor, and ambient air sample locations are indicated on **Figure 2**. If the initial investigation is conducted outside of the normal heating season, a limited follow-up soil vapor intrusion study within the building footprint may be conducted based upon future development plans.

4.7.1 Sub-slab Vapor/Indoor Air

PWGC will install ten temporary soil vapor sampling points through the slab of the main building and at locations in the parking area to obtain representative soil vapor data. Sub-slab vapor points will be installed no more than two inches below the bottom of the floor slab utilizing a hammer drill to create the opening in the slab. A seal will be created around the sub-slab vapor point to prevent infiltration of ambient air into the sub-slab vapor sample. A tracer gas will be utilized to test if a competent seal exists around the sub-slab vapor probe. Once the integrity of the seal is confirmed at each location, a minimum of three volumes of air will be extracted from each point prior to sample collection with a flow rate of less than 0.2 liters/minute.

In addition to the sub-slab vapor samples, two indoor air samples will be collected concurrently within the building and one outdoor air sample will be collected.

As documented in the NYSDOH guidance document, during the soil vapor and indoor air sampling, PWGC will perform a chemical inventory of the building to determine potential contributors to indoor air quality.

4.7.2 Vapor and Air Sampling Protocol

Sub-slab vapor, soil vapor, and indoor/outdoor air samples will be collected using SUMMA vacuum canisters fitted with eight-hour flow controllers with a flow rate of less than 0.2 liters/minute. Canisters utilized for indoor air samples shall be certified clean individually by the laboratory; sub-slab vapor and soil vapor SUMMA vacuum canisters shall be batched certified clean by the laboratory. Sub-slab vapor and soil vapor and will be analyzed for VOCs by USEPA Method TO-15. Ambient air samples will be analyzed for VOCs by USEPA Method TO-15-SIM.

4.8 On-site and Off-site Qualitative Human Health Exposure Evaluation

A qualitative human health exposure assessment will be completed for the site, characterizing the exposure setting, identifying exposure pathways, and evaluating contaminant fate and transport. The qualitative human health exposure assessment will follow DER-10, appendix 3B and Section 3.3 (b) 8.

5.0 QUALITY ASSURANCE PROJECT PLAN

This quality assurance project plan (QAPP) presents the objectives, functional activities, methods, and quality assurance / quality control (QA/QC) requirements associated with sample collection and laboratory analysis for characterization activities. The QAPP follows requirements detailed in DER-10, Section 2.

5.1 Project Organization

The investigative efforts defined in this RIWP will be coordinated by PWGC on United Properties Corp. The following identifies the responsibilities of various organizations supporting the RI:

- The NYSDEC Project Manager (Steven Scharf) will be responsible for reviewing and approving this work plan, coordinating approval of requested modifications, and providing guidance on regulatory requirements.
- The PWGC Program Manager (Kris Almskog and Paul Boyce) will provide technical expertise for review of the project plans, reports and ongoing field activities. The Program Manager will act as the project's Quality Assurance Manager.
- PWGC Project Manager (John Eichler) will be responsible for the day-to-day project management, task leadership, and project engineering support and for the planning and implementation of RI activities. The Project Manager is responsible for ensuring that the requirements of this RIWP are implemented. The Project Manager will also act as the Site Health and Safety Manager (HSM).
- PWGC Field Team Leader (Usman Chaudhry) will be responsible for sample collection, oversight of subcontractor personnel, and coordination of daily field activities. The Field Team Leader will act as the Site Health and Safety Officer ensuring implementation of the Site Health and Safety Plan.
- A NYSDOH Environmental Laboratory Accreditation Program (ELAP) certified laboratory (to be determined) will be contracted to perform required analyses and reporting, including Analytical Services Protocol (ASP) Category B Deliverables, which will allow for data validation.
- Subcontractors will perform surveying, drilling, and/or sampling at the direction of the Field Team Leader in accordance with this work plan.

Qualifications of the principal personnel participating in the investigation are included in **Appendix A**.

5.2 Laboratory Analysis

Requirements for sample analysis are described below. All samples will be submitted to a NYSDOH ELAP certified laboratory (to be determined) for analysis. Analytical methods, preservation, container requirements, and holding times are summarized below:

ANALYTICAL METHODS

(SOIL)

Sample Matrix	Sample Type	Parameters	EPA Method	Sample Preservation	Holding Time	Sample Container
Soil	Grab	VOCs	8260C/5035 (High Level)	5ml MeOH Cool to 4°C	14 days	En-core or Terracore
Soil	Grab	VOCs	8260C/5035 (Low Level)	5ml Water Cool to 4°C	48 Hrs freeze 14 Days analysis	En-core or Terracore
Soil	Grab	SVOCs	8270	Cool to 4°C	14 days	4 oz. wide mouth glass
Soil	Grab	TAL Metals	6010/7471	Cool to 4°C	6 months (28 days for Mercury)	4 oz. wide mouth glass
Soil	Grab	PCBs	8082	Cool to 4°C	7 Days to extract; 40 days following extraction	4 oz. wide mouth glass
Soil	Grab	Pesticides	8081	Cool to 4°C	7 Days to extract; 40 days following extraction	4 oz. wide mouth glass

Soil	Grab	TPH	8015	Cool to 4°C	14 days	4 oz. wide mouth glass

ANALYTICAL METHODS

(GROUNDWATER)

Sample Matrix	Sample Type	Parameters	EPA Method	Sample Preservation	Holding Time	Sample Container
Groundwater	Grab	VOCs	8260	HCL to pH <2.4 Cool to 4°C	14 days	(3) 40-mil vials
Groundwater	Grab	SVOCs	8270	Cool to 4°C	7 days	(2) 1 L amber glass jars.
Groundwater	Grab	TAL Metals	6010/7470	HNO_3 to pH<2 Cool to 4°C	6 months (28 days for Mercury)	0.5 L Plastic.
Groundwater	Grab	Pesticides/PCBs	8081/8082	Cool to 4°C	7 days	1 L amber glass jars.
Groundwater	Grab	PFAS	537	Trizma Cool to 4°C	14 days	(3) 250-mL plastic

ANALYTICAL METHODS

(VAPOR/AIR)

Sample Matrix	Sample Type	Parameters	EPA Method	Sample Preservation	Holding	Sample Container

					Time	
Vapor	8-hour	VOCs	TO-15	None	30 days	SUMMA canister
Air	8-hour	VOCs	TO-15-SIM	None	30 days	SUMMA canister

5.2.1 Soil Samples

Soil samples will be collected as described in Section 4.3. Analysis will conform to NYSDEC Analytical Services Protocol (ASP) Category B data deliverables in accordance with NYSDEC DER-10, Appendix 2B, 1.0 (b), including calibration standards, surrogate recoveries, and chromatograms.

5.3 Field/Laboratory Data Control Requirements

Quality Control (QC) procedures will be followed in the field and at the laboratory to facilitate reliable data. When performing field sampling, care shall be taken to prevent the cross-contamination of sampling equipment, sample bottles, and other equipment that could compromise sample integrity. QC samples will include blind duplicates, equipment blanks, trip blanks, method blanks, matrix spike and matrix spike duplicates. For soil and groundwater, QA/QC samples will be collected for each 20 samples collected per matrix. Analysis will conform to NYSDEC ASP Category B data deliverables in accordance with NYSDEC DER-10, Appendix 2B, 1.0 (b), including calibration standards, surrogate recoveries, and chromatograms.

5.4 Sample Identification

Each sample will be identified with a set of information relating individual sample characteristics. Required information consists of Sample Designation, Depth, Date, Time, and Matrix. Examples of sample IDs are shown below.

- SB001(0-2) (soil sample, boring 001 from 0 to 2 feet)
- GW001(6-8) (groundwater sample, temporary monitoring well 001 screened at 6 to 8 feet)
- MW004 (groundwater sample, permanent monitoring well 004)
- VP001(36-40) (groundwater sample, vertical profile location 001 screened at 36 to 40 feet)
- SV001 (soil vapor point 001)

- SS001 (sub-slab vapor point 001)
- IA001 (indoor air sample 001)
- OA001 (outdoor air quality sample 001)

Sample frequency, locations, depths, and nomenclature may change subject to field decisions and professional judgment, based on field conditions.

5.5 Chain-of-Custody, Sample Packaging and Shipment

Each day that samples are collected, a chain-of-custody / request for analysis form will be completed and submitted to the laboratory with samples to be analyzed. A copy of the chain-of-custody will be retained by the Project Manager. The chain-of-custody will include the project name, sampler's signature, sample IDs, date and time of sample collection, and analysis requested.

Samples will be packaged and shipped in a manner that maintains sample preservation requirements during transport (i.e., ice to keep samples cool until receipt at the laboratory), ensures that sample holding times can be achieved by the laboratory, and prevents sample tampering.

If a commercial carrier ships samples, a bill of lading (waybill) will be used as documentation of sample custody. Receipts for bills of lading and other documentation of shipment shall be maintained as part of the permanent custody documentation. Commercial carriers are not required to sign the chain-of-custody as long as it is enclosed in the shipping container and evidence tape (custody seal) remains in place on the shipping container.

5.6 Data Usability and Validation

The main purpose of the data is for use in defining the extent of contamination at the site, to aid in evaluation of potential human health and ecological exposure assessments, and to support remedial action decisions. Based upon this, data usability and validation will be performed as described below. Complete data packages will be archived in the project files, and if deemed necessary, additional validation can be performed using procedures in the following sections.

5.6.1 Data Usability and Validation Requirements

Data usability and validation are performed on analytical data sets, primarily to confirm that sampling and chain-of-custody documentation are complete, sample IDs can be tied to specific sampling locations, samples were analyzed within the required holding times, and analyses are reported in conformance with NYSDEC ASP Category B data deliverable requirements as applicable to the method utilized.

5.6.2 Data Usability and Validation Methods

A designee of the PWGC Project Manager will complete a data usability evaluation for the data collected during the RI and a data usability summary report (DUSR) will be prepared. The DUSR will be prepared in accordance with NYSDEC DER-10, Appendix 2B.

Independent third party data validation will be performed on 5% of the sample data, or on one sample from each sample delivery group (SDG), whichever is greater. Data validation will be performed by a qualified subcontractor independent of the project.

5.7 Field Equipment Calibration

Equipment will be inspected and approved by the Field Team Leader before being used. Equipment will be calibrated to factory specifications, if required. Monitoring equipment will be calibrated following manufacturer recommended schedules. Daily field response checks and calibrations will be performed as necessary (i.e. PID calibrations) following manufacturer standard operating procedures. Equipment calibrations will be documented in a designated field logbook.

5.8 Equipment Decontamination

In order to minimize the potential for cross-contamination, non-dedicated drilling and sampling equipment shall be properly decontaminated prior to and between sampling/drilling locations.

5.8.1 General Procedures

Drilling equipment will be decontaminated in a designated area. Sampling equipment and probes will be decontaminated in an area covered with plastic sheeting near the sampling location. Waste material generated during decontamination activities will be containerized, stored, and disposed of in accordance with the procedures detailed in Section 5.9. Decontamination of sampling equipment shall be kept to a minimum, and

wherever possible, dedicated sampling equipment shall be used. Personnel directly involved in equipment decontamination shall wear appropriate personal protective equipment (PPE).

5.8.2 Drilling Equipment

Drilling equipment shall be decontaminated prior to performance of the first boring/excavation and between all subsequent borings/excavations. This shall include hand tools, casings, augers, drill rods, temporary well materials and other related tools and equipment. Water used during drilling and/or steam cleaning operations shall be from a potable source.

5.8.3 Sampling Equipment

Sampling equipment (i.e., trowels, knives, split-spoons, bowls, hand augers, etc.) will be decontaminated prior to each use as follows:

- Laboratory-grade glassware detergent and tap water scrub to remove visible material
- Generous tap water rinse
- Distilled water rinse

5.8.4 Meters and Probes

All meters and probes that are used in the field (other than those used solely for air monitoring purposes, e.g., PID meters) will be decontaminated between uses as follows:

- Laboratory-grade detergent and tap water solution wash
- Tap water rinse
- Distilled water rinse (triple rinse)

5.9 Management of Investigation Derived Waste

Waste materials generated from the field operations may consist of soil cuttings, purge water, and miscellaneous solid materials such as personal protective equipment (PPE) and supplies. Investigation derived waste (IDW) generated during field operations will be disposed of in accordance with applicable regulations.

Soil cuttings generated from soil boring and well installation activities will be stored in 55-gallon drums. Drums will be labeled to indicate the source of the soil and will be stored in a designated area onsite. Soil cores and soil cuttings will be field-screened using a PID, while performing drilling operations. Drummed soils will be disposed of at an off-site disposal facility. Following receipt of the analytical results, recommendations for disposition of the drummed soil will be provided to the NYSDEC.

Development and purge water generated during the field activities will be stored in a portable holding tank and/or 55-gallon drums. Drums will be labeled to indicate the source of the fluid and will be stored in a designated area onsite. Drummed groundwater will be sampled to determine if discharge to the surface of the site is appropriate or if off-site disposal is required. Following receipt of the groundwater sampling results, recommendations for disposition of the water will be provided to NYSDEC.

5.10 Field Documentation

Documentation will take place on either appropriate forms or in a dedicated site logbook. Permanent black or blue ink will be used to record information in the logbook. Errors in field documentation will be lined through, initialed, dated, and corrected. Forms will be kept by the PWGC Field Team Leader during the field activities. Field activities will be documented in the field logbook. The logbook will contain waterproof pages that are consecutively numbered, and be permanently bound with a hard cover. Upon completion of daily activities, unused portions of pages will be lined-through and initialed.

The primary purpose of the field logbook is to document the daily field activities and to provide descriptions of each activity. All entries in the field logbook will be recorded and dated by the person making the entry.

6.0 REMEDIAL INVESTIGATION REPORT PREPARATION

The Remedial Investigation Report (RIR) will incorporate the methods and findings of the investigation activities performed as outlined in this Work Plan. The report will identify specific contamination concentrations throughout each media (i.e., soil, groundwater, soil vapor, and ambient air), delineate the extent of contamination in soil and groundwater, evaluate potential exposure pathways, and provide conclusions and recommendations for additional investigation and/or remedial action. Electronic copies of the RIR will be submitted to the NYSDEC along with hard copies. Analytical results of the investigation will be submitted in the electronic data delivery (EDD) format through the Department's environmental information management system (EIMS).

7.0 HEALTH AND SAFETY

Field operations will be performed in accordance with the health and safety requirements to be provided in the site specific Health and Safety Plan (HASP). The HASP is included as **Appendix B**. The HASP outlines the requirements for training, medical surveillance, daily tailgate meetings, emergency response, and accident and injury reporting.

Activity hazard analyses (AHAs) have been completed for identified work activities planned for the investigation.

The PWGC Field Team Leader will be responsible for implementing the HASP, completing the daily tailgate safety meetings, and performing necessary Industrial Hygiene (IH) monitoring as specified in the HASP.

8.0 COMMUNITY AIR MONITORING PLAN

A site-specific Community Air Monitoring Plan (CAMP) has been prepared to provide measures for protection for on-site workers and the downwind community from potential airborne contaminants as a direct result of the RI. The CAMP is included as **Appendix C**.

The CAMP will be implemented and executed in accordance with 29 CFR 1910.120(h), the New York State Department of Health's (NYSDOH) Generic Community Air Monitoring Plan, and the New York State Department of Environmental Conservation (NYSDEC) TAGM #4031.

9.0 PROJECT SCHEDULE

The preliminary schedule for the major project milestones is presented in **Table 1**. The field work is anticipated to be performed in June through August 2018A draft RIR should be submitted to the NYSDEC by September 2018.

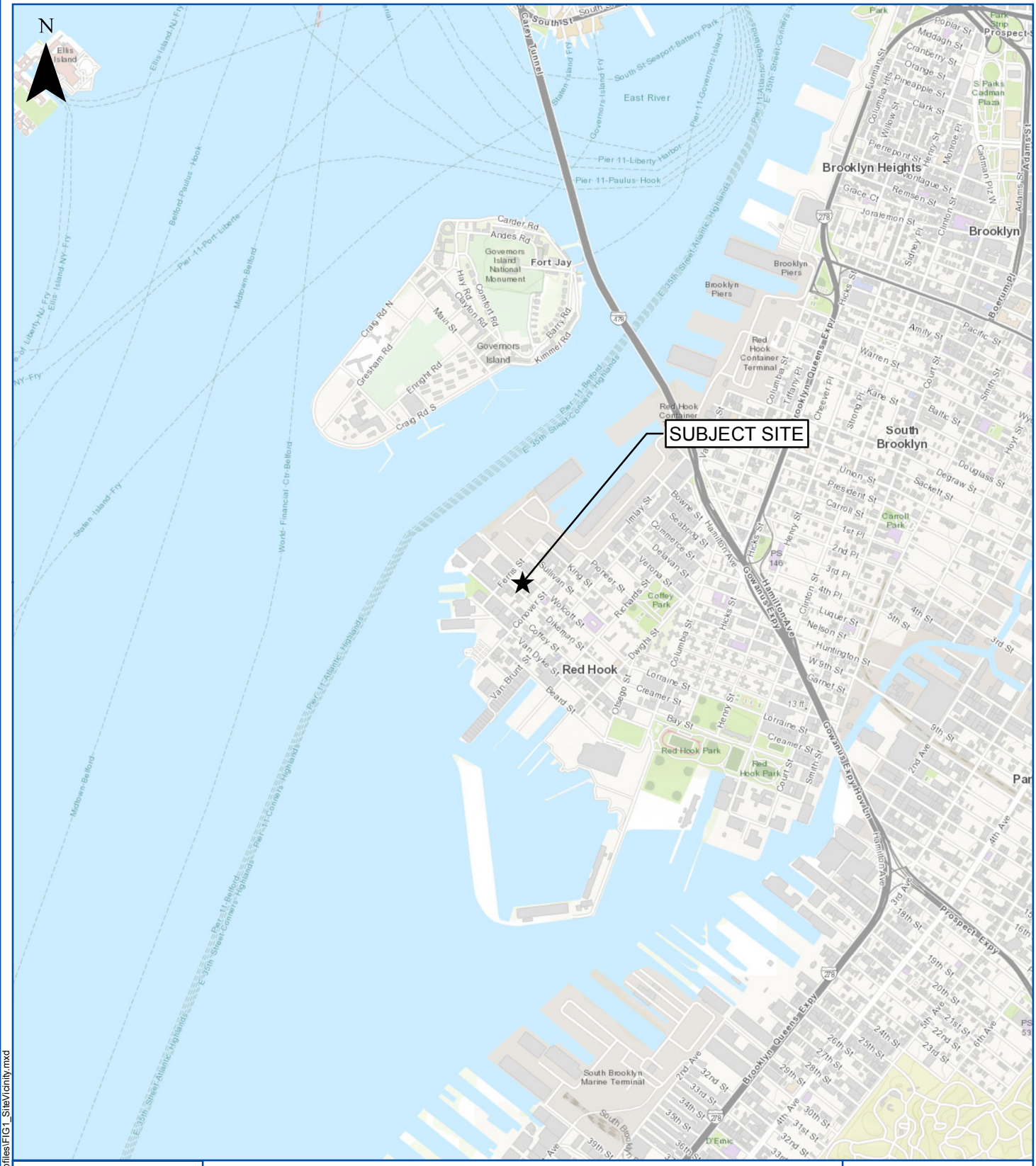
10.0 REFERENCES

NYSDEC, Division of Environmental Restoration, 6 NYCRR Part 375 Subpart 6, Remedial Program Soil Cleanup Objectives

NYSDEC, Division of Environmental Remediation, May 2010, DER-10, Technical Guidance for Site Investigation and Remediation.

NYSDEC, Division of Water, June 1998, Addendum April 2000, Technical and Operational Guidance Series 1:1:1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations

FIGURES



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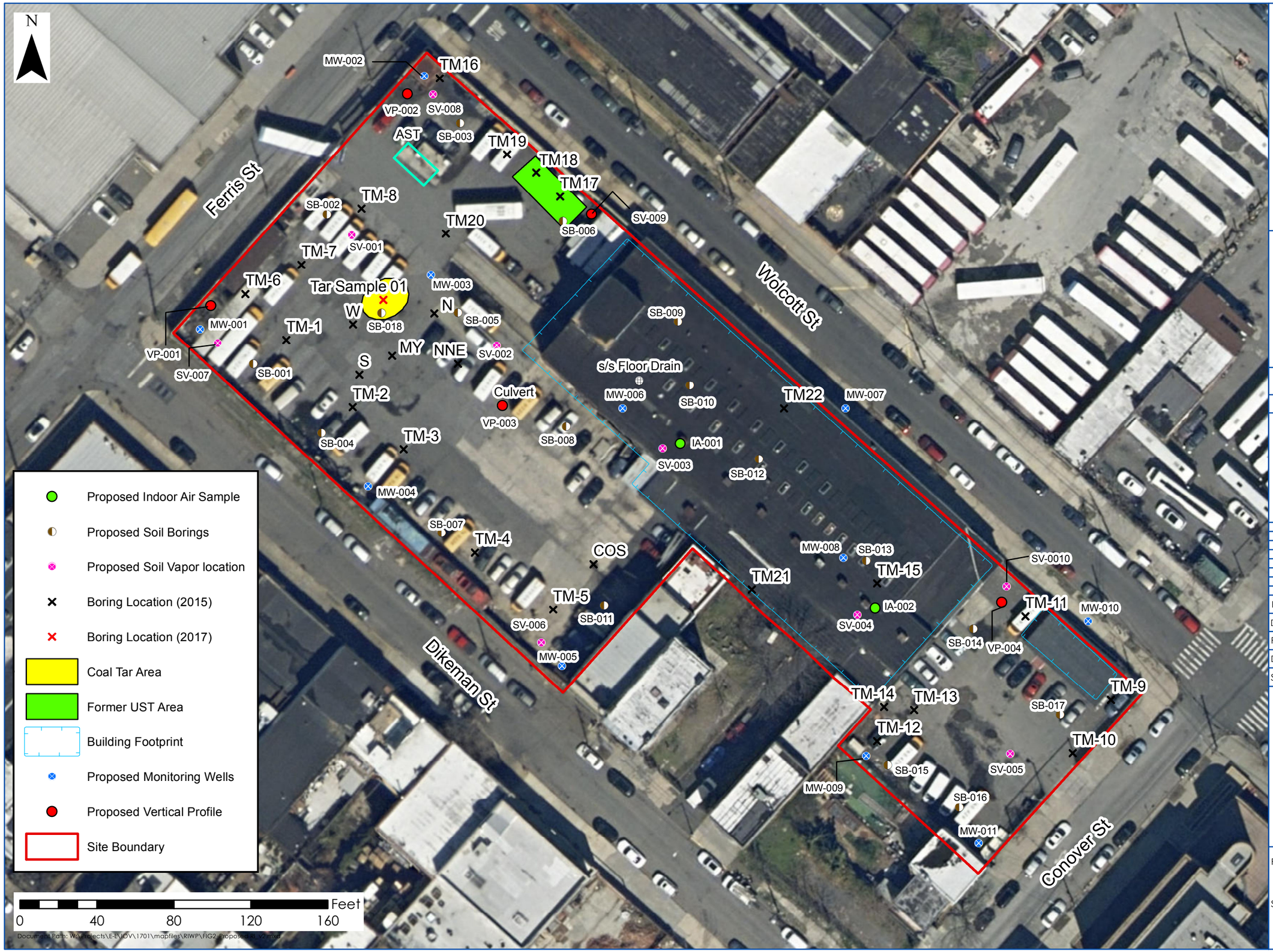
SUBJECT SITE VICINITY

145 Wolcott Street
Brooklyn, NY

0 ¼ ½ ¾ 1 Miles

Project:	IOV1701
Date:	3/23/2018
Designed by:	BB
Drawn by:	TS
Approved by:	JE
Figure No:	1



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DRAWING PREPARED FOR:

REVISION	DATE	INITIAL	COMMENTS

DRAWING INFORMATION:

Project:	IOV1701	Designed by:	JE
Date:	6/1/2018	Drawn by:	UC
Scale:	AS SHOWN	Approved by:	JE

PROPOSED REMEDIAL INVESTIGATION

145 Wolcott Street
Brooklyn, NY

FIGURE NO:
2

SHEET:

PWGC
Strategic Environmental Engineering Solutions

REMEDIAL INVESTIGATION SCHEDULE

Remedial Investigation Schedule
145-65 Wolcott Street, Brooklyn, New York

WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
TASK																						
NYSDEC approved work plan	■																					
Public Comment Period		■	■	■	■																	
Ten day notice to NYSDEC						■	■															
Field Activities								■	■	■	■	■	■									
Laboratory Analysis								■	■	■	■	■	■	■	■							
Data Usability and Validation																■	■	■	■			
Prepare RI Report																■	■	■	■	■	■	
Submission of Draft RI Report to NYSDEC																						■

APPENDIX A
RESUMES

PWGC
Strategic Environmental Engineering Solutions

Paul K Boyce, PE, PG, President

Professional Experience

PWGC: 25 years

Education

- MS, Environmental Engineering, Polytechnic University, NY
- BS, Civil Engineering, SUNY Buffalo, NY

ASCE Grade VII

Professional Certification/Training

- Professional Engineer, NY, PA
- New York State Professional Geologist
- BNL Radiological Worker I & III
- OSHA HAZWOPER 40-hr (29CRR 1910.120)

Areas of Expertise

- Water Resource/Supply Design
- Civil Site Design
- Remedial System Design
- Geothermal Systems
- Groundwater Hydrology
- Groundwater Modeling

Affiliations

- American Society of Civil Engineers (ASCE)
- NYS Society of Professional Engineers (Suffolk County Chapter)
- American Council of Engineering Companies (ACEC)
- Long Island Professional Geologists Association
- American Water Works Association (AWWA)
- National Groundwater Association (NGWA)
- International Ground Source Heat Pump Association (IGSHPA)

Honors and Awards

- Platinum Award, C. W. Post College Campus Geothermal System, ACEC New York 2009 Engineering Excellence Award
- ACEC, NY, 2005 New Principal of the Year
- NYSSPE Suffolk Chapter, 2006 Young Engineer of the Year

Profile

An environmental engineering professional for more than 20 years, Mr. Boyce has an impressive portfolio of successful project strategies, designs, management and execution. He is an expert in providing commercial, public and private clients with targeted analyses, designs, modeling services, investigations, master planning development, construction oversight and regulatory as well as sustainability consulting.

His experience covers a broad spectrum of remediation designs and techniques, such as combining institutional controls and engineered systems to create workable, cost-effective solutions. Mr. Boyce looks beyond the obvious to determine whether new natural techniques will achieve the client's long-term plans, limit future liability and have the least impact on overall operations. He assists clients with choosing conventional technologies and implementing them for use to their fullest capacity.

Mr. Boyce creates customized structural, mechanical, civil/environmental designs, implementation strategies and ultimately, management plans. His thorough knowledge of regulatory issues and his dedication to sustainable engineering solutions provides clients with invaluable guidance and effective tools to establish, and implement, long-term strategies based on facts.

Mr. Boyce is an expert on all aspects relevant to Geothermal Wells - from the planning stage through to system start up and operation. He assists clients with selecting the appropriate system and location, assessing a given system's feasibility in terms of the client's objectives, preparing designs in accordance with regulatory requirements, managing the system's construction and coordinating its startup.

Mr. Boyce has earned a reputation with clients and within the industry for his vast hands-on experience in assessing feasibility of existing systems and providing financially sound modifications for possible improvements.

Notable Projects

Mr. Boyce's responsibilities with regards to lead sampling and analysis include interpretation of regulatory requirements and federal action levels as they pertain to lead in potable systems, investigations into causes for high lead concentrations in drinking water, recommending solutions to remedy high lead levels, cost estimates for lead treatment strategies, designs for remedial solutions involving flushing, plumbing material replacements and chemical treatment and water chemistry modeling. He provided coordination and supervision of field teams performing lead sample collection. Mr. Boyce was the regulatory agency liaison for all parties involved.

NYC School Construction Authority (SCA)

Discolored Water Investigations and Remedies at Numerous Schools across New York City – Notable projects included: 229K, 163K, R062, Q316. Mr. Boyce's responsibilities included aiding STV and SCA in investigating casuses, overseeing field investigation services, water quality sampling, metallurgy of pipe sections, water quality/chemistry analyses, recommending remedies, report preparation, oversight of remedy implementation and follow-up samplings.

Disinfection Oversight – Mr. Boyce's responsibilities included overseeing field teams who were responsible for witnessing disinfection of potable water systems at new or renovated school buildings.

Disinfection Specification Update – Mr. Boyce was responsible for updating the SCA's standard disinfection specification for potable water systems.

Paul K Boyce, PE, PG, President

Brooklyn Army Terminal Pre-K Site – Incoming potable water into the leased space was experiencing bacteriological issues. Mr. Boyce was responsible for investigating the cause and designing a remedy which consisted of new piping system and filtration units.
Lead (Pb) Sampling – Mr. Boyce served as a lead consultant to SCA for a major sampling program of all schools in the New York City school system. His responsibilities included assembling lead sampling teams, coordinating and scheduling sampling events with STV and SCA, coordinating with analytical laboratories, review sampling results and consulting with SCA regarding results and potential remedies.

Diocese of Rockville Center
Lead (Pb) Sampling – Mr. Boyce was responsible for overall project management and coordination of sampling for lead in the potable drinking water systems at more than 25 Long Island Catholic schools in Nassau and Suffolk Counties. His responsibilities included coordinating field sampling teams, working directly with individual school staffs, reviewing lead results and recommending remedies. Once a remedy was implemented, Mr. Boyce oversaw follow-up sampling. Mr. Boyce is the primary point of contact for Senior Diocese management staff.

North Shore LIJ Health Systems, NY
Environmental Policy & Procedures for the Prevention of Legionella Contamination
Mr. Boyce's responsibilities for this project included researching local, state, and federal legionella standards and guidelines and updating a pre-existing environmental policy and procedures manual for the prevention of legionella contamination in NSLIJ healthcare facilities. Mr. Boyce coordinated with the New York State Health Department to determine the present status of legionella updates on the state level. Following extensive research on revisions undertaken to various guidelines and standards pertinent to legionella, Mr. Boyce updated the routine legionella sampling program, disinfection procedures, maintenance and long term control measures to prevent legionellae contamination and the requirements for the development of a water safety management program.

SUNY Stony Brook University and Hospital
Cooling Tower and Evaporative Condenser Maintenance Manual for the Prevention of Legionella – Mr. Boyce performed inspections at numerous cooling towers and evaporative condensers to learn about the specific equipment being used at the buildings. She researched current industry standards and guidelines to ensure compliance. Mr. Boyce developed the manual which included information for the design and siting of cooling towers and evaporative condensers, the system start-up and shut down procedure, information on sampling requirements, qualifications for sampling performance, interpreting and how to respond to sample results, notifications and documentation, and how to respond to a case.

Stony Brook Hospital
Water Management Plan – Mr. Boyce performed an inspection of the main campus facility to gain an understanding of the potable system. He coordinated with SBH's facilities engineer, infection prevention/control, administration and medical staff in development of the manual. Mr. Boyce developed the manual which discusses how to respond environmentally and discusses the maintenance and long term control measures that can be implemented to help prevent legionellae contamination.

South Nassau Communities Hospital
Overall Potable Water Manual – Mr. Boyce performed an inspection of the main campus facility to gain an understanding of the potable system. He coordinated with SNCH's facilities engineer, infection prevention/control, administration and medical staff in development of the manual. Mr. Boyce developed the manual which discusses how to respond environmentally and discusses the maintenance and long term control measures that can be implemented to help prevent legionellae contamination.

Winthrop University Hospital
Overall Potable Water Manual – Mr. Boyce performed an inspection of the main campus facility to gain an understanding of the potable system. He coordinated with WUH's facilities engineer, infection prevention/control, administration and medical staff in development of the manual. Mr. Boyce developed the manual which discusses how to respond environmentally and discusses the maintenance and long term control measures that can be implemented to help prevent legionellae contamination.

Water Resource Management

Ross School, East Hampton, NY

Master Planning & Campus Design - Mr. Boyce provided civil engineering design services to develop a master plan for the private school campus, which was to be "one of a kind", transforming the school into a state of the art learning institution, situated in a rural, wooded groundwater recharge area.
Civil Engineering Services - Civil engineering and consulting were provided for grading, drainage, utility layout, roadways, parking, site lighting, athletic playing fields, irrigation, water supply, sanitary, wastewater collection, and open loop geothermal heating/cooling water systems. Throughout the project, Mr. Boyce collaborated with other project consultants, foremost planners, architects, landscape architects, MEP engineers, surveyors, contractors, the construction manager and the school administration. He oversaw and participated in the conceptualization and preliminary design of the campus' proposed layout, which included eco-friendly engineering designs

consulting/development and integration of civil engineering design aspects with other important features such as academic programs, architecture, landscaping and pedestrian walkways.

Environmental Engineering Services - The campus was to be as green as possible utilizing available eco-friendly technologies for the most environmentally sensitive and appealing design. The campus' sensitive environmental location as well as sanitary density issues required a sewage treatment plant. Mr. Boyce investigated and evaluated different sewage treatment technologies capable to meet the school's projected needs functionally, aesthetically and academically. Mr. Boyce took into consideration some sustainability goals and be in compliance with regulatory requirements.

Environmental Consulting/Conceptual Design Services After researching the latest sewage treatment technologies, Mr. Boyce recommended to the master planning team and school administration a wastewater treatment system that naturally treats sewage and industrial waste to re-use quality that met the Master Plan goals: aesthetics, economic/environmental advantages and well below regulatory discharge standards. The panel accepted his recommendation and he created conceptualized layouts, sited for possible plant locations and designed a preliminary ecologically engineered sewage collection system.

Geothermal Well System Design – Mr. Boyce managed the site assessment, design, construction oversight and preparation of O&M manuals for the systems, and conducted a feasibility study of using open-loop geothermal systems to heat and cool two of the school's most prominent buildings - The Center for Well Being (Bldg 5) and the Media Pavilion (Bldg 2). He researched local hydrogeological and groundwater quality conditions and analyzed the effects of required flow rates on a nearby Suffolk County Water Authority (SCWA) well field. Mr. Boyce employed Groundwater Vistas by ESI, to create a detailed 3-dimensional model for the area. His analysis illustrated the potential effects of supply and recharge wells on (1) each other, (2) nearby neighboring shallow wells, (3) the SCWA well field, and (4) the local water table (The model also took into account of the local groundwater divide). Once he had demonstrated that operating two separate open-loop geothermal well systems in close proximity would not have an impact, he prepared the engineering report for the NYS Department of Environmental Conservation, along with the appropriate Long Island Well permit applications for approval.

North Shore Long Island Jewish Health System, NY

North Shore University Hospital (NSUH), Glen Cove, NY, Geothermal Wells Project – As project manager, Mr. Boyce prepared the feasibility study, well permits, construction documents, oversaw the construction and fieldwork for the installation of a 400 GPM open-loop groundwater heat pump system. Before design, Mr. Boyce conducted the study to assess the feasibility of augmenting the AC's geothermal well system; he investigated size and location options for new wells and prepared construction cost estimates based on minimizing potential conflicts with existing site constraints and the likelihood of regulatory agency approval. He determined that expansion to the existing system would be feasible based on cost, local hydrogeology, and his modeling results. He advised the client that construction would cause significant disruptions to the hospital's daily operations. In accordance with NYSDEC guidelines, he investigated the potential effects of the proposed project on a nearby inactive hazardous waste site, obtained baseline water quality data, estimated aquifer characteristics to refine and calibrate the model and drafted a design and construction plan of a test and monitoring well to determine local geologic conditions. As liaison between NSUH, the NYSDEC, and the local regulatory agencies, Mr. Boyce established that a scaled-down, relocated system would have negligible effects on the hazardous waste site, and consequently, obtained approval for the proposed construction. NSUH selected Mr. Boyce to design, plan, and oversee the construction of the new system, which involved developing the design and strategy for a supply and recharge well system with inter-connecting process piping, detailed hydraulic analyses, sizing the various system components, and coordination with other project consultants on the installation of piping and process equipment.

Pratt Institute, Brooklyn, NY

Geothermal Feasibility Study - Mr. Boyce oversaw and coordinated a test hole drilling, geological characterization, and water quality sampling. Additionally he prepared a feasibility study comparing and evaluating open loop, closed loop and standing column well geothermal technologies and recommended the most appropriate based on site constraints and water quality issues.

C.W. Post Campus – LI University, Brookville, NY

Open Loop Geothermal Well System –Mr. Boyce conducted 3-d numerical groundwater modeling to determine possible and real effects of proposed geothermal wells (i.e. effects on each other, and/or other nearby wells). He designed open loop geothermal wells and associated piping; and managed the development of project plans and specifications as well as permitting documents. Subsequent, he supervised, and provided QA/QC, for construction services, and served as regulatory agency liaison and primary client contact. The system went in service spring 2007.

Water Supply & Treatment

Suffolk County Department of Public Works, NY

Timber Point Country Club, Great River, Water Supply System & Irrigation Well Upgrades - Mr. Boyce directed the well's condition assessment, including pump test, to determine capacity and water quality and prepared specifications/plans to upgrade supply well with new

pump and motor. Further, he designed new piping configurations to integrate an irrigation well with distribution and cross-connection to the Suffolk County Water Authority, and specified new variable frequency drive for well pump motor.

West Sayville Golf Course, Sanitary System Improvements – Mr. Boyce oversaw construction phases through completion including, supervised design, development of permitting, bidding and administrative buildings sub-surface sanitary disposal system.

Peconic Dunes Park, Peconic, NY, Water Distribution System Improvements – Mr. Boyce supervised design/development of permitting, bidding, and construction documents to upgrade the existing water distribution system's components including backflow prevention devices water mains/meters, hydrants, and internal plumbing. Further, he oversaw construction phase services through to completion.

BOMARC Police Firing Range Westhampton, Drainage Improvements - Mr. Boyce directed design/development of permitting, bidding, and construction documents for drainage conditions improvements (i.e. stormwater collection/conveyance systems, new recharge system), and oversaw construction phase services through to completion.

Suffolk County Fire Academy, Yaphank, Water Supply Well Improvements - Mr. Boyce supervised design/development of bidding and construction documents for the re-circulated supply system. This included: physical/chemical rehabilitation, electrical service upgrades, a new motor starter, and replacement of a diesel driven booster pump with an electrically operated one, as well as the deep well vertical turbine pump and motor with a new submersible pumping unit. He managed construction phase services (administration, observation) to project completion.

SUNY Stony Brook, Sewer District 21, Groundwater Modeling Study, Stony Brook NY - Mr. Boyce performed a 3-d numerical groundwater modeling to estimate flow path and travel time of sewage treatment plant effluent from recharge basins to the Long Island Sound, and prepared an engineering report documenting findings and modeling results.

Pinelawn Memorial Park, Farmingdale, NY

Colonial Springs Golf Course Irrigation Well System Design & Construction – Mr. Boyce designed and supervised the installation of a new system for the new 18-hole golf course. The system, comprised of two groundwater supply wells, a 12-acre storage lake, booster pumping station, and distribution piping, has been running smoothly since start-up.

Water Authority of Great Neck North, Nassau County, NY

Weybridge Road Clearwell Design - Mr. Boyce prepared a design for a new air stripper clearwell, upgraded the booster pump, piping, controls modifications, coordinated with NCDOH, and performed cost estimates. The design is completed and NCDOH has approved it, however, funding constraints have put the project on hold.

SCADA System Design - Mr. Boyce prepared a design for a new Supervisory Control and Data Acquisition System. He prepared bidding and construction documents, providing construction administration and observation services, and cost estimates.

Emergency Water Main Replacement, Berkshire Road - Mr. Boyce prepared design, construction and bidding documents for emergency water main replacements, expedited NCDOH review and approval, and provided PE certification services.

Air Stripper Cap at Watermill Lane – Mr. Boyce coordinated with contractor and WAGNN regarding design and sizing of appropriate air exit cap atop existing air stripper at Watermill Lane treatment plant.

Valve Book Review/Updates – Mr. Boyce updated valve location sketches as new valves are being installed in the distribution system.

Municipal Supply Well Design, Well #14 – Mr. Boyce oversaw the design services for the new 1,400 gpm municipal supply well. The design included an engineering report for NYSDEC and NCDOH review/approval, preparation of plans and specifications for a new well, associated piping, well house, electric, controls, instrumentation, chemical treatment, safeties, etc. Project is just underway as of Sept 2007. Construction phase services will also be provided.

Weybridge Road Ground Storage Tank Replacement – Mr. Boyce lead the project team charged with designing a new 500,000- gallon steel ground storage tank to replace a deteriorated and dilapidated existing 400,000-gallon ground storage tank. The team prepared bidding/construction documents, inclusive plans and specifications, obtained NCDOH approval, provided construction administration and oversight services.

General Consulting Services – Mr. Boyce attended Board of Directors meetings to present monthly engineering report, assist with hydrogeological issues, contaminant fate and transport concerns, well maintenance, water main rehabilitation, etc.

Hampton Bays Water District, Suffolk, NY

Well Field Construction & Integration – Mr. Boyce prepared the structural, mechanical, and electrical designs for a new well field including two pump stations. In addition to construction plans and specifications, Mr. Boyce oversaw the integration of a new well field with an existing distribution system via hydraulic analyses, and guided the client through the regulatory agency review and approval process. In a subsequent project phase, he partook in creating the layout of several residential water main projects, for which he analyzed the proposed water main layouts and prepared conceptual designs based on Health Department and ISO requirements.

Caustic Feed Systems Design - Mr. Boyce was responsible for the design of caustic feed systems at all eight District supply wells. He prepared existing conditions drawings by conducting field visits to obtain the necessary information. He then designed caustic feed systems consisting of double-walled underground storage tanks, piping, metering pumps, safety interlocks, controls, alarms and injection equipment to raise

Paul K Boyce, PE, PG, President

the ambient pH of the groundwater withdrawn from the shallow aquifer system to between seven and eight and a half. He was responsible for preparing plans and specifications, obtaining Health Department approval, and then overseeing the construction administration and observation aspects of the project.

Isolated Pressure Zone Design - Mr. Boyce was responsible for designing an isolated pressure zone in an area that was experiencing chronic low-pressure conditions within the District's distribution system. He worked with existing distribution system maps and survey data to identify the boundaries of the proposed zone, he worked with available hydraulic data to estimate pressure conditions and developed a planned approach on how to isolate the zone and create a booster pumping station to raise pressures within the zone to acceptable levels. Mr. Boyce was responsible for preparing the project plans and specifications that included a new packaged booster pumping station, water main and valve work, electrical service and site work. The SCDHS approved the plans and the pressure zone's were constructed closely to his design and construction cost estimate.

Good Samaritan Hospital, West Islip NY

Well Turbidity Study – After review of existing water quality data, Mr. Boyce recommended sampling and analyses for additional parameters. He applied a water quality model, using the existing raw water quality data. To achieve optimal water quality pH-level, hardness, and alkalinity, he performed trial and error solutions using a numerical model. Different treatment chemicals were included in the model in various combinations or by themselves. Concluding modeling efforts led to a realistic chemical concentration.

Copper & Lead Desktop Study – The results of the study Mr. Boyce performed served to identify the possible cases for turbid water condition and proposing alternative options for corrective actions to restore acceptable water quality. He presented each alternative for evaluation and comparison to determine most advantageous choice, based on potential for success, technical complexity, and cost. In addition, he prepared a treatment specification and coordinated with an experienced well driller, resulting in a successful chemical treatment, and restoration of the water quality to acceptable conditions.

Shelter Island Heights Water District

Water Main Replacement - Mr. Boyce was responsible for providing construction observation services for a water main replacement project in the Shelter Island Heights Water District. He provided daily oversight throughout the new mains' installation. He ensured the mains were installed in accordance with project plans and specifications. Mr. Boyce inspected pipe sizes and materials, installation and excavation procedures, flushing, pressure testing and backfilling of the trenches. He prepared inspector's daily reports and coordinated closely the contractor, design engineer, and heights personnel.

Town of Oyster Bay, Syosset, NY

Potable Water Supply System Upgrade Design & Compliance Management Services – As Project Manager, Mr. Boyce coordinates inspection and assessment services for the town's Tobay Beach Park & Marina potable water supply system. PWGC focuses on the water supply system's status of compliance with NYSDOH, NCDOH, 10-State Standards, and provides feasible engineering designs to in response to the town's objectives: Safe, potable water for Tobay Beach patrons, in an economically sound fashion. Mr. Boyce managed the authoring of a feasibility report and selected/recommended minimum corrections and system upgrades. In addition, he prepared the design of a dry-briquette calcium hypochlorite chlorination system and other upgrades at Well House 3 of the Tobay Beach Park & Marina. To date, he continues to provide engineering services and design specifications for wellhead improvements. He also directs PWGC water quality monitoring and assessment services at the beach to determine compliance with local and state health department water quality and equipment guidance.

West Neck Water District, Shelter Island

New Well and Upgraded Pumping Station - Mr. Boyce was responsible for designing a new well and the upgrade for an existing treatment plant for the West Neck Water District on Shelter Island. The existing plant was a below grade vault that housed two shallow supply wells, two pressure tanks and some chemical feed equipment. He designed and integrated a new well and upgraded the vault to an above ground treatment building. The upgrade involved new piping, pumps, monitoring equipment, controls, a new structure, and accessories such as heating, ventilation, lighting, and power. Mr. Boyce was responsible for preparing plans and specifications obtaining Health Department approval and preparing as-built drawings once the project was completed.

Village of Dering Harbor Water District

Corrosion Control – A study to evaluate various corrosion-control treatment options for the Village's water district was performed. Based on the study, Mr. Boyce recommended adding soda ash to raise the groundwater's pH and allow for continued water supply to the Village. Following completion a d acceptance of the study by the SCDHS, he designed the chemical solution feed systems to inject soda ash at the wellheads of the Village's two supply wells. He designed chemical mixing and solution storage tanks, feed pumps, interconnecting piping, injection tube assemblies, and safety interlocks. Once the systems' construction was completed, Mr. Boyce prepared record drawings for the Village and SCDHS.

Paul K Boyce, PE, PG, President

Village of Hempstead

Iron Sequestering Report - Mr. Boyce was responsible for preparing a report that documented the results of an iron sequestering study that was performed for the Village of Hempstead. He evaluated different sequestering products for effectiveness in keeping the dissolved iron in the Village's water supply in solution. He was responsible for collecting all the field data, comparing the various sequestering agents that were used and ultimately recommending the most effective and cost efficient product.

Civil Site

Three Mile Harbor Boat Yard, East Hampton, NY

Site Planning Analysis – After evaluating site conditions, Mr. Boyce recommended feasible improvements to enhance an existing boat yard facility. He investigated local zoning/building codes, sized/located sanitary facilities, sized/designed layout and arrangement of parking facilities, sized/located/orientated a new proposed structure to house a marine shop, offices, storage, and industrial space. He effectively addressed critical issues such as the site's location in a harbor protection area and no public water access, which put severe constraints on sizing and locating the sanitary facilities. He prepared plans and reports delineating suitable site alternatives and requirements for implementation in compliance with regulatory agencies and utility companies.

Inlet Seafood, East Hampton NY

Site Plan Application - As senior engineer, Mr. Boyce designed and coordinated the preparation of site-plan application drawings for the commercial/industrial fishing marina looking to expand the site from a commercial to a multiple use area that included retail, restaurant, and commercial fishing. He managed civil/site concerns, which included grading, drainage, sanitary, water supply, utilities, parking, traffic controls, site lighting, and building locations/elevations. Mr. Boyce worked with the owners and other project consultants to conceptualize and plan the site layout for optimum use and compliance with local zoning and building codes. In addition, he prepared site-plan application drawings for the Town Planning Board and local regulatory agencies. He supervised development of designs and bidding/construction documents for new water mains/services/flow meters, hydrants, and drinking water fountains. Mr. Boyce oversaw construction, and supervised wetlands delineation and permitting with the NYSDEC through to project completion.

Jay Construction Corp, NY

Pile Foundation Designs for Residential Homes - Mr. Boyce was responsible for designing foundations for four residential homes in Patchogue, New York. The design included investigating existing soil conditions, reviewing architectural plans, sizing piles based on soil conditions, locating piles based on architectural layout, determining number of piles based on loads including self-weight, building dead, live, snow and wind load, and worst case combination of loads based on building code. He created designs for reinforced concrete pile caps in accordance with ACI requirements and created foundation walls to serve as grade beams between pile caps. In addition, Mr. Boyce prepared construction documents including plans and specifications and acted as the primary client contact throughout the project.

Times Square Construction, New York, NY

Geotechnical Report for 47 East 34th Street Building Construction – Mr. Boyce oversaw a rock core boring program, characterized rock core samples and developed a geotechnical report based upon findings of the rock core boring program. He provided foundation recommendations for a new 38 story residential building being erected upon Manhattan schist on the east side of midtown Manhattan. Mr. Boyce assisted with the rock anchor design and specification. He supervised and managed field observation services for rock anchor testing. Supervised and managed the September 2007 design and development of a foundation waterproofing system.

Storm Water Management

Benjamin Beechwood, LLC, Arverne Urban Renewal Area (URA), Far Rockaway, NY

Design/Engineering Management Services, Stormwater Collection & Conveyance System - Mr. Boyce managed the design and siting of a stormwater collection and conveyance system for an 80+ acre development along the south shore of Queens County. He coordinated catch basins locating, grading design, sizing interconnected piping networks and tie-ins with the local NYC storm sewer system. Mr. Boyce was also responsible for incorporating BMP's in the system design.

Stormwater Quality Impact Assessment on Local Surface Water Body - Mr. Boyce was responsible for determining stormwater roadway run-off concentrations for TPH's, suspended solids, metals, coli forms, pH, and dissolved oxygen. To estimate the influence of these parameters on the nearby canal basins into which they were to be discharged, he employed chemical and mathematical relations using chemical

properties and mass balances based on flow rates and tidal flushing volumes to estimate potential effects. Subsequently, he assisted in preparing the stormwater portion section of a Draft Environmental Impact Statement.

NYC DOT, Kensico Reservoir Rte, Westchester, NY

120 Expansion Stormwater Management System Stormwater Quality Pre-Construction Baseline Assessment – Mr. Boyce directed the roadway run-off sampling of 15 storm events and 5 outfalls along the Reservoir. He oversaw installation of automated sampling equipment to monitor weather conditions, sampling events, and system/statistical data analyses for a stormwater-runoff quality report.

Allied Aviation Services, LaGuardia Airport, NY

Stormwater Sediment & pH Control Investigation, LaGuardia Airport, Queens, NY – Mr. Boyce was responsible for reviewing and investigating an ongoing problem of storm water discharge to a surface water body with a too high solids content level. Storm water runoff collected at the fuel tank farm for LGA is passed through a treatment system to remove oils and organic contaminants. Under severe rainfall events, the treated storm water effluent had been discharged to the adjacent harbor with unusually high amounts of suspended solids, which were temporary violations of the facility's State Pollutant Discharge Elimination System permit. To find a cost effective solution for the continuing problem, he evaluated various alternatives from in line cartridge filters, to settling tanks, to storm drain separators. Aside from cost, he considered other restrictions, such as limited space for installation, maintenance, durability, and reliability. Mr. Boyce studied peak hydrologic events and recommended the most efficient and effective treatment option for the owner to implement. Elevated pH of the discharged treated storm water effluent presented an unexpected, and separate, water quality issue. In addition he was responsible for investigating the cause of the problem and recommending a course of corrective action.

AIL Systems Inc, Deer Park, NY

Recharge Basin Size Analysis – To assess the feasibility of reclaiming land used for recharge purposes, to sell or alter its land use, Mr. Boyce analyzed the industrial facility's existing cooling water recharge system. His analysis included an investigation of the facility's hydrological and drainage characteristics, and the existing storm water handling facilities' capability to accommodate various storm events. Mr. Boyce reviewed local building codes to make sure any proposed alterations could handle the minimum required storm events. He investigated the cooling water discharge rates to the recharge basins, to determine how much of the existing basins were required to handle the cooling water. With his report, AIL Systems was able to effectively evaluate its real estate options.

Wastewater Management

Montauk Yacht Club, Star Island, Lake Montauk, NY

Sewage Treatment Plant Design – Mr. Boyce managed the structural design of the key components of a sewage treatment plant for the Montauk Yacht Club. The plant, a sequential batch reactor type with a peak design load of 50,000 gpd, featured a treatment process involving several large tanks made of reinforced concrete. He worked closely with the process design engineers to size, arrange, and orientate the various tanks in the treatment train within the plant. He then prepared the structural design of the tanks and associated building facilities, which included reinforced concrete, steel and masonry components. In addition, Mr. Boyce prepared the design drawings and specifications, and collaborated with the project architect to coordinate the overall height, shape, and exterior appearance of the sewage treatment plant.

Lemon-X Corp., Huntington Station, NY

Industrial Wastewater Treatment Study – Generating roughly 3,000 gallons per day of industrial wastewater at a facility without a wastewater treatment system, the mixed drink and fruit juice beverages manufacturer was required to comply with a NYSDEC order of consent. To rectify their current method of wastewater disposal into on-site drywells, Mr. Boyce prepared an analysis of viable treatment options, such as a hold and haul, and a 2-step treatment process that uses roughing filters to filter and remove nitrogen. He led the on- going waste stream sampling program that was involved with the treatment process selections and cost estimates. The treatment system design received NYSDEC approval based on the report's recommendations.

Heatherwood Communities, LLC, Manorville, NY

Ecologically Engineered STP Design & Engineering Study - Mr. Boyce designed and supervised an engineering study to determine optimum site for the planned STP in the environmentally sensitive and shallow groundwater area. After thorough analysis of the area's historical groundwater level data from nearby off-site wells, and simulation (using numerical analysis to estimate anticipated high water levels for the site), he compared water level readings at the designated site to readings from nearby off-site wells. He had a series of observation wells installed, which he used to investigate the relationship between his findings, the proposed layout for the apartment community and STP location, and environmental constraints (i.e. wetlands setbacks).

Paul K Boyce, PE, PG, President

Southampton College, Southampton, NY

Sewage Treatment Alternatives Evaluation - Mr. Boyce assisted in preparing an engineering report to evaluate various sewage treatment alternatives for the current campus, and for possible expansion of the campus. He researched ecologically engineered sewage treatment systems (i.e. Living Machines, Solar Aquatics, and Ocean Arks), determined their applicability, coordinated with the SCDHS regarding acceptance, and computed estimated sanitary flow numbers based on County sanitary code requirements. Mr. Boyce was involved with the conceptual layout of sewage treatment locations and associated sewage collection systems. He helped develop and prepare cost estimates for the various viable alternatives and provided input into the report recommendations.

Catholic Health Services – St. Charles Hospital, Port Jefferson, NY

Cooling Tower and Boiler Blow Down Discharges – SPDES Permitting – Mr. Boyce led the investigation into alternatives for blow-down discharges that included discharge to either groundwater or sanitary sewer. He conducted flow studies of the sanitary sewer to determine how much water the Hospital was discharging and compared it to the Hospital's water bills, which the SCDPW was basing sewer usage on. He oversaw and managed the preparation State Pollutant Discharge Elimination System permit applications for groundwater discharges.

AIL Systems, Deer Park, NY

Sewage Treatment Plant Evaluation Study - ALL Systems, an electrical defense contractor, was attempting to sell their Deer Park property occupied by their large engineering and testing facility. The facility has its own sanitary wastewater treatment plant on-site. Located outdoors, the activated sludge type plant has a peak design flow of 43,000 gpd. A prospective buyer, The Tree line Companies, contracted PWGC to evaluate he condition and performance of the existing sewage treatment plant. Mr. Boyce performed a plant

inspection and obtained and reviewed operational records, annual operating costs, O&M manuals, plant influent, the effluent water quality data, design drawings, reports, schematics and equipment catalog cuts. He supervised the following analysis and evaluation to determine the overall condition of the plant, its estimated remaining life expectancy, future operating costs, and level of performance according to the facility's SPDES permit requirements.

Village of Sag Harbor, East Hampton, NY

Municipal Sewage Treatment Plant Engineer of Record - Mr. Boyce is assisting in providing engineering services for the Village of Sag Harbor municipal sewage treatment plant. The plant is a sequential batch reactor with a peak design flow of 250,000 gpd. His responsibilities include providing on-call technical support to plant operators on how to troubleshoot operational and process problems, review of plant effluent data, analysis of flow and effluent quality conditions, and provision of design services when needed.

Birchwood Nursing Home, Huntington, NY

Structural Design – Mr. Boyce developed and created the structural design of a sewage treatment plant (STP) retrofit and upgrade for the nursing home, which, thus far, utilized a rotating biological contactor (RBC) process to treat 40,000 gpd of wastewater. The plant was to be upgraded to handle a new peak design flow of 60,000 gpd and be retrofitted from the RBC type of process to a sequential batch reactor style plant while utilizing as much of the existing plant as possible. Process tanks needed to be increased in capacity and the footprint of the plant needed to be enlarged to accommodate the expansion. Mr. Boyce conducted a site survey to review and confirm the existing conditions. He worked closely with the process design engineers to rearrange and configure new tank sizes, piping runs, equipment locations, and the proposed building layout. To conduct the structural design of the tank upgrades and building expansion, Mr. Boyce utilized reinforced concrete and steel design procedures. He prepared plans, specifications and coordinated with contractors during construction accordingly.

Environmental Compliance

Environmental Compliance Audits (ECA) - Mr. Boyce oversaw the ECAs for NSUH at Glen Cove, Franklin, Syosset, Southside, and Plainview. The ECAs concentrate on major environmental areas of concern, inlcuding storage tanks, air emissions, hazardous materials/wastes, storm water, potable, and wastewater. He prepared an Environmental Compliance Issues report, based on the ECAs. Further, he provides on-going guidance and support to address any identified violations per government, state, and local environmental regulations.

Islip Resource Recovery Agency, Town of Islip, NY

Environmental Compliance and Permitting – Mr. Boyce managed and supervised environmental compliance audits for three Town facilities that included a C&D landfill, a composting facility, and a recycling center. He managed the preparation of environmental permits and design upgrades to bring facilities into compliance with SCDHS and NYSDEC requirements.

Paul K Boyce, PE, PG, President

NYC Transit – Multiple Projects, NY

Environmental Anticipatory Boring Program - Mr. Boyce served as the Environmental Engineer for multiple New York City Transit (NYCT) capital improvement projects. He reviewed the project scope and resulting project plans and documentation for feasibility, accuracy and completeness. When necessary or requested, Mr. Boyce attended meetings and performed site visits with the client and NYCT.

Lawrence Live more National Laboratory, Livermore, CA

CD 0/1 Document Peer Review – As a member of a National Nuclear Security Administration (NNSA) team, Mr. Boyce was responsible for conducting a peer review of preliminary CD 0/1 documents that site staff had prepared for the D&D of a nuclear research facility at LLNL (Bldg 431). As a focus area lead, he conducted the review's technical scope and value engineering portions. He toured the facility, reviewed pertinent work documents, interviewed staff responsible for document preparation, reviewed/evaluated the work documents for coherency, completeness and acceptable levels of detail for CD 0/1 stage requirements. He recommended document improvements and participated in a debriefing with the NNSA team and site staff.

Groundwater Remediation

Brookhaven National Laboratory, Upton, NY

Engineering Services for the Glass Holes & Animal Chemical Pits CERCLA Remedial Excavation - Mr. Boyce prepared the excavation plan and design drawings for a remedial excavation of over 50 individual waste pits at the client's site. He managed the waste pits' initial delineation, oversaw the geophysical survey using electromagnetic survey equipment, and prepared the excavation plan detailing technical guidelines for the hazardous waste site's remediation. The plan provided direction for the removal/recovery of organic, inorganic, biological and radioactive buried wastes, as well as explosive, reactive, and corrosive materials. His engineering drawings detailed excavation layout, work/stockpiling areas, grading, drainage, haul routes, utilities, and site restoration. He acted as a field engineer during the field operations, oversaw excavation/waste removal, stockpiling, characterization and segregation of excavated materials, and monitored daily logistics for field crews.

Mercury-Contaminated Soil Treatment Alternatives Evaluation Report - Mr. Boyce's report evaluated various appropriate remedial treatment technologies, including visual and technical system descriptions, a comparison study of each alternative's technology, treatment process efficiency in the types, quantities and concentrations of mercury present in the soil, as well as the overall economics and cost effectiveness. He called attention to the presence of other contaminants such as organics and radioactive parameters, and studied the available technologies. He also presented recommendations for a soil stabilization process and options for the remediated soil's disposal.

OUIII Western South Boundary Remedial System Design - Mr. Boyce was responsible for assisting in selecting the appropriate remedial technology for a groundwater pump treatment system for a volatile organic contaminant plume clean up. He suggested appropriate technologies and reviewed them from a feasibility standpoint. He recommended the most applicable one, based on effectiveness, available capital and O&M costs, implementation, reliability, operation, and maintenance. Mr. Boyce was then responsible for preparing a portion of the design of the recommended treatment technology, which included sizing and optimizing the primary treatment equipment (4-foot diameter x 35-foot tall air stripping tower).

Ash Pits Capping –Mr. Boyce was responsible for preparing the design of a capping system for an area formerly used as incinerator ash repository. He conducted the initial investigation to assess the area's extent by reviewing old aerial photographs, digging test pits, and conducting interviews with BNL personnel. Once he had delineated and surveyed the area, Mr. Boyce designed a soil-cap cover system in accordance with NYSDEC regulations to prevent surface exposure to ash and to minimize rainfall infiltration through the area. He was responsible for repairing design/construction drawings that included grading, drainage, slope stabilization details, limits of clearing and coverage and site restoration work such as fencing, roadways, signage, etc.

Ridge Mobil Gas Station, Ridge, NY

Soil & Groundwater Remediation System - Mr. Boyce evaluated, selected, and designed the system for a petroleum spill at a gas station. He chose a soil vapor extraction (SVE) system in conjunction with an air-sparging system as the appropriate remedial technology, based on the characteristics of the contamination, site hydrogeology and overall size of the spill and associated plume. Mr. Boyce oversaw SVE wells and air-sparge points locating/sizing, SVE blower and air sparge compressor designs, off-gas treatment needs assessment, and appropriate controls and instrumentation selection for system interlocking capability. He prepared project plans/specifications for NYSDEC review and construction purposes.

Minmilt Realty, Farmingdale NY

Groundwater & Soil Remediation Systems Design - Mr. Boyce evaluated, selected and designed appropriate remediation systems to cleanup a large industrial solvent plume that had contaminated nearby soil and groundwater. The chosen groundwater remediation consisted of an air-stripping tower, granular activated carbon (GAC) filters for off gas treatment and recharge structures; the soil treatment system was a

soil-vapor extraction system (SVE) and GAC filters. Mr. Boyce's design responsibilities included sizing and selecting remediation system equipment, structural, mechanical, electrical, hydraulic, well, controls and instrumentation design. Mr. Boyce also performed three-dimensional numerical groundwater modeling to evaluate the effectiveness of the proposed groundwater remediation system and to size and locate a series of deep and shallow wells. Mr. Boyce prepared plans and specifications, a technical report for the NYSDEC detailing the choice of the specific components overall design process. He was involved in the construction administration and oversight of the remediation systems and was responsible for reviewing and approving shop drawings and performing routine construction observation services.

Lincoln Bright Bay, Bay Shore, NY

Groundwater & Soil Remediation System Design - Mr. Boyce evaluated, selected and designed a soil and groundwater remediation system for a petroleum spill at a car dealership. His choice of a soil vapor extraction (SVE) system in combination with an air-sparging system was the appropriate remedial technology based on the characteristics of the contamination, the site hydrogeology and capability to measure the extent of the spill and associated plume. Mr. Boyce located and sized SVE wells and air-sparge points, designed the SVE

blower and air-sparge compressor, evaluated whether off-gas treatment would be necessary and selected appropriate controls and instrumentation to interlock the systems smoothly. He prepared plans and specifications, assisted the client in the bid and award of construction contracts and oversaw the system's construction, testing, startup and operation, maintenance and monitoring.

Allied Aviation Services, LaGuardia Airport, NY

Filter Pad Design – Mr. Boyce managed the structural design of a reinforced concrete pad to supply fuel for a jet fuel tank farm. After investigating soil conditions to determine bearing capacity/structural adequacy to support the new proposed loads, Mr. Boyce located, sized, and situated the new filter pad among an existing pipe and tank network, and prepared designs for concrete reinforcement to withstand differential settling effects. He sized a secondary containment volume and dyke wall for the pad, prepared designs to integrate fuel filters into the existing system, and for a steel frame staircase and catwalk system to provide maintenance workers access to the fuel filters. Subsequently, he prepared structural calculations and construction documents (i.e. plans and specifications). He submitted the plans to the NY/NJ Port Authority for review and comment before construction. During construction, unexpected sub-surface conditions were encountered that required significant design changes, including re-engineering the pad foundation. He provided adjusted structural calculations and revised the design to accommodate the conditions that could not be alleviated.

Computer Circuits Hauppauge, NY

Soil Remediation System Design - Mr. Boyce was responsible for the design of a soil vapor extraction (SVE) system to remediate a small plume of solvents at an industrial site in Hauppauge, NY. The design included SVE wells both vertical and horizontal, a treatment shed, an SVE blower, air/water separator, a particle separator, electrical power supply and distribution and instrumentation and controls. He performed all necessary calculations to estimate radii of influence for the horizontal and vertical SVE wells and was responsible for preparing the project plans and specifications that were to be submitted to the NYSDEC for approval and used as construction documents.

Brentwood Water District (BWD) Air Stripper, Plant No. 2, Brentwood, NY

Treatment Alternatives Study & System Design – As Project Engineer, Mr. Boyce conducted the treatment alternatives study for a VOC contaminated well field at BWD. The study ultimately recommended air stripping as the most effective and cost efficient technology to treat groundwater withdrawn from Plant No. 2. Upon the study's completion and acceptance, he prepared the design for the treatment system, which encompassed mechanical, electrical, structural, hydraulic, architectural and site components. Specific design components included an 11' diameter by 30' packed bed depth aluminum air stripper, a 100,000-gallon ground storage clearwell, and booster pumps. Specific design aspects include restaging an existing well pump, electrical service upgrade, a new natural gas engine generator set, stripping tower enclosure and three existing pumping stations refinish. Mr. Boyce prepared the plans and specifications, which were approved by the SCDHS and ultimately used to construct the air stripper and related facilities. Following the design phase of the project Mr. Boyce was responsible for providing construction administration and observation services.

Nitrate Study & Analysis - Mr. Boyce prepared a statistical analysis to compare increasing groundwater nitrate concentrations with pumpage from Plant No. 2 of the BWD. The analysis involved compiling water quality data to measure levels in three wells of Plant No. 2, reviewing the data, and using statistical methods to forecast the water quality of pumpage from the aquifers utilized by the BWD. He superimposed pumpage data from Plant No. 2 over his water quality findings to create a trend analysis, which showed nitrate concentrations fluctuated in the different wells based on pumpage. Mr. Boyce recommended available treatment technologies which eventually would be necessary to slow the deterioration rate of water quality caused by nitrate level changes. He advised that, based on the statistical analysis, establishing pumping sequences would slow the rate of water quality deterioration. His report also included estimates for when treatment of nitrate will become necessary and appropriate treatment technologies available.

Paul K Boyce, PE, PG, President

Roanoke Sand & Gravel, Mid Island, NY

Sand Mining Design and Permitting – As the primary client contact, Mr. Boyce oversaw the application submittal to the Town of Brookhaven and NYSDEC to expand mining operations at an existing sand and gravel mine. The scope of services included assembling engineering drawings for proposed mining operations by excavating deeper through the bottom; preparing an engineering report addressing environmental, geotechnical and hydrogeological issues; preparing volume estimates to determine how much more sand and gravel could be mined by expanding the operations at the existing site and acting as regulatory liaison for the client.

Tank Management

City of Long Beach, NY

New Elevated Storage Tank Hydraulic Analysis & Permitting -Mr. Boyce was responsible for performing a hydraulic analysis to identify the optimal height and location for a new steel elevated water storage tank for the City of Long Beach. He used computer modeling to perform the analysis and was responsible for obtaining and entering all data into the model. He worked closely with the City's water department personnel to accurately represent the City's distribution system and obtain factual hydraulic data (ie: flow rates, operating flow rates, velocities, pipe sizes). Mr. Boyce ran several different modeling scenarios including worst-case conditions under peak day with fire flow demands. He used the model output to locate and recommend an appropriate height for the new tank.

Reactor Decommissioning

Brookhaven National Laboratory, Upton, NY

Building 705 Stack Study – Mr. Boyce was the lead author of the study report, which was an evaluation of end-state alternatives for the D&D of a 320-ft tall reinforced concrete stack that had been used to exhaust reactor and nuclear experiment cooling gases. The report assessed different D&D technologies, disposal options and potential effects of demolishing such a large structure on laboratory operations. PWGC prepared preliminary cost estimates that the DOE used to select a feasible demolition method as well as a plan to construct a smaller replacement stack for any site activities that still needed a stack.

High Flux Beam Reactor (HFBR) D&D Cost Estimates & Scheduling - Mr. Boyce is well versed in D&D services for nuclear research facilities. He managed and oversaw various services at this DOE facility to provide the client with estimates for a facilities ultimate D&D end-state. Key tasks included:

- Quantity takeoffs from original design and as-built/record drawings
- "Bottoms-up" cost estimating for D&D, waste management, health physics (HP), radiation control support, project management, engineering and planning aspects
- Development of project contingency matrix, and assignment of contingency degree for each D&D activity
- Applicable labor rates review and analysis
- Comprehensive project schedule - permitting, planning, engineering, execution, program management, closeout
- Preliminary scope of work and estimates for indirect HP quantities and costs
- Regulatory rules/regulations review
- Liaison between client, contractors, vendors
- Preliminary D&D, restoration sequences
- Key assumption establishment for cost estimates and schedule

Medical Research Reactor (BMRR) D&D Consulting - Mr. Boyce provided the planning and cost estimates for the planned D&D activities at the 5-megawatt research reactor and its associated structures (stack and well house). He provided an estimate for the complete demolition of the mechanical, electrical, and structural components of the reactor building and the exhaust stack, including quantity estimates (construction & demolition debris, hazardous wastes, LLW materials and site restoration materials). In addition, he developed work scopes for D&D activities relative to specific BOPs and individual levels within the BMRR, and a project schedule and time line for D&D activities, and furnished supporting documentation in the form of a work-breakdown structure dictionary.

Brookhaven Graphite Research Reactor (BGRR) D&D Services – As project manager, Mr. Boyce was responsible for D&D oversight and engineering services, which included the design of ventilation systems, design of structural components in support of radiation shielding and equipment placement, as well as the design and construction of a facility mock-up to assist in personnel training for actual D&D activities. Throughout the project he provided guidance and direction to project engineers charged with performing design work and reviewed design drawings for adequacy. D&D activities design services were associated with included demolition and removal of radiological contaminated air filters.

Paul K Boyce, PE, PG, President

Alternative Fuels

Town of Oyster Bay Department of Public Works, NY

Design of Compressed Natural Gas (CNG) Fueling Station - As the Project Director, Mr. Boyce serves as the client's representative and is responsible for the overall quality assurance and quality control of the project. He oversees the team of engineers to ensure that the firm's resources are available so that the project is adequately staffed, equipped and managed to effectively develop the civil, mechanical, and electrical design details and construction bid documents for a combined time and fast-fill CNG fueling station at the Town's Syosset, NY facility. Mr. Boyce attends meetings with the town and reviews designs, plans, and specifications as necessary.

Suffolk County Department of Public Works, NY

Design of Compressed Natural Gas (CNG) Fueling Stations – As the Project Director for three locations, Mr. Boyce serves as the client's representative and is responsible for the overall quality assurance and quality control of the project. He oversees the team of engineers to ensure that the firm resources are available so that the project is adequately staffed, equipped and managed to effectively develop the civil, mechanical, and electrical design details and construction bid documents for two fast-fill CNG refueling stations and one time-fill refueling station in Suffolk County, NY. Mr. Boyce attends meetings with the town and reviews designs, plans and specifications as necessary

Geothermal Consulting, Planning, Design, Compliance & Construction Management

Mr. Boyce is the designated PWGC expert on all aspects relevant to Geothermal Wells - from the planning stage through to system start up and operation. He assists clients with selecting the appropriate system and location, assessing a given system's feasibility in terms of the client's objectives, preparing designs in accordance with regulatory requirements, managing the system's construction, and coordinating its startup. Mr. Boyce has earned a reputation with clients and within the industry for his vast hands-on experience in assessing feasibility of existing systems and providing financially sound modifications for possible improvements enables clients to make sound decisions on how and if at all to conduct a proposed project.

GEOTHERMAL SYSTEMS PROJECTS – Summary Table
St. Patrick's Cathedral, New York, NY – Standing Column Well System
Feasibility Study, Subsurface Due Diligence, Design, Permit/Filings Support
Glen Cove Hospital, Glen Cove, NY - 800 gpm Open Loop
Feasibility Study, Hydrogeological Study/Engineering Report, Long Island Well Permit Application, Groundwater Modeling
Standard Microsystems, Hauppauge, NY - 600 gpm Open Loop
Design , Construction administration/oversight
C.W. Post College, Brookville, NY - 320 gpm Open Loop
Feasibility Study, Long Island Well Permit Application, Regulatory Agency Liaison
Bear Mountain, Upstate NY - Closed Loop Lake System – Coils
Evaluation of Thermal Effects on Lake Biota, Bathymetric Survey
157 Central Ave, Greenport, NY - Closed Loop System 4 Ton
Feasibility Study Open Loop vs. Closed Loop, Closed Loop Boreholes Preliminary Design
Loeb Residence, East Hampton, NY - Open Loop System
Supply & Recharge Well Design for Residential Air Conditioning System
175 Mohawk Ave, Watermill, NY - Closed Loop System 56 Ton
Proposed Design Peer Review (borehole depths, spacing, sizes, piping)
Ross School, East Hampton, NY - Bldg 5 (500 gpm) & Bldg 2 (250 gpm) Open Loop Systems
Hydrogeological Study/Engineering Report, Long Island Well Permit Application, Groundwater Modeling
Telyas Residence, Old Westbury. NY - 90 gpm Open Loop System
Long Island Well Permit Application & Design
New Lane Elementary School, Coram, NY – Open Loop
Existing System Assessment, Corrective Actions Recommendations
Citibank, Melville. NY - 325 gpm Open Loop System
Existing System Evaluation Corrective Actions Recommendations
Pratt Institute, Brooklyn, NY - Standing Column Wells 150 Ton System (5 Wells)
Feasibility Study Compared Open Loop, Closed-Loop & Standing Column, Test Hole Oversight & Logging, Cost Estimating
AIL Systems, Deer Park, NY - 2,650 gpm Open Loop System
4 supply wells totaling 2,650 gpm discharging to a recharge basin, hydrogeological analysis
Lerner Residence, Lloyd Harbor, NY – 66 gpm Open Loop System
Feasibility Study – hydrogeological & water quality investigations
30 Wheatley Road, Old Westbury, NY - 90 gpm Open Loop
Iron Removal System Design
Front Street (Manhattan, NYC) - Standing Column Well
Expert Witness Testimony & Support
Brooklyn Children's Museum (Brooklyn, NYC, NY) - 420 gpm open loop system
Investigation & Trouble Shooting, Analysis of Malfunctioning Diffusion Wells
Kensington Public Library, NYC DDC (Brooklyn, NY) - 200 gpm open loop system

Paul K Boyce, PE, PG, President

Consult and advise on design and feasibility
Cow Neck (Suffolk County, NY) - Closed loop system 40 tons
Feasibility study, Field testing program-
Queens Botanical Garden, NYC DDC (Queens, NY) - open loop system
Consult and advise on construction, Rehabilitation and re-development specification
Snug Harbor, NYC DDC (Staten Island, NY) – closed loop system 230 tons
Field testing program, Design – modeling using GLHEPRO Version 4.0
Bronx Zoo Lion House, NYC DDC (Bronx, NY) – standing column well 160 tons
Investigation and troubleshooting analysis of malfunctioning well system
NYC DDC Geothermal Heat Pump Manual (NYC, NY)
Update NYC Depart of Design and Construction Technical Manual on Geothermal Heat Pumps
Macys Bay Shore Mall (Suffolk County, NY) – Open loop system
Existing System Assessment, Develop Corrective Actions, Well Rehabilitation
Macy's Broadway Mall (Nassau County, NY) – Open loop system
Hydrogeological Analysis, Design, Cost Estimating, Groundwater Sampling , Permit/Filings Support
Underwriters Laboratories (Suffolk County, NY) – Open loop system
Feasibility Study, Groundwater Investigation
Eastport/South Manor School District (Suffolk County, NY) – Open loop system
Feasibility Study, Subsurface Due Diligence, Hydrogeological Analysis, Groundwater Investigation
Clark Art Institute- New Visitor, Exhibition and Conference Center, Williamstown, MA - Open loop system
Subsurface Due Diligence, Hydrogeological Analysis, Groundwater Investigation
Clark Art Institute- Stone Hill Conservation Center - Open loop system
Subsurface Due Diligence, Hydrogeological Analysis, Groundwater Investigation
Town of Babylon, Office of the Supervisor, Wyandanch Rising – District Utility Scale Open loop system
ATES Feasibility Study
New York Institute of Technology, Old Westbury, NY – 1800 gpm Open Loop System
Feasibility Study, Subsurface Due Diligence, Hydrogeological Analysis, Groundwater Investigation, Design, Permit/Filings Support
40 Meadow Lane, Southampton, NY – 45 gpm Open Loop System
Feasibility Study, Subsurface Due Diligence, Hydrogeological Analysis, Groundwater Investigation
Suffolk County Community College, Brentwood, NY – 200 gpm Open Loop System
Feasibility Study, Subsurface Due Diligence, Hydrogeological Analysis, Groundwater Investigation
Amneal Pharmaceuticals, Brookhaven, NY – 3,600 gpm Open Loop System
Feasibility Study, Subsurface Due Diligence, Hydrogeological Analysis, Groundwater Investigation, Design, Permit/Filings Support, Construction Oversight
Brooklyn Navy Yard – Bldg 92, Brooklyn, NY – 140 gpm Open Loop System
Feasibility Study, Subsurface Due Diligence, Hydrogeological Analysis, Groundwater Investigation, Design, Permit/Filings Support, Construction Oversight
St. Joseph's Church, Brooklyn, NY – 550 gpm Open Loop System
Feasibility Study, Subsurface Due Diligence, Hydrogeological Analysis
Cornell NY Tech Campus, Roosevelt Island, NY – Closed Loop System
Feasibility Study, Subsurface Due Diligence, Hydrogeological Analysis, Groundwater Investigation, Design
Weeksville Heritage Center (NYCDDC), Brooklyn, NY – Closed Loop System
Feasibility Study, Subsurface Due Diligence, Design, Construction Oversight
1240 Meadow Lane, Southampton, NY – Closed Loop System
Feasibility Study, Subsurface Due Diligence, Design, Permit/Filings Support, Construction Oversight
Suffolk County Department of Public Works – Board of Elections Bldg, Yaphank, NY
Feasibility Study, Subsurface Due Diligence

MODELING EXPERIENCE

MODEL – CLIENT & APPLICATION
Groundwater Vistas - Environmental Simulations International (Groundwater Modeling)
(I) Glen Cove Hospital, Glen Cove, NY - Study of geothermal wells impacting each other, hazardous waste site, and water table
(II) Glen Cove Hospital, Glen Cove, NY – Replacement of two geothermal systems, one in Lloyd Aquifer required extensive modeling of Lloyd Aquifer plus North Shore Confining Unit and North Shore Aquifer
Amneal Pharmaceuticals, Yaphank, NY – 3,600 gpm open loop geothermal system, analyze influence on neighboring SCWA well fields, surface water bodies and heat transport
NYIT, Old Westbury, NY – 2,250 gpm open loop geothermal system, analyze influence on area municipal supply wells and model heat transport
SCCC Brentwood Campus, Brentwood, NY - 600 gpm open loop geothermal system, locate and space supply and return wells and model heat transport
C.W. Post College, Brookville, NY - Size & locate open loop geothermal well system
Trigen-Nassau Energy Corp, Garden City, NY - Size new industrial well, estimate impacts on nearby wells and East Meadow Brook headwaters
BNL, Western South Boundary, Upton, NY - Estimate capture zone of groundwater recovery wells for Remediation Project

Paul K Boyce, PE, PG, President

Ross School, East Hampton, NY - Study effects of geothermal wells on neighboring wells, water table, each other
Suffolk County, Department of Public Works, Sewer District 21, SUNY Stony Brook - Evaluate Travel time and flow of Sewage Treatment Plant effluent to Long Island Sound using The County's Groundwater Model
The Hills Golf Resort, East Quogue, NY – Evaluate Irrigation Well placement to Capture Farm Field Nitrogen
Construction Site Dewatering, Gravesend, Brooklyn, NY – determine well locations and pumping rates to dewater construction site to desired excavation depth – steady state and transient conditions evaluated
52 & 62 Further Lane, East Hampton, NY – Two adjacent open loop geothermal systems: evaluate system interference, well positioning, screen settings and proximity to shoreline (Atlantic Ocean)
WaterCAD - Haestad Methods (Water Distribution System Modeling)
Hampton Bays Water District, Hampton Bays, NY - Water distribution system design & analysis
West Neck Water Supply, Shelter Island, NY - Water distribution system design & analysis
City of Long Beach, Long Beach, NY - New elevated storage tank integration into existing distribution system
GMS – Aquaveo, LLC (Groundwater Modeling)
BNL – New Remediation Well at Middle Road System – well location and capture zone analysis
BNL – Industrial Park Fate and Transport Model of VOC plume
BNL – Rebalancing of Recharge Basin Water Site Wide
BNL – EDB Plume Fate and Transport Model
BNL – Chem-Holes Sr-90 Plume Fate and Transport Model
BNL – Former Hazardous Waste Management Facility (FHWMF) Sr-90 Fate and Transport Model
BNL – Current Landfill VOC Fate and Transport Model + Particle Tracking
BNL – Building 96 VOC Particle Tracking Model
BNL – Western South Boundary TVOC Plume Fate & Transport Model
BNL – 1,4-Dioxane Particle Tracking Model
BNL – North Street East EDB Particle Tracking and Fate and Transport Model

Publications

- **Not Just a Chemical Interaction: Complementary Roles of Geologist & Engineer on a Hazardous Waste Remediation Project at BNL** (5th Conference: Metropolitan & Long Island Association of Prof'l Geologists (M/LIPAG, 04/98, SUNY Stony Brook)
- **Much Ado About Mercury: Evaluation of Treatment Options for Mercury Contaminated Soil at Brookhaven Nat'l Laboratory (BNL)** (6th Conference, M/LIPAG, 04/99, SUNY Stony Brook)
- **Open-Loop Geothermal Well Systems on Long Island** (10th Conference, M/LIPAG, 04/03, SUNY Stony Brook)

PWGC
Strategic Environmental Engineering Solutions

Kris E. Almskog, Vice President

Professional Experience

PWGC 20 years

Education

- BS, Geology, Stony Brook University, NY

Certifications and Training

- OSHA Health & Safety 40-hr, Supervisor 8-hr, Competent Person for Excavation
- OSHA 10-hr Construction
- Manager Leadership Training (Dale Carnegie)
- Advanced Technologies for Natural Attenuation (Regenesis)

Areas of Expertise

- Water Treatment System Construction Management/Oversight
- NYSDEC Brownfield Cleanup Program Management
- NYCOER Brownfield & E Designation Management
- Remedial Systems - Construction, Installation, Start-up, Troubleshooting, O&M
- Soil Excavations and Soil Logging
- Groundwater & Soil Investigations
- Health & Safety Oversight/Consulting
- Phase I, Phase II Investigations

Affiliation

- Long Island Association of Professional Geologists (Board Member)
- New York City Brownfield Partnership (Board Member)
- New York City Building Congress
- New York Council of Professional Geologists

Profile

Mr. Almskog's construction inspector/field engineer oversight and quality control experience includes projects for multiple BNL Groundwater Treatment Systems construction projects, landfill monitoring and maintenance and for decontamination and decommissioning activities at the High Flux Beam Reactor and the Brookhaven Graphite Research Reactor. In addition, he serves as liaison to the Environmental Management and Plant Engineering Divisions, providing progress updates and recommendations to for multiple construction projects. He has an excellent working knowledge of hydrology and geoscience issues and related tasks for groundwater, soil, and air quality investigations, characterizations, environmental remediation and reporting. Further, Mr. Almskog has provided field oversight for, and conducted, soil and subsurface water characterizations, pesticide investigations and remediation services on diverse environmental studies such as Phase II investigations, geothermal well installations, treatment system installation and operation and dredging projects.

Mr. Almskog has assisted real estate interests with environmental concerns, including New York City's Office of Environmental Remediation "E" designation zoning requirements during property transactions and site development. His focus has been on soil and groundwater investigations, air quality studies and associated remedial measures. His clients benefit from his expertise in Phase II, RI/FS, cost to cure estimates and brownfield remediation. Mr. Almskog's construction background enables an acute understanding of property development mitigating project delays and cost overruns. He coordinates with PWGC clients to prepare plans - Remedial Action Plans, Health and Safety Plans, Work Plans, Interim Remedial Measures - for approval by regulatory agencies. Further, he monitors each project's day-to-day progress to meet client budgetary and timing requirements.

Notable Projects

Brookhaven National Laboratory - Upton, NY

Mr. Almskog has extensive experience working at Brookhaven National Laboratory providing practical environmental engineering solutions for the ever-evolving world class science institution. His work focused on coordination with the Environmental Management Director and Plant Engineering Construction Coordination Group/Modernization Project Office. He provides support to the facility's Groundwater, Surface and Reactor Groups. Using his construction knowledge and that of BNL's EM Operational Procedure Manual (OPM), Standard Operating Procedures, Standards Based Management System and Work Control Procedures has enabled him to complete projects on time and within budget. He has extensive knowledge of water treatment and remedial system construction including well installation, piping, concrete work, control systems and construction health and safety. His field responsibilities include oversight and management of remediation systems' construction projects, remediation system start-up testing, reporting, surface soil excavation, decontamination and decommissioning of reactor structures, landfill inspections, disposal coordination of generated project waste, environmental procedural compliance, health & safety oversight and oversight of subcontractors. He has worked closely with subcontractors and regulatory agencies to conduct field activities safely and efficiently.

Kris E. Almskog, Vice President

Soil and Air Sampling

BNL, Environmental Management Directorate

Landfill Monitoring/Maintenance - He was responsible for the monthly inspections and maintenance of BNL's Former, Interim and Current Landfills. He performed monthly site visits and inspections of the landfills and conducted soil-gas monitoring. Mr. Almskog then prepared monthly status reports documenting the findings. Mr. Almskog also worked with BNL's Plant Engineering group to keep the landfills maintained according to NYSDEC requirements. He later coordinated landfill gas sampling by BNL's Environmental Services Division and was responsible for gathering data and contributing to the preparation of the Annual Landfill Report.

Calibration Coordinator – In his role, he assisted with revisions of OPM 4.14 and was responsible for implementing and monitoring project procedures according to guidelines (e.g. field calibration, equipment usage, and manufacturer's maintenance, recommendations). He provided assistance to determine calibration based on equipment function and use conditions (required the use of level C personal protection).

PCB Delineation & Excavation System - Conducted sampling activities defining the vertical and horizontal extent of PCB contaminated soils. Upon completion of the sampling, he was responsible for oversight of the excavation, disposal of the soils and for collection of confirmatory endpoint samples. Due to the hazards involved with the contaminated soils, he was responsible for conducting daily tailgate safety meetings with all of the contractors and coordinating the effort with EM ES&H professional.

Groundwater Remediation

BNL, Environmental Management Directorate

Off Site Treatment Systems: LIPA/Airport, North Street/North Street East, Industrial Park East, & OUVI EDB Treatment Systems - Provided long term construction inspections services for multiple large-scale GTS designed to remove volatile organic compounds from groundwater. He was responsible for ensuring contractors followed stringent design specifications at various treatment buildings and long-run buried piping through residential areas of BNL property. He also acted as the site geologist to determine the pumping/recharge wells locations and screen zones.

Sr-90 Pilot Study Groundwater Treatment System (GTS) Oversight and System Start-Up Administration - Mr. Almskog provided construction inspection services for an on-site groundwater treatment system (GTS) aimed at removing Sr-90 from the groundwater. His oversight responsibilities included project planning, as well as oversight and coordination of contractors (e.g. drillers, plumbers, electricians, heavy equipment operators, programmers, engineers, and consultants). He ensured the work was performed in accordance with BNL's SBMS, OPMs, and in accordance with applicable OSHA guidelines. He provided administrative and invoice review to ensure that the project was documented properly to meet BNL's strict guidelines.

Off-Site Groundwater Remedial System - Provided sampling services and hydrogeologic oversight for several vertical profiles as part of the off-site OUIII plume evaluation. His responsibilities included logging of soil borings and collection of groundwater samples. He was responsible for construction observation and documentation for numerous monitoring well and remediation well installations. He collected groundwater quality data for analysis to determine the effectiveness of the treatment system.

OUIII Western South Boundary GTS Construction/Hydrogeologic Oversight & Coordination – Mr. Almskog provided construction oversight for a GTS designed to remove volatile organic compounds from groundwater. Specifically, he provided hydrogeologic oversight to locate extraction screen zones and construction oversight to coordinate trades working on the project in order to complete the system in a timely fashion. He provided health and safety coordination to ensure that work was performed in a safe manner and by properly trained professionals. Mr. Almskog also provided administrative and billing assistance to the BNL project manager to ensure that the project was properly documented and invoiced according to BNL's SOP's.

OUIII Middle Road GTS Construction & System Start Up - Mr. Almskog was involved on this project from the construction kick-off meeting through system start-up and reporting. In addition to responsibilities similar in scope to his current Sr-90 construction project duties, he provided hydrogeologic, health & safety oversight for the project as part of the OUIII plume evaluation. His responsibilities included the coordination of a drilling crew, conducting daily tailgate meetings, using and maintaining granular activated carbon units and ambient air monitoring. He was responsible for the logging of soil borings and collection of groundwater samples from temporary vertical profile wells. He performed these duties for nine months while working on several other ongoing remediation projects at BNL.

Kris E. Almskog, Vice President

HFBR Tritium On-Site Tritium Remediation - Mr. Almskog provided intermittent oversight for the Low-Flow Tritium Extractions as part of the remediation of the onsite HFBR tritium plume. He monitored groundwater extraction rates, conducted daily tailgate safety meetings, managed the collection and shipment of groundwater samples and coordinated the mobilization/demobilization of all necessary equipment and personnel. Mr. Almskog ensured that the work was performed under a Radiological Work Permit and required strict health and safety, sampling, and QA/QC procedures.

Off Site Treatment Systems: LIPA/Airport, North Street/North Street East, Industrial Park East, & OUVI EDB Treatment Systems - Provided long term construction inspections services for multiple large-scale GTS designed to remove volatile organic compounds from groundwater. He was responsible for ensuring that contractors followed stringent design specifications at various treatment buildings and long-run buried piping through residential areas of BNL property. He acted as the site geologist to determine the pumping/recharge wells locations and screen zones.

Glen Isle Development - Glen Cove, NY

Waterfront Redevelopment – Mr. Almskog served as Project Manager of environmental Due Diligence for the redevelopment of a 56-acre industrial site, slated for residential-use. The site's multiple parcels included Federal and State Superfund sites as well as municipal brownfields. Contamination ranged from organics, metals, and radionuclides in soil and groundwater. He provided document review and fact checking of previous investigations of the multiple sites and prepared a summary report detailing the findings of the previous investigations, data gaps that represented potential environmental areas of concern, cost and schedule estimates to conduct further investigation and remediation and administrative services to get the sites delisted by the various regulatory agencies involved.

Bright Bay Lincoln- Bay Shore, NY

Groundwater Quality Monitoring - Mr. Almskog provided quarterly sampling and reporting to evaluate the ongoing groundwater quality of the site. He used a soil-vapor extraction system that PWGC had designed for the project. The DEC ordered the spill number for the site be closed based upon these reports.

E Designation

McCarren Park Mews - Williamsburg, NY

Subsurface Investigation – NYCDEP E Designation/NYSDEC Spill Site Redevelopment - PWGC conducted a subsurface investigation and submitted a subsequent Remedial Action Plan & Health and Safety Plan to NYCDEP. PWGC provided engineering oversight during earth moving activities and during installation of engineering controls to mitigate vapor intrusion concerns at this NYSDEC spill site. Mr. Almskog provided project management services and coordinated remedial designs and field efforts with NYCDEP and NYSDEC throughout construction. He acted as a spokesperson for the developer, to news media, to address environmental concerns of the neighborhood residents and assisted the developer with tenants questions during sales of the units.

North Development Group - Brooklyn, NY

Property Transaction, Subsurface Investigations, NYCDEP E Designation Redevelopment, & NYSDEC Spills Remediation - PWGC coordinated subsurface investigations and remediation of five ongoing re-development projects for North Development Group. PWGC provided services that included a sub-surface investigation beneath existing buildings and a design and implementation of engineering controls that could be implemented during ongoing construction to meet regulatory compliance and assure that project schedules would remain on track. Mr. Almskog provided project management services, field investigation oversight and coordinated remedial designs.

Brownfield Redevelopment

Former Darby Drug Facility - Rockville Centre, NY

NYSDEC BCP Implementation During Redevelopment Mr. Almskog is serving as Project Manager to implement an environmental investigation and substantial remediation effort during redevelopment activities at this 150,000 square foot warehouse being converted to apartments. PWGC previously conducted a subsurface investigation and was able to get the project accepted into the NYSDEC Brownfield Cleanup Program (BCP). As part of the remediation of the site, PWGC

Kris E. Almskog, Vice President

prepared an Interim Remedial Measure Work Plan to address significant chlorinated solvent contamination beneath the existing warehouse. As project manager, Mr. Almskog was responsible for ensuring compliance with strict administrative policies of the BCP, while working within the developer's strict schedule requirements. He has prepared Remedial Investigation Work Plans, Community Participation Plans and a Remedial Investigation Report. He has represented the developer at public meetings, prepared and conducted a competitive bid process to ensure a competitive price for this multi-million dollar remedial phase.

White Plains Courtyard Apartments - Bronx, NY

NYSDEC BCP Implementation During Redevelopment PWGC provided sub-surface investigation services and analysis of site conditions to get this previously rejected project entered into the NYSDEC Brownfield Cleanup program (BCP). Formerly an abandoned gas station, the current developer was able to obtain funding, upon acceptance into the BCP, to remediate the VOC impacted groundwater and transform this abandoned lot into an eight story residential building with retail space on the first floor. Mr. Almskog managed the remedial investigation and the IRM implementation at the site, which was conducted during construction of the new mixed-use building. Following the field effort and the installation of engineering controls at the site, Mr. Almskog prepared and received approval on the Final Engineering Report which documented the previous investigations, IRMs, remedial actions conducted, engineering controls installed, and the site management plan for the property. Due to the aggressive approach implemented at this site, the developer received his certificate of completion from the BCP program prior to construction activities being finished.

Tank Management

Green Bus Lines, Bus Terminals - NY City Metro Area

Underground Storage Tank (UST) Investigation – UST Closure – Groundwater Investigation & Remediation NYSDEC Spill Management - PWGC conducted the investigations at five bus storage and maintenance yards through New York City. Mr. Almskog was part of the team performing field oversight of soil sampling using a Geoprobe®. He was integral in determining the source and amount of contamination in multiple areas, which contained up to 80 UST. Mr. Almskog is now working closely with NYSDEC to implement stipulation agreements and corrective action plans at each of the sites to deal with residual sub-surface impact from the UST removal action.

Reactor Decommissioning

BNL, BGRR Decontamination and Decommissioning Activities

Mr. Almskog provided management and field oversight for several Decontamination and Decommissioning (D&D) related activities at the BGRR. He was responsible for stabilizing asbestos containing materials and flaking lead paint throughout the reactor structure. He also oversaw brick facade refurbishment and the replacement of a built-up-roof on the reactor structure. Due to the nature of the building being a nuclear reactor, the strictest security and safety procedures were called for during the projects to ensure that BNL technical and health and safety procedures were followed by the contractors.

Environmental Compliance

Neptune Transmission System

Mr. Almskog supported the environmental and health and safety compliance for the Neptune project, a large-scale power generation construction project. The project had two separate construction contractors and two distinct scopes: the upland cable route, a 13-mile stretch through environmentally sensitive areas including wetlands and the converter station, constructed on a former landfill. This required the use of a team of inspectors that were on-site daily as well as auditors that reported monthly. Prior to commencing the field effort, he directed the effort to generate inspector checklists that warranted the review of multiple plans and documents including the Certificate of Environmental Compatibility and Public Need. The checklists were accepted by the Public Service Commission (PSC) without comment. He reviewed the inspector's daily checklists and auditors reports to ensure the project met environmental and safety requirements. The reports were then released to the PSC. His project management approach allowed each contractor to operate more efficiently and save money. This was done by not duplicating effort and being part of the project team, i.e. notifying contractors of potential issues before problems arose and reducing need for additional environmental oversight on the contractor's part resulting in

money savings. This approach resulted in participation of all upland operations, as opposed to those areas deemed solely environmentally sensitive, as had been called for in the project documents. The project was completed with no significant violations, satisfying the regulatory agencies as well as the PSC.

Risk Assessment

Computer Circuits - Hauppauge, NY

Remedial Investigation and Feasibility Study (RI/FS) - Mr. Almskog acted as project director evaluating remedial alternatives following an extensive remedial investigation at the former Computer Circuits industrial site, a US Environmental Protection Agency Superfund Site (CERCLA-02-2000-2036). Mr. Almskog compiled data collected over several years of the remedial investigation to compile the Final Remedial Investigation Report and prepare remedial alternatives detailed in the Feasibility Study for the site. In addition, Mr. Almskog is responsible for implementation of the Interim Remedial Measure, which consists of a SVE system designed to remove VOCs from the impacted sub-surface soils.

PWGC
Strategic Environmental Engineering Solutions

John D. Eichler, Project Manager

Professional Experience

PWGC: 13 years

PRIOR: 6 years

Education

- BS, Environmental Studies, University at Buffalo, NY

Registrations/Certificates

- UST Decommissioning (Int'l Council of Building Officials)
- OSHA Health & Safety 8-hr Supervisor, 40-hr HAZWOPER

Areas of Expertise

- Environmental Compliance
- Hydrogeology
- Soil/Groundwater/Subsurface Investigation & Sampling
- Environmental Site Assessments
- Sub-Slab Vapor Investigation and Mitigation
- Remediation
- Storage Tank Decommissioning

Profile

Mr. Eichler works closely with clients, sub-contractors, and regulatory agencies and manages field activities according to project plans, such as work plans, sampling and analysis plans, Health and Safety plans as well as Quality Assurance and Quality Control. To ensure efficient workflow and reliable data collection, he draws from his hydrogeological/geoscientific background and experience with groundwater, soil, and air quality investigation techniques. PWGC's role on these projects include soil/groundwater investigations, air quality studies, and remedial measures. His clients, ranging from developers to attorneys, and municipal agencies, benefit from his expertise in overseeing Phase II, RI/FS, cost to cure estimates for financial institutions, and Brownfield projects.

Notable Projects

Wastewater Management

Penetrex Processing, Glenwood Landing, New York

Subsurface Investigation, NYS Class II Inactive Hazardous Waste Site - Mr. Eichler manages the investigative fieldwork, such as groundwater/soil sampling in accordance with NYSDEC-approved work plan. Further, he prepared and implemented the NYSDEC-approved work plan for the sub-slab vapor & indoor air sampling, coordinated the implementation of sub-slab depressurization systems designed to mitigate the vapors associated with chlorinated hydrocarbons, prepared the investigation reports, and implemented a chemical oxidant injection program as an interim remedial measure which will facilitate the closure of this project.

Groundwater Remediation

Safeguard Storage, Baldwin, New York

Remedial Investigation, NYS Voluntary Cleanup Program Site - Mr. Eichler manages and oversees the investigative fieldwork which is involved with this project. Aspects of the investigation included soil and groundwater sampling, sub-slab vapor and indoor air sampling, a tidal influence and saltwater intrusion evaluation, and an underground injection control investigation. He prepared various NYSDEC-approved work plans for the project and prepared the investigation reports, which will facilitate the closure of this project.

Brookhaven National Laboratory (BNL), Upton, NY

BNL HFBR and g-2 Tritium Investigations – Supported field engineering and oversaw installation and sampling of temporary monitoring and Geoprobe® wells. He managed groundwater sampling/analysis and water disposal, provided health and safety oversight, coordinated necessary permits, and oversaw project work to ensure compliance with the radiological work permit.

John D. Eichler, Project Manager

Brownfield Redevelopment

Brownfield Cleanup (BCP)/Environmental Restoration Program (ERP)

Mr. Eichler manages BCP and ERP projects for both private and municipal clients. He prepares technical documents and interfaces with NYSDEC project managers to ensure project schedules and scopes meet the NYSDEC's requirements for approval of incentives/reimbursements. These sites require preparation of BCP and ERP applications, technical work plans, RI reports, human health and ecological assessments, remedial alternatives reports, citizens participation plans, public meetings and completion reports. Under contract with the Suffolk County Department of Health Services (SCDHS) and the Department of Public Works (DPW), Mr. Eichler assists the County in managing the technical aspects of County owned sites in the NYSDEC Brownfields Cleanup and Environmental Restoration Programs. These sites include former industrial and gasoline service stations which are currently vacant or unused because the redevelopment of the sites are hampered by the historical site uses which have contaminated soil and groundwater.

Renaissance Realty Group (RRG), Brooklyn, NY

Phase II Investigation – PWGC conducted the investigation to support the client in a pending real estate transaction. Mr. Eichler's on-site tasks included Geoprobe™ oversight, soil/groundwater sampling, and field note preparation. He used on-site findings and data observations for accurate soil/groundwater classification and reports preparation.

Phase I Environmental Site Assessments

Project Management – Mr. Eichler routinely performs Phase I ESA's for PWGC clients. Fluent in Phase I ASTM Standards, he is highly efficient in verifying that each Phase I meets these standards. He is familiar with the latest applicable regulatory laws, such as the new federal All Appropriate Inquiry (AAI) guidance, a Brownfield law, which refers to requirements for assessing a property's environmental conditions prior to its acquisition.

Avalon Bay, Rockville Center, NY

Field Investigation Oversight– Mr. Eichler was responsible for the oversight and documentation of the field investigation for this Brownfield Redevelopment Project. The investigation consisted of soil and groundwater sampling using direct push technology to track the source of an on-site perchloroethylene plume. The investigation also included the installation of several monitoring wells. He evaluated the results and incorporated the data into a report.

Tank Management

Allied Aviation, JFK International Airport

Subsurface Investigation – Mr. Eichler is responsible for the management of this petroleum UST investigation. He prepared a NYSDEC-approved work plan for the sampling of soil and groundwater to determine if petroleum fuel tanks had impacted the subsurface. He coordinated the effort with the client, the property owner, field personnel, and subcontractors to meet the objectives of the investigation.

Wastewater Management

Minmilt Realty, East Farmingdale, NY

Remediation System Monitoring – Mr. Eichler was responsible for quarterly monitoring at the site. He supported efforts that assisted in shutting down the SVE system. While on site, he performed collection of air and water samples at the on-site pump and treat/SVE remediation system and water table monitoring in the area of the system.

Expeditors, Inwood, NY

Petroleum Remediation - Mr. Eichler provided field oversight for the remediation of a former Shell Oil terminal, contaminated with petroleum. His responsibilities included excavation management, soil sampling, coordination with the NYSDEC, and report preparation, to expedite an extensive remediation. His management of the project facilitated the closure of the site by the NYSDEC.

John D. Eichler, Project Manager

Brookhaven National Laboratory (BNL), Upton, NY

BNL Peconic River Remediation - Mr. Eichler supported field engineering and oversaw fieldwork and waste disposal for the remediation. He was responsible for riverbed sediment sampling, management of disposal documentation, and quality assurance for the dredging of impacted sediments from the Peconic River for disposal via railcar.

Environmental Compliance

Storm Water Pollution Prevention Plan (SWPPP) Inspections and Reports

Mr. Eichler inspects SWPPP erosion and sediment control for various demolition and construction projects including the Neptune Regional Transmission System, Liberty Industrial Finishing, and the Ross School. He prepares reports detailing findings, and coordinates with contractors to ensure that the site is compliant with the state-approved plan.

Soil Excavation

New York University, New York, NY

Soil Quality Investigation - He oversaw and documented the field investigation for this project. The investigation consisted of soil sampling using direct push technology to define the extent on impacted soil at the site. Upon completion of the fieldwork, Mr. Eichler assisted in the evaluation of the results and incorporated the data into a final report.

General Consulting

Allstate Insurance Company

Mr. Eichler oversees projects, such as petroleum spill remedial activities. He prepares spill reports, and coordinates with contractors and the NYSDEC to ensure that the client's goals are met in accordance with regulatory guidelines.

Computer Circuits, Hauppauge, New York

Mr. Eichler performed air sampling in accordance with the USEPA-approved work plan for the investigation at this Federal Superfund site. The investigation consisted of soil, groundwater, and air sampling, and the installation and operation of a soil/vapor extraction system. Mr. Eichler performed sampling activities following the QA/QC procedures detailed in the work plan.

Previous Experience

Petro Oil, Stamford, CT

Remediation Management - Mr. Eichler served as primary contact for clients, contractors, and regulatory agencies on remedial issues for Fuel Oil Tanks. His position involved meticulous communication and coordination between diverse clientele, ranging from property owners & developers to attorneys and insurance agents. Additional responsibilities pertained to field & contractor oversight, soil and groundwater sampling, laboratory data analyses, and field documentation to monitor the project process. For each project completed under his oversight, he prepared UST tank closure reports, detailing findings and field observations.

DOE/Brookhaven National Laboratory Certifications

- Back Safety (TQ-BACKSAFE)
- Chain of Custody Training (ES-COC)

John D. Eichler, Project Manager

- Contamination Performance (HP-RWT-300A)
- Contamination, High Cont. and Airborne Areas (HP-RWT-300)
- Cyber Security Training (GE-CYBERSEC)
- Emergency Planning & Response (GE-EMERGPLAN)
- Environmental Protection Training (GE-ENV-GET)
- Fall Protection (GE-FALLPROTECT)
- Groundwater Program Environmental Training (ER-DENV2)
- Hazard Communication (HP-IND-200)
- Hazardous Waste Generator Training (HP-RCRIGEN3)
- Lyme and Tick-borne Disease Prevention (TQ-LYME1)
- Radioactive Waste Generator (HP-RADIGEN)
- RadWorker I Final (TQ-RW1)
- Surface Program (ER-DENV1)
- Transportation, Hazardous Material-On/Off-site (TQ-HAZMAT-A)

PWGC
Strategic Environmental Engineering Solutions

Usman Chaudhry, Sr. Field Technician

Professional Experience

PWGC: 3 years

Education

- MS, Energy Management and Systems Technology, New York Institute of Technology, May 2014
- BS, Earth Science, COMSATS Institute of Technology

Certifications/Licenses

- 8 hr HAZWOPER
- C2 Confined Spaces in Construction
- MTA NYC Transit Track Safety
- OSHA 10 hr Construction
- 40 hr HAZWOPER

Skills

- ArcGIS (ESRI)
- Petrel Schlumberger
- Strater (Golden Software)
- Surfer (Golden Software)
- AutoCARD

Languages

- English
- Urdu
- Punjabi

Profile

Usman Chaudhry earned his Bachelor of Science degree in Earth Science from Pakistan-based COMSATS Institute of Technology. Though recent to PWGC he has already proved himself in the realm of hydrogeology, soil sampling and field studies. Mr. Chaudhry is continuously improving his skills as a field inspector in the areas of civil, structural, and environmental engineering. He has an excellent record in timely completion and maintenance of project coordination, monitoring, and document preparation, while successfully maintaining communication between clients, government agencies, and other parties involved.

Notable Projects

Lead Sampling Analysis - New York, NY

Mr. Chaudhry performed water sampling to test for lead in accordance with the Lead and Copper Rule (LCR). Mr. Chaudhry coordinated with the building staff to access the sites and assess the building to determine which plumbing fixtures were to be sampled. He accessed the building, after school hours, to create site plan layouts of each floor and the fixtures to be sampled. Samples were drawn within a specific time frame in accordance with clients requests.

Allstate Insurance Company - NY Wide

Residential/ Commercial Fuel Oil Spills Oversight and Reporting - Mr. Chaudhry oversees fieldwork for projects such as petroleum spill remediation. He completes spill reports and invoice reviews, and coordinates with contractors and the NYSDEC to ensure that the project stays on schedule, is compliant with regulatory guidelines, and meets the client's goals.

Phase II Environmental Site Assessments – Performed various aspects of Phase II ESA scopes of work for commercial and industrial properties, including: field work; subcontractor oversight; coordinating daily with assigned laboratories, and; general project coordination and management.

NYCOER E-Designation/VCP Sites – Mr. Chaudhry has provided management services for sites which are included in the NYCOER E-Designation Program. The services included on-site services performed in accordance with the NYCOER approved Remedial Action Work Plan (RAWP) and Health & Safety Plan (HASP), reporting to the NYCOER, coordinating field efforts, and coordinating with contractors and disposal facilities for the removal of impacted soils to obtain site specific cleanup objectives.

UIC Control Programs - Suffolk and Nassau Counties, NY

Remediation Oversight – Mr. Chaudhry has overseen remediation activities of dry wells (Class V wells) at multiple sites for various clients throughout Suffolk and Nassau Counties. He ensures proper soil and sediment removal during VacTruck operations, performs endpoint sampling of storm drains and sanitary systems, coordinates and performs sampling in conjunction with the SCDHS and NCDH, and prepares reports documenting the remediation and endpoint sampling so a No Further Action letter can be obtained.

Usman Chaudhry, Sr. Field Technician

Saint Patrick's Cathedral
New York, NY
Mr. Chaudhry is currently performing oversight for the installation and commissioning of nine 2,000 feet geothermal standing column wells. He also prepared the construction plans and assisted in the design of the mechanical room and pipe routing. He also performed coordination and oversight for installation of twelve open loop geothermal wells. He provided oversight for well drilling, provided water quality testing, analyzed geophysical data from wells and prepared well completion reports for the geothermal system. Mr. Chaudhry provided monitoring of the drift surveys, core sampling, and performing and evaluating pumping tests.

Sand and Gravel Mining Project - 3D Modeling
Mr. Chaudhry coordinated soil borings at sand and gravel mining sites, conducted gamma log surveys of the soil borings, evaluated the soil quality, and used modeling software to generate 3D figures to illustrate the different geologic strata, including confining layers and sand and gravel layers, and to assist clients with making financial decisions regarding where to expand their mining footprint. In addition, Mr. Chaudhry was responsible for coordinating 3D submarine survey of mining operations to determine reserve volumes for mining operations, to establish baselines for proposed dredging operations, and to determine slope stability of underwater features.

PUBLICATIONS

Integration of Seismic and Rock Physics Interpretation to Confirm Hydrocarbon Bearing Zone of Meyal Area-Pakistan
(Journal of Himalayan Earth Sciences, 2012)

WORK HISTORY

P.W. Grosser Consulting
April 2014 – December 2016 – Field Hydro/ES (2 years 8 months)
January 2017 – Present – Project Hydro/ES (6 months)

APPENDIX B
HEALTH AND SAFETY PLAN

145-65 WOLCOTT STREET
BROOKLYN, NEW YORK
NYSDEC BCP ID: C224256

SUBSURFACE INVESTIGATION
HEALTH AND SAFETY PLAN

SUBMITTED TO:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7016

PREPARED FOR:

145-65 Wolcott St. Realty Corp.
109 Southampton Place North
Venice, Florida 34298

PREPARED BY:

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John Eichler, Project Manager — JohnE@pwgrosser.com
Kris Almskog, Vice President — KrisA@pwgrosser.com

PWGC Project Number: IOV1701

MARCH 2018

SUBSURFACE INVESTIGATION HEALTH & SAFETY PLAN
145-65 WOLCOTT STREET, BROOKLYN, NEW YORK

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FIGURES

APPENDICES

1.0 STATEMENT OF COMMITMENT

On-site employees may be exposed to risks from hazardous conditions related to the Subsurface Investigation activities to be performed on the 145-65 Wolcott Street, Brooklyn, NY project site. P.W. Grosser Consulting Inc.'s (PWGC's) policy is to minimize the possibility of work-related injury through awareness and qualified supervision, health and safety training, medical monitoring, use of appropriate personal protective equipment, and the following activity specific safety protocols contained in this Health and Safety Plan (HASP). PWGC has established a guidance program to implement this policy in a manner that protects personnel to the maximum reasonable extent.

This HASP, which applies to PWGC personnel actually or potentially exposed to safety or health hazards, describes emergency response procedures for actual and potential physical and chemical hazards. This HASP is also intended to inform and guide personnel entering site work zones. Persons are to acknowledge that they understand the potential hazards and the contents of this Health and Safety policy by signing off on receipt of their individual copy of the document. Contractors and suppliers are retained as independent contractors and are responsible for ensuring the health and safety of their own employees.

PWGC may require that its personnel take certain precautions in accordance with this HASP and PWGC requests that others protect their personnel in a manner that they deem necessary or sufficient.

2.0 INTRODUCTION AND SITE ENTRY REQUIREMENTS

This document describes the health and safety guidelines developed by PWGC at the request of the "Developer" for the proposed Subsurface Investigation to be performed at the 145-65 Wolcott Street, Brooklyn, NY site ("the Site") to protect on-site personnel, visitors, and the public from physical harm and exposure to hazardous materials or wastes. In accordance with the Occupational Safety and Health Administration (OSHA) 29 CFR Part 1910.120 Hazardous Waste Operations and Emergency Response (HAZWOPER) Final rule, this HASP, including the attachments, addresses safety and health hazards relating to each phase of site operations and is based on the best information available. The HASP may be revised by PWGC at the request of the Developer, and/or regulatory agency upon receipt of new information regarding site conditions. Changes will be documented by written amendments signed by PWGC's project director, project manager, and/or field team leader.

2.1 Training Requirements

Personnel entering the exclusion zone or decontamination zone must meet the training requirements for hazardous waste site operations and emergency response operations in accordance with OSHA 29 CFR 1910.120(e).

Each subcontractor and supplier working on the job must provide the field team leader with training documentation for its personnel upon request.

2.2 Medical Monitoring Requirements

PWGC personnel and visitors entering the exclusion zone or decontamination zone must have completed appropriate medical monitoring required under OSHA 29 CFR 1910.120(f). Medical monitoring enables a physician to monitor each employee's health, physical condition, and his fitness to wear respiratory protective equipment and carry out on-site tasks.

Evidence of compliance with additional medical monitoring requirements for this site must also be included upon request.

2.3 Fit Test Requirements

Personnel and visitors entering a work zone using a negative pressure air purifying respirator (APR) must have successfully passed a qualitative respirator fit test in accordance with OSHA 29 CFR 1910.134 or the American National Standards Institute (ANSI).

Fit testing documentation is the responsibility of each subcontractor. Documentation of PWGC's personnel fit-testing is maintained on file. PWGC does not anticipate the need for work to be performed using APR's.

2.4 Site Safety Plan Acceptance, Acknowledgement, and Amendments

The project superintendent and the field team leader are responsible for informing personnel (P.W. Grosser employees and/or owner or owner's representatives) entering a work area of the contents of this plan and ensuring that each person signs the safety plan acknowledging the on-site hazards and procedures required to minimize exposure to adverse effects of these hazards. A copy of the Acknowledgement Form is included in **Appendix A**.

Site conditions may warrant an amendment to the HASP. Amendments to the HASP are acknowledged by completing forms included in **Appendix B**.

2.5 Daily Safety Meetings

Each day before work begins, the field team leader will hold safety (tailgate or tool box) meetings to ensure that on-site personnel understand the site conditions and operating procedures and to address safety questions and concerns. Meeting minutes and attendance will be recorded. Personnel eligible to enter a work zone must attend the meetings. Project staff will discuss and remedy health and safety issues at these meetings.

2.6 Key Personnel – Roles and Responsibilities

The following PWGC key personnel are planned for this project:

- PWGC Project Director — Mr. John Eichler
- PWGC Project Manager — Mr. John Eichler
- PWGC Field Team Leader — Mr. Usman Chaudhry, or assignee

The PWGC project manager is responsible for overall project administration and, with guidance from the PWGC field team leader, for supervising the implementation of this HASP. The field team leader will conduct daily (tail gate or tool box) safety meetings at the project site and oversee daily safety issues. Each subcontractor and supplier (defined as an OSHA employer) is also responsible for the health and safety of its employees. If there is any dispute about health and safety or project activities, on-site personnel will attempt to resolve the issue. If the issue cannot be resolved at the site, then the project manager will be consulted.

The PWGC field team leader is also responsible for coordinating and enforcing health and safety activities on-site. The field team leader must meet the emergency response and hazardous materials training requirements of OSHA 29 CFR Part 1910.120; must have completed OSHA supervisor training, 29 CFR 1910.120 (e) 4; and must have appropriate experience to the related site work. The field team leader is authorized to suspend the site work based on safety concerns, and is responsible for the following:

1. Educating personnel about information in this HASP and other safety requirements to be observed during site operations, including, but not limited to, decontamination procedures, designation of work zones and levels of protection, air monitoring, fit testing, and emergency procedures dealing with fire and first aid.
2. Coordinating site safety decisions with the project manager.
3. Designating exclusion, decontamination and support zones (work zones) on a daily basis.
4. Monitoring the condition and status of known on-site hazards and maintaining and implementing the air quality monitoring program specified in this HASP.
5. Maintaining the work zone entry/exit log and site entry/exit log.
6. Maintaining records of safety problems, corrective measures and documentation of chemical exposures or physical injuries (the field team leader will document these conditions in a bound notebook and

maintain a copy of the notebook on-site).

The person who observes safety concerns and potential hazards that have not been addressed in the daily safety meetings should immediately report their observations/concerns to the field team leader or appropriate key personnel.

3.0 SITE BACKGROUND AND SCOPE OF WORK

The Site is identified in Kings County as Section 30207, Block 547 and Lots 1, 24 and 23. The site measures approximately 1.8 acres and is improved with a warehouse and two portable office trailer buildings. The remainder of the site is a paved parking area. The site is currently inactive and has recently been utilized for bus storage and maintenance activities.

The environmental Site history is detailed in a combined Phase I / Phase II Environmental Site Assessment (ESA) Report prepared by Volumetric Techniques, Ltd. (VTL) dated February 9, 2015 (VTL). The summary of the property's environmental history detailed below is based upon the findings of the VTL ESA:

- The Site consists of 1.8 acres over three adjacent tax lots. The Site encompasses ¾ of a city block and is bound by Wolcott Street to the north, Conover Street to the east, Dikeman Street to the south and Ferris Street to the west. There are several adjacent property lots in the southeast corner of the block that are not included as part of this Site. The property is improved with a 30,000 ft2 garage structure built in the early 1900s and two portable office structures each approximately 500 ft2. The remained of the site is paved parking area. RPS GaiaTech identified suspect ACMs in the form of wallboard systems (drywall, tape and joint compound) in isolated areas of the buildings. Suspect ACMs were observed to be in good condition. Based on date of construction of the 127 Building (early 1950s), before asbestos stopped being commonly used in the construction industry, there is potential for the suspect materials identified to contain asbestos.
- The garage structure has a maintenance pit, and electric lifts and contains offices on the second floor. The property has recently been used for school bus maintenance and storage.
- As part of the VTL ESA, soil samples and groundwater samples from 20 borings through the site were collected in February and March 2015. No soil vapor samples were collected. The soil samples that were collected were analyzed for VOCs, SVOCs and metals. The samples were compared the NYSDEC Unrestricted Use Soil Clean-Up Objectives (UUSCO) and Commercial Use Soil Clean-Up Objectives (CUSCO). Laboratory analysis showed each soil sample contained one or more analytes that exceeded UUSCOs. Multiple SVOCs and metals were also detected in multiple samples in excess of the CUSCO. The northeast corner of the site showed exceedances in SVOCs, VOCs and metals. Some of these exceedances included but are not limited to benzo(a)anthracene, chrysene, indeno(1,2,3 -cd)pyrene, toluene, acetone, arsenic, lead and chromium. The southeast corner of the site showed exceedances in n-Propylbenzene and lead and Chromium. The attached figure illustrates the location of previous soil sample locations along with exceedances of VOCS, SSVOCs and metals in excess of UUSCOs. In addition, a sample collected 2' below surface of a storm drain culvert on the east side of the rear yard also had elevated VOCs, SVOCS, and metals that exceeded UUSCOs.
- During the investigation, evidence of up to eight underground and aboveground storage tanks were noted including a 6,000 gallon diesel fuel tank, five gallon gasoline tanks, a former cosmoline tank, and several 275 gallon waste oil tanks were reported. It has been reported that many, if not all, of these tanks,

have been removed. No tank closure reports have been provided.

A Remedial Investigation (RI) will be performed to identify and characterize potential contaminants within the surface/subsurface at the site. The RI will include ground-intrusive activities including a soil boring program, and the collection of soil, groundwater, soil vapor, and air samples. The sampling locations are identified on **Figure 2** in the accompanying RIWP.

Soil and groundwater samples will be collected and analyzed for volatile organic compounds (VOCs) by EPA Method 8260, semi-volatile organic compounds (SVOCs) by EPA Method 8270 (base neutrals and acid extractables), pesticides/polychlorinated biphenyls (PCBs) by EPA Method 8081/8082, and Target Analyte List (TAL) metals to characterize subsurface conditions at the site. Soil vapor samples will be collected and analyzed for VOCs using USEPA Method TO-15. Air samples will be collected and analyzed for VOCs using USEPA Method TO-15-SIM. Samples will be delivered under chain of custody documentation and will be analyzed by a New York State Department of Health ELAP-certified laboratory.

4.0 HAZARD ASSESSMENT

This section identifies the hazards associated with the proposed scope of work, general site operations which may also be conducted at site, and the standard operating procedures (SOPs) that should be implemented to reduce the hazards; identifies general physical hazards that can be expected at most sites; and presents a summary of documented or potential chemical hazards at the site. Every effort must be made to reduce or eliminate these hazards. Those that cannot be eliminated must be guarded against using engineering controls and/or personal protective equipment.

4.1 Activity-Specific Hazards and Standard Operating Procedures

4.1.1 Drilling and Probing Operations

Soil borings using a jackhammer or a core drill along with a hand auger will be installed as part of the proposed subsurface investigation. PWGC and/or subcontractors shall follow the jackhammer/core drill Standard Operating Procedures (or equivalent), included as **Appendix C**.

4.1.2 Work in Extreme Temperatures

Work under extremely hot or cold weather conditions requires special protocols to minimize the chance that employees will be affected by heat or cold stress. As necessary, PWGC shall follow the heat and cold stress safety protocols included as **Appendix D**.

4.1.3 Dust Control and Monitoring

Dust generated during work activities may contain contaminants associated with the site characteristics. Dust generation is not anticipated during the subsurface investigation. In the event that fugitive dust is generated, PWGC shall control the dust by wetting the working surface with water, or other approved method of dust suppression.

4.2 Chemical Hazards

Historic environmental investigations at the subject site and throughout the five boroughs of New York City have identified the widespread presence of historic urban fill material, which contains slightly elevated concentrations of SVOCs and metals.

The primary routes of exposure to contaminants in soil are inhalation, ingestion and absorption.

Appendix E includes information sheets for the potential chemicals that may be encountered at the site.

4.2.1 Respirable Dust

The subsurface investigation activities are not anticipated to generate particulate dust. However, dust may be generated from vehicular traffic and/or other construction activities. If visible observation detects elevated levels of dust, a program of wetting will be employed by the field team leader. If elevated dust levels persist, the site safety office will employ dust monitoring using a particulate monitor (MiniRAM or equivalent). If monitoring detects concentrations greater than 150 µg/m³ over daily background, the field team leader will take corrective actions as defined herein, including the use of water for dust suppression and if this is not effective, requiring

workers to wear APRs with efficiency particulate air (HEPA) cartridges.

Absorption pathways for dust and direct contact with soils will be mitigated with the implementation of latex gloves, hand washing, and decontamination exercises when necessary.

4.2.2 Organic Vapors

Based upon historical environmental investigations at nearby sites, the potential for isolated areas of VOC impact exists. Therefore, drilling/excavation activities may cause the release of organic vapors to the atmosphere. The field team leader will monitor organic vapors with a Photoionization Detector (PID) during drilling activities to determine whether organic vapor concentrations exceed action levels shown below.

PID Response	Action
Sustained readings of 5 ppm or greater	Shut down drilling equipment and allow area to vent. Resume when readings return to background
Sustained readings of 5 ppm or greater that do not subside after venting	Implement Vapor Release Plan (Section 9.8). Re-evaluate respiratory protection as upgrade may be required.

4.3 General Site Hazards

Applicable OSHA 29 CFR 1910.120(m) standards for illumination shall apply. Work is to be conducted during daylight hours whenever possible.

Electrical power must be provided through a ground fault circuit interrupter. Equipment that will enter an excavation must be suitable and approved (i.e. intrinsically safe) for use in potentially explosive environments. Applicable OSHA 29 CFR 1926 Subpart K standards for use of electricity shall apply.

Work where there is a fall hazard will be performed using appropriate ladders and/or protection (e.g. body harness and lifeline). All work should be conducted at the ground surface or in trench excavations.

In accordance with 29 CFR 1910.151(c), workers involved in operations where there is the risk of eye injury, (chemical splash, etc.), must have ready access to an approved eye wash unit. Protective eye wear shall be donned in Level D, when directed by the field team leader.

Operations where there is a potential for fire will be conducted in a manner that minimizes risk. Non-sparking tools and fire extinguishers shall be used or available as directed by the field team leader when work is in potentially explosive atmospheres. Ignition sources shall be removed from work areas. Explosion-proof instruments and/or bonding and grounding will be used to prevent fire or explosion when the field team leader directs their use.

Overhead and underground utilities shall be identified and/or inspected and appropriate safety precautions taken before conducting operations where there is potential for contact or interference.

5.0 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) shall be selected in accordance with the site air monitoring program, OSHA 29 CFR 1910.120(c), (g), and 1910.132. Protective equipment shall be NIOSH-approved and respiratory protection shall conform to OSHA 29 CFR Part 1910.133 and 1910.134 specifications; head protection shall conform to 1910.135; eye and face protection shall conform to 1910.133; and foot protection shall conform to 1910.136. The only true difference among the levels of protection from D thru B is the addition of the type of respiratory protection.

PWGC anticipates that work performed under the scope of the proposed Remedial Investigation will be conducted in Level D PPE.

5.1 Level D

Level D PPE shall be donned when the atmosphere contains no known hazards and work functions preclude splashes, immersion, or the potential for inhalation of, or contact with, hazardous concentrations of harmful chemicals. Level D PPE consists of:

- standard work uniform, coveralls, or tyvek, as needed;
- steel toe and steel shank work boots;
- hard hat;
- gloves, as needed;
- safety glasses;
- hearing protection;
- equipment replacements are available as needed.

5.2 Level C

Level C PPE shall be donned when the concentrations of measured total organic vapors in the breathing zone exceed background concentrations (using a portable PID, or equivalent), but are less than 5 ppm. The specifications on the APR filters used must be appropriate for contaminants identified or expected to be encountered. Level C PPE shall be donned when the identified contaminants have adequate warning properties and criteria for using APR have been met. Level C PPE consists of:

- chemical resistant or coated tyvek coveralls;
- steel-toe and steel-shank work boots;
- chemical resistant over boots or disposable boot covers;
- disposable inner gloves (surgical gloves);
- disposable outer gloves;
- full-face APR fitted with organic vapor/dust and mist filters or filters appropriate for the identified or expected contaminants;
- hard hat;
- splash shield, as needed; and,
- ankles/wrists taped with duct tape.

The field team leader will verify if Level C is appropriate by checking organic vapor concentrations using

compound and/or class-specific detector tubes.

5.3 Level B

Level B PPE shall be donned when the contaminants have not been identified and/or the concentrations of unknown measured total organic vapors in the breathing zone exceed 5 ppm (using a portable OVA, or equivalent). Level B PPE shall be donned if the IDLH of a known contaminant is exceeded. If a contaminant is identified or is expected to be encountered for which NIOSH and/or OSHA recommend the use of a positive pressure self-contained breathing apparatus (SCBA) when that contaminant is present, Level B PPE shall be donned even though the total organic vapors in the breathing zone may not exceed 5 ppm. Level B shall be donned for confined space entry, and when the atmosphere is oxygen deficient (oxygen less than 19.5%) or potentially oxygen deficient. If Level B PPE is required for a task, at least three people shall be donned in Level B at any one time during that task. PPE shall only be donned at the direction of the field team leader. Level B PPE consists of:

- supplied air SCBA or air line system with five-minute egress system;
- chemical resistant coveralls;
- steel-toe and steel-shank work boots;
- chemical resistant over boots or disposable boot covers;
- disposable inner gloves;
- disposable outer gloves;
- hard hat; and,
- ankles/wrists taped.

The exact PPE ensemble is decided on a site-by-site basis by the PWGC Health and Safety Officer with the intent to provide the most protective and efficient worker PPE.

5.4 Activity Specific Levels of Personal Protection

The required level of PPE is activity-specific and is based on air monitoring results (Section 7.0) and properties of identified or expected contaminants. It is expected that all site work will be performed in Level D. If air monitoring results indicate the necessity to upgrade the level of protection engineering controls (i.e. Facing equipment away from the wind and placing site personnel upwind of excavations, active venting, etc.) will be implemented before requiring the use of respiratory protection.

6.0 DECONTAMINATION PROCEDURES

Equipment and PPE exiting the exclusion zone must be decontaminated or properly discarded upon exit. Personnel must enter and exit the exclusion zone through the decontamination area. The exclusion and decontamination zones may change depending on the nature of the site work. Plastic bags containing personal protective clothing and equipment will be placed in designated receptacles.

Boots and other potentially contaminated garments that have come in contact with hazardous materials will be cleaned in wash tubs with detergent/water solution and rinsed with water and must remain on site. The wash water, rinse water, and residues will be collected and properly stored until sampling results are received and the final method of disposal can be determined. Disposable PPE, including spent respirator cartridges and canisters, will be properly bagged and disposed. Contaminated boots, clothing, and equipment (e.g. leather boots, equipment carrying straps) that cannot be decontaminated will be disposed of with the disposable garments or left on site in the decontamination trailer.

The ***minimum*** measures for Level B doffing and decontamination are:

- deposit equipment on plastic drop cloths;
- scrub outer boots and gloves with a water and detergent solution and rinse;
- remove outer boots and outer gloves. Discard disposable outer garments in receptacle provided;
- remove SCBA and face piece and place on rack provided;
- remove tyvek/outer garment and place in receptacle provided;
- remove inner gloves and deposit in receptacle provided; and,
- shower/wash face and hands.

The ***minimum*** measures for Level C doffing and decontamination are:

- deposit equipment on plastic drop cloths;
- scrub outer boots and gloves (if worn) with a water and detergent solution and rinse;
- remove outer boots and outer gloves. Discard disposable outer garments in receptacle provided;
- remove tyvek/outer garment and place in receptacle provided;
- remove first pair of inner gloves;
- remove respirator (using "clean" inner gloves) and place on rack provided;
- remove last pair of inner gloves and deposit in receptacle provided; and,
- shower/wash face and hands.

The second to last item to be removed is the APR, and the last item to be removed is the last of several pairs of surgical gloves. Wearing several pairs of inner gloves permits layers to be removed as needed during various stages of the doffing procedure, and if the APR inadvertently becomes contaminated, inner gloves guard against bare hands contacting the APR.

Equipment that comes into contact with site contaminants is decontaminated according to manufacturer specifications. Decontamination is done in the exclusion or decontamination zones. Rented equipment is photographed after decontamination.

7.0 AIR MONITORING AND ACTION LEVELS

29 CFR 1910.120(h) specifies that monitoring shall be performed where there may be a question of employee exposure to hazardous concentrations of hazardous substances in order to assure proper selection of engineering controls, work practices and personal protective equipment so that employees are not exposed to levels which exceed permissible exposure limits, or published exposure levels if there are no permissible exposure limits, for hazardous substances.

7.1 Community Air Monitoring Requirements

If excavation work is performed, fugitive respirable dust will be monitored using a MiniRAM Model PDM-3 aerosol monitor or equivalent and air will be monitored for VOCs with a MiniRAE 2000 PID or the equivalent. If necessary, carbon dioxide and carbon monoxide will be monitored with a three-position analyzer and Lower Explosive Limit (LEL) and oxygen will be monitored with a Combustible Gas Indicator (CGI). Air will be monitored when any of the following conditions apply:

- initial site entry;
- during any work where a potential IDLH condition or flammable atmosphere could develop;
- excavation work begins on another portion of the site;
- contaminants, other than those previously identified, have been discovered;
- each time a different task or activity is initiated;
- during trenching and/or excavation work; or
- before and during entry into confined spaces.

The designated field team leader will record air monitoring data. PWGC's field team leader or delegate must ensure that air monitoring instruments are calibrated and maintained in accordance with manufacturer's specifications. Instruments will be zeroed daily and checked for accuracy. A daily log will be kept. Monitoring results will be recorded on the sheets contained in Appendix F.

Below are examples of site specific guidelines and actions which are taken based on routine air monitoring:

- OVA/PID readings for VOCs sustained at background and 5 ppm over the site specific background in breathing zone: continue.
- OVA/PID readings for VOCs sustained between 5 ppm and 25 ppm over the site specific background in breathing zone: Level C PPE. (See Note)
- OVA/PID readings for VOCs sustained >25 ppm over the site specific background in breathing zone: Level B PPE. (See Note)

Note: To ensure that readings are not generated by methane, screen vapors with a PID[1]. If the PID reading is less than 5 ppm, continue work (assume vapors are methane). If PID readings are over 5 ppm allow the work zone to vent. If PID and OVA readings continue to persist over 5 ppm, request PWGC to screen the area with compound specific detector tubes for benzene.

If this compound is not present then level C can be worn.

OVA readings >5 ppm in breathing zone: Level B PPE.

Total Respirable Dust at background in breathing zone: continue.

Total Respirable Dust at 150 mg/m3 in breathing zone: Level C PPE - HEPA filters. Field team leader can call for upgrades based on visual dust without metering total respirable dust.

Prior to site work, the PWGC field team leader will compile a list of likely site contaminants, select appropriate air monitoring instrumentation and define action levels.

7.2 Perimeter Air Monitoring

To establish ambient air background concentrations, air will be monitored at several locations around the site perimeter before drilling/excavation activities begin. These points will be monitored periodically in series during the site work. VOCs will be monitored with a MiniRAE 2000 PID or the equivalent. If appropriate, fugitive dust will be monitored using a MiniRAM Model PDM-3 aerosol monitor, or equivalent.

The specific guidelines for actions to be taken based on air monitoring at the site perimeter are listed below:

OVA/PID readings for VOCs less than 5.0 ppm over background: continue.

OVA/PID readings for VOCs greater than 5.0 ppm over background: stop work and implement vapor release contingency plan until readings return to acceptable levels.

Total Respirable Dust below 100 µg/m³: continue.

Total Respirable Dust above 100 µg/m³ in breathing zone: stop work and implement dust control measures (Section 3.0) until readings return to acceptable levels.

7.3 Activity Specific Air Monitoring

The monitoring of VOC concentrations present in the employees breathing zone will be periodically monitored during drilling/excavation activities using a MiniRAE 2000 PID or the equivalent. Air monitoring results will be recorded in the field log book. No trenches/excavations will be entered until they have been checked for combustible gases, percent oxygen VOCs and carbon dioxide. An MSA Model 361 combustible gas indicator, or the equivalent will be used to monitor trenches/excavations for the above listed compounds. If additional monitoring is required, the protocols will be developed and appended to this plan.

8.0 SITE CONTROL

8.1 Work Zones

The primary purpose of site controls is to establish the perimeter of a hazardous area, to reduce the migration of contaminants into clean areas, and to prevent access or exposure to hazardous materials by unauthorized persons. When operations are to take place involving hazardous materials, the field team leader will establish an exclusion zone, a decontamination zone, and a support zone. These zones "float" (move around the site) depending on the tasks being performed on any given day. The field team leader will outline these locations before work begins and when zones change. The field team leader records this information in the site log book. **It is expected that for subsurface investigation activities, identification of an exclusion zone, decontamination zone, and support zone will not be necessary.**

Tasks requiring OSHA 40-hour Hazardous Waste Operations and Emergency Response Operations training are carried out in the exclusion zone. The exclusion zone is defined by the field team leader but will typically be a 50-foot area around work activities. Gross decontamination (as determined by the site Health and Safety Officer) is conducted in the exclusion zone; all other decontamination is performed in the decontamination zone or trailer.

Protective equipment is removed in the decontamination zone. Disposable protective equipment is stored in receptacles staged in the decontamination zone, and non-disposable equipment is decontaminated. All personnel and equipment exit the exclusion zone through the decontamination zone. If a decontamination trailer is provided the first aid equipment, an eye wash unit, and drinking water are kept in the decontamination trailer.

The support zone is used for vehicle parking, daily safety meetings, and supply storage. Eating, drinking, and smoking are permitted only in the support zone. When a decontamination trailer is not provided, the eye wash unit, first aid equipment, and drinking water are kept at a central location designated by the field team leader.

8.2 General Field Safety and Standard Operating Procedures

PWGC's policy is to control hazards at all site areas by limiting entrance to exclusion zones to essential personnel and by implementing the following rules:

- Non-essential (as judged by the field team leader) personnel and unauthorized persons will not enter the exclusion or decontamination zone.
- Before entering the exclusion or decontamination zones, all personnel must be familiar with emergency response procedures (Section 9.0), site safety locations, first aid and communication equipment, and the location of the map to the hospital and the list of emergency telephone numbers.
- The buddy system will be used at all times by field personnel in the exclusion zone; no one is to perform work within the exclusion zone alone. When in Level D or C, visual contact or radio contact shall be maintained at all times.
- Contact with contaminated and potentially contaminated surfaces should be avoided. Walk around (not through) puddles and discolored surfaces. Do not kneel on the ground or place equipment on the ground. Protect equipment from contamination.

- Eating, drinking, or smoking is permitted only in designated areas in the support zone.
- Each worker must be supplied with and maintain his/her own personal protective equipment.

9.0 CONFINED SPACE

OSHA published a Final Rule on permit-required confined spaces on January 14, 1993, for General Industry at 29 CFR 1910.146 et seq., with an implementation date of April 15, 1993. The rule specifically excludes agriculture, construction, or shipyard employment. Confined space entry and work within confined spaces is not anticipated to be performed under the proposed scope of work. However, if confined space work is conducted it will be performed in accordance with the applicable OSHA regulations. OSHA defines confined space as:

1. is large enough and so configured that an employee can bodily enter and perform assigned work;
2. has limited or restricted areas for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited entry); and
3. is not designed for continuous worker occupancy.

OSHA further requires that an "entry supervisor" (the site designated safety officer) decide at the time of entry whether the space is permit-required or non-permit required space. The field team leader will monitor the space two hours prior to entry and continuously during work to ensure that the atmosphere is not hazardous. OSHA defines as hazardous atmosphere as:

1. Flammable gas, vapor, or mist in excess of 10 percent of its lower explosive limit (LEL);
2. Airborne combustible dust at a concentration that meets or exceeds its LEL;NOTE: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less.
3. Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;
4. Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z. Toxic
5. and Hazardous Substances, of this part and which could result in employee exposure in excess of its dose or permissible exposure limit;
6. Any other atmospheric condition that is immediately dangerous to life or health.

A space is non-permit required if none of the above defined hazardous conditions are present. OSHA requires that an attendant (e.g., an individual stationed outside one or more spaces who monitors the entrants and who performs air monitoring of the space(s)) be assigned to each space. The attendant is not allowed to perform any direct rescue related duties, but is there to communicate with the entrant and call for rescue procedures if required.

The following protocol applies when PWGC employees must enter a confined space:

- The field team leader evaluates the space and site conditions to determine whether the space must be considered "confined".
- If so, the field team leader monitors the space for hazardous atmospheres prior to entry and fills out a pre-

entry checklist (**Appendix F**) to determine whether an entry-permit is required.

- If there is no hazardous atmosphere, the space will be continuously monitored during the entry to assure that the atmosphere remains non-hazardous.
- If the space contains a hazardous atmosphere, an entry permit (**Appendix F**) will be prepared and the space will only be entered in accordance with 29 CFR 1910.146.

10.0 CONTINGENCY PLAN/EMERGENCY RESPONSE PLAN

Site personnel must be prepared in the event of an emergency. Emergencies can take many forms: illnesses, injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful contaminants, or sudden changes in the weather.

Emergency telephone numbers and a map to the hospital (Figure 1) will be posted in the command post. Site personnel should be familiar with the emergency procedures, and the locations of site safety, first aid, and communication equipment.

10.1 Emergency Equipment On-site

Private telephones:	Site personnel.
Two-way radios:	Site personnel where necessary.
Emergency Alarms:	On-site vehicle horns*.
First aid kits:	On-site, in vehicles or office.
Fire extinguisher:	On-site, in office or on equipment.

* Horns: Air horns will be supplied to personnel at the discretion of the project manager or field team leader.

10.2 Emergency Telephone Numbers

General Emergencies - New York City Police/Fire Department/Ambulance	911
Non-Emergency Hotline - New York City Police/Fire Department/Ambulance	311
Local Emergency Medical Center (UMD Williamsburg Urgent Care)	1-347-987-4144
National Response Center	1-800-424-8802
Poison Control	1-212-340-4494
NYSDEC Spills Division	1-800-457-7362
NYSDEC Hazardous Waste Division	1-718-482-4994
NYC Office of Environmental Remediation	1-212-788-8841
NYC Department of Health	1-212-788-4711
PWGC Project Director, Kris Almskog and Paul Boyce	1-631-589-6353
PWGC Project Manager, John Eichler	1-212-786-7420
PWGC Field Team Leader, Usman Chaudhry (or assignee)	1-516-315-2585

A copy of this page shall be posted in the office and a copy is provided in **Appendix G**.

10.3 Personnel Responsibilities During an Emergency

The project manager is primarily responsible for responding to and correcting any emergency situations. However, in the absence of the project manager, the field team leader shall act as the project manager's on-site designee and perform the following tasks:

- Take appropriate measures to protect personnel including: withdrawal from the exclusion zone, evacuate and secure the site, or upgrade/downgrade the level of protective clothing and respiratory protection;
- Ensure that appropriate federal, state, and local agencies are informed and emergency response plans

are coordinated. In the event of fire or explosion, the local fire department should be summoned immediately. If toxic materials are released to the air, the local authorities should be informed in order to assess the need for evacuation;

- Ensure appropriate decontamination, treatment, or testing for exposed or injured personnel;
- Determine the cause of incidents and make recommendations to prevent recurrence; and,
- Ensure that all required reports have been prepared.

The following PWGC key personnel are planned for this project:

- PWGC Project Director — Kris Almskog and Paul Boyce
- PWGC Project Manager — John Eichler
- PWGC Field Team Leader — Usman Chaudhry, or assignee

10.4 Medical Emergencies

A person who becomes ill or injured in the exclusion zone will be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination will be completed and first aid administered prior to transport. First aid will be administered while waiting for an ambulance or paramedics. A Field Accident Report (**Appendix G**) must be filled out for any injury.

A person transporting an injured/exposed person to a clinic or hospital for treatment will take the directions to the hospital and information on the chemical(s) to which they may have been exposed (**Appendix G**).

10.5 Fire or Explosion

In the event of a fire or explosion, the local fire department will be summoned immediately. The field team leader or his designated alternate will advise the fire commander of the location, nature and identification of the hazardous materials on-site. If it is safe to do so, site personnel may:

- use firefighting equipment available on site; or,
- remove or isolate flammable or other hazardous materials that may contribute to the fire.

10.6 Evacuation Routes

Evacuation routes established by work area locations for each site will be reviewed prior to commencing site operations. As the work areas change, the evacuation routes will be altered accordingly, and the new route will be reviewed.

Under extreme emergency conditions, evacuation is to be immediate without regard for equipment. The evacuation signal will be a continuous blast of a vehicle horn, if possible, and/or by verbal/radio communication.

- When evacuating the site, personnel will follow these instructions:
- Keep upwind of smoke, vapors, or spill location.
- Exit through the decontamination corridor if possible.

- If evacuation through the decontamination corridor is not possible, personnel should remove contaminated clothing once they are in a safe location and leave it near the exclusion zone or in a safe place.
- The field team leader will conduct a head count to ensure that all personnel have been evacuated safely. The head count will be correlated to the site and/or exclusion zone entry/exit log.
- If emergency site evacuation is necessary, all personnel are to escape the emergency situation and decontaminate to the maximum extent practical.

10.7 Spill Control Procedures

Spills associated with site activities may be attributed to project specific heavy equipment and include gasoline, diesel and hydraulic oil. In the event of a leak or a release, site personnel will inform their supervisor immediately, locate the source of spillage and stop the flow if it can be done safely. A spill containment kit including absorbent pads, booms and/or granulated speedy dry absorbent material will be available to site personnel to facilitate the immediate recovery of the spilled material. Daily inspections of site equipment components including hydraulic lines, fuel tanks, etc. will be performed by their respective operators as a preventative measure for equipment leaks and to ensure equipment soundness. In the event of a spill, site personnel will immediately notify the NYSDEC (1-800-457-7362), and a spill number will be generated.

10.8 Vapor Release Plan

If work zone organic vapor (excluding methane) exceeds 5 ppm, then a downwind reading will be made either 200 feet from the work zone or at the property line, whichever is closer. If readings at this location exceed 5 ppm over background, the work will be stopped.

If 5 ppm of VOCs are recorded over background on a PID at the property line, then an off-site reading will be taken within 20 feet of the nearest residential or commercial property, whichever is closer. If efforts to mitigate the emission source are unsuccessful for 30 minutes, then the designated field team leader will:

- contact the local police;
- continue to monitor air every 30 minutes, 20 feet from the closest off-site property. If two successive readings are below 5 ppm (non-methane), off-site air monitoring will be halted.
- All property line and off site air monitoring locations and results associated with vapor releases will be recorded in the site safety log book.

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FIGURE

HOSPITAL ROUTE

PWGC
Strategic Environmental and Engineering Solutions
P.W. GROSSER CONSULTING, INC.
630 Johnson Avenue, • Suite 7
Bohemia • NY • 11716-2618
Phone: (631) 589-6353 • Fax: (631) 589-8705
E-mail: INFO@PWGROSSER.COM

Project:	
Date:	3/23/2018
Designed by:	JE
Drawn by:	UC
Approved by:	JE
Figure No:	1

Document Path: W:\Projects\E-LI\OV\1701\mapfiles\RIWP\FIG1_HospitalRoute.mxd

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APPENDIX A
SITE SAFETY ACKNOWLEDGMENT FORM

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SITE SAFETY ACKNOWLEDGMENT FORM

This form serves as documentation that field personnel have read, or have been informed of, and understand the provisions of the HASP/EAP. It is maintained on site by the Field team leader as a project record. Each field team member shall sign this section after site-specific training is completed and before being permitted to work on site.

I have read, or have been informed of, the Health and Safety Plan/Emergency Action Plan and understand the information presented. I will comply with the provisions contained therein.

Name (Print and Sign)	Date

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APPENDIX B
SITE SAFETY PLAN AMENDMENTS

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SITE SAFETY PLAN AMENDMENT FORM

SITE SAFETY PLAN AMENDMENT NUMBER: _____

SITE NAME: _____

REASON FOR AMENDMENT: _____

_____

_____

_____

_____

ALTERNATIVE PROCEDURES: _____

_____

_____

_____

_____

REQUIRED CHANGES IN PPE: _____

_____

_____

_____

_____

_____ _____

PROJECT DIRECTOR DATE

_____ _____

PROJECT MANAGER DATE

_____ _____

FIELD TEAM LEADER DATE

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APPENDIX C
DRILLING PROTOCOLS

SAFETY PROCEDURES DURING THE OPERATION OF DRILLING/PROBING MACHINESINCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:

- All site personnel should know the location of the rig emergency shut-off switch prior to beginning operations.
- The rig should be inspected prior to operation to ensure that it is in proper working condition and that all safety devices are functioning.
- Each rig should have a first-aid kit and fire extinguisher which should be inspected to ensure that they are adequate.
- All operators should wear, at a minimum, hard hats, steel-toe safety shoes or boots, gloves and safety glasses. Additional clothing and protective equipment may be required at sites where hazardous conditions are likely. Clothing must be close fitting, without loose ends, straps, draw strings or belts or other unfastened parts that might catch on moving machinery.
- Work areas should be kept free of materials, debris and obstruction, and substances such as grease or oil that could cause a surface to become slick or otherwise hazardous.
- Prior to drilling, the site must be checked to determine whether it can accommodate the rig and supplies and provide a safe working area.
- The drill rig mast (derrick) must be lowered prior to moving between drilling locations.
- The drill rig masts should not be raised if the rig will not be at least 20 feet away from overhead utilities.
- The location of underground utilities should be determined prior to erecting the rig.
- The drill rigs must be properly erected, leveled and stabilized prior to drilling.
- The operator must shut down the vehicle engine before leaving the vicinity of the machine.
- All personnel not directly involved in operating the rig or in sampling should remain clear of the drilling equipment when it is in operation.
- All unattended boreholes must be adequately covered or otherwise protected to prevent trip and fall hazards. All open boreholes should be covered, protected or backfilled as specified in local or state regulations.
- When climbing to or working on a derrick platform that is higher than 20 feet, a safety climbing device should be used.
- The user of wire line hoists, wire rope and hoisting hardware should be as stipulated by the American Iron and Steel Institute Wire Rope User's Manual.
- The rig should be operated in a manner which is consistent with the manufacturers' ratings of speed, force, torque, pressure, flow, etc. The rig and tools should be used for the purposes for which they were intended.

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APPENDIX D
HEAT/COLD STRESS PROTOCOLS

HEAT STRESS

Heat Stress (Hyperthermia)

Heat stress is the body's inability to regulate the core temperature. A worker's susceptibility to heat stress can vary according to his/her physical fitness, degree of acclimation to heat, humidity, age and diet.

1. Prior to site activity, the field team leader may make arrangements for heat stress monitoring (i.e., monitoring heart rate, body temperature, and body water loss) during actual site work if conditions warrant. In addition, the FTL is to ensure that each team member has been acclimatized to the prevailing environmental conditions, that personnel are aware of the signs and symptoms of heat sickness, that they have been adequately trained in first aid procedures, and that there are enough personnel on-site to rotate work assignments and schedule work during hours of reduced temperatures. Personnel should not consume alcoholic or caffeinated beverages but rather drink moderate levels of an electrolyte solution and eat well prior to commencing site work.

2. Although there is no specific test given during a baseline physical that would identify a person's intolerance to heat, some indicators are tobacco or medication use, dietary habits, body weight, and chronic conditions such as high blood pressure or diabetes.

3. *Heat cramps*, caused by profuse perspiration with inadequate fluid intake and salt replacement, most often afflict people in good physical condition who work in high temperature and humidity. Heat cramps usually come on suddenly during vigorous activity. Untreated, heat cramps may progress rapidly to heat exhaustion or heat stroke. First aid treatment: remove victim to a cool place and replace lost fluids with water.

4. Thirst is not an adequate indicator of heat exposure. Drinking fluid by itself does not indicate sufficient water replacement during heat exposure. A general rule, the amount of water administered should replace the amount of water lost, and it should be administered at regular intervals throughout the day. For every half pound of water lost, 8 ounces of water should be ingested. Water should be replaced by drinking 2 – 4 ounce servings during every rest period. A recommended alternative to water is an electrolyte drink split 50/50 with water.

5. Heat exhaustion results from salt and water loss along with peripheral pooling of blood. Like heat cramps, heat exhaustion tends to occur in persons in good physical health who are working in high temperatures and humidity. Heat exhaustion may come on suddenly as dizziness and collapse. Untreated, heat exhaustion may progress to heat stroke.

6. Treatment for heat exhaustion: Move the victim to a cool environment (e.g. air-conditioned room/car), lay victim down and fan him/her. If the air-conditioning is not available, remove the victim to a shaded area, remove shirt, and fan. If symptoms do not subside within an hour, notify 911 to transport to hospital.

7. Heat stroke results from the body's inability to dissipate excess heat. A true medical emergency that requires immediate care, it usually occurs when one ignores the signs of heat exhaustion and continues strenuous activities. Working when the relative humidity exceeds 60% is a particular problem. Workers in the early phase of heat stress may not be coherent of they will be confused, delirious or comatose. Changes in behavior, irritability and combativeness are useful early signs of heat stroke.

8. Treatment of heat stroke: Move the victim to a cool, air-conditioned environment. Place victim in a semi-reclined position with head elevated and strip to underclothing. Cool victim as rapidly as possible, applying ice packs to the arms and legs and massaging the neck and torso. Spray victim with tepid water and constantly fan to promote evaporation. Notify 911 to transport to hospital as soon as possible.

SYMPTOMS OF HEAT STRESS

Heat cramps are caused by heavy sweating with inadequate fluid intake. Symptoms include;

- Muscle cramps
- Cramps in the hands, legs, feet and abdomen

Heat exhaustion occurs when body organs attempt to keep the body cool. Symptoms include;

- Pale, cool moist skin
- Core temperature elevated 1-2o
- Thirst
- Anxiety
- Rapid heart rate
- Heavy sweating
- Dizziness
- Nausea

Heat stroke is the most serious form of heat stress. Immediate action must be taken to cool the body before serious injury and death occur. Symptoms are;

- Red, hot, dry skin
- Lack of perspiration
- Seizures
- Dizziness and confusion
- Strong, rapid pulse
- Core temperature of 104o or above
- Coma

HEAT STRESS INDICATORS

Heat stress indicator:	When to measure:	If Exceeds:	Action:
Heart rate (pulse)	Beginning of rest period	110 beats per minute	Shorten next work period by 33%
Oral temperature	Beginning of rest period	99°F (after thermometer is under tongue for 3 minutes) 100.6°F (after thermometer is under tongue for 3 minutes)	Shorten next work period by 33% Prohibit work in impermeable clothing
Body Weight	1. Before workday begins 2. After workday ends		Increase fluid intake

COLD STRESS

Cold stress (Hypothermia)

In hypothermia the core body temperature drops below 95°F. Hypothermia can be attributed to a decrease in heat production, increased heat loss or both.

Prevention

Institute the following steps to prevent overexposure of workers to cold:

1. Maintain body core temperature at 98.6oF or above by encouraging workers to drink warm liquids during breaks (preferably not coffee) and wear several layers of clothing that can keep the body warm even when the clothing is wet.

2. Avoid frostbite by adequately covering hands, feet and other extremities. Clothing such as insulated gloves or mittens, earmuffs and hat liners should be worn. To prevent contact frostbite (from touching metal and cold surfaces below 20°F), workers should wear gloves. Tool handles should be covered with insulating material.

3. Adjust work schedules to provide adequate rest periods. When feasible, rotate personnel and perform work during the warmer hours of the day.

4. Provide heated shelter. Workers should remove their outer layer(s) of clothing while in the shelter to allow sweat to evaporate.

5. In the event that wind barriers are constructed around an intrusive operation (such as drilling), the enclosure must be properly vented to prevent the buildup of toxic or explosive gases or vapors. Care must be taken to keep a heat source away from flammable substances.

6. Using a wind chill chart such as the one included below, obtain the equivalent chill temperature (ECT) based on actual wind speed and temperature. Refer to the ECT when setting up work warm-up schedules, planning appropriate clothing, etc. Workers should use warming shelters at regular intervals at or below an ECT of 20°F. For exposed skin, continuous exposure should not be permitted at or below an ECT of -25°F.

FROSTBITE

Personnel should be aware of symptoms of frostbite/hypothermia. If the following symptoms are noticed in any worker, he/she should immediately go to a warm shelter.

Condition	Skin Surface	Tissue Under Skin	Skin Color
Frostnip	Soft	Soft	Initially red, then white
Frostbite	Hard	Soft	White and waxy
Freezing	Hard	Hard	Blotchy, white to yellow-grey to grey

1. Frostnip is the incipient stage of frostbite, brought about by direct contact with a cold object or exposure of a body part to cool/cold air. Wind chill or cold water also can be major factors. This condition is not serious. Tissue damage is minor and the response to care is good. The tip of the nose, tips of ears, upper cheeks and fingers (all areas generally exposed) are most susceptible to frostnip.

2. Treatment of frostnip: Care for frostnip by warming affected areas. Usually the worker can apply warmth from his/her bare hands, blow warm air on the site, or, if the fingers are involved, hold them in the armpits. During recovery, the worker may complain of tingling or burning sensation, which is normal. If the condition does not respond to this simple care, begin treatment for frostbite.

3. Frostbite: The skin and subcutaneous layers become involved. If frostnip goes untreated, it becomes superficial frostbite. This condition is serious. Tissue damage may be serious. The worker must be transported to a medical facility for evaluation. The tip of the nose, tips of ears, upper cheeks and fingers (all areas generally exposed) are most susceptible to frostbite. The affected area will feel frozen, but only on the surface. The tissue below the surface must still be soft and have normal response to touch. DO NOT squeeze or poke the tissue. The condition of the deeper tissues can be determined by gently palpating the affected area. The skin will turn mottled or blotchy. It may also be white and then turn grayish-yellow.

4. Treatment of frostbite: When practical, transport victim as soon as possible. Get the worker inside and keep him/her warm. Do not allow any smoking or alcohol consumption. Thaw frozen parts by immersion, re-warming in a 100°F to 106°F water bath. Water temperature will drop rapidly, requiring additional warm water throughout the process. Cover the thawed part with a dry sterile dressing. Do not puncture or drain any blisters. NOTE: Never listen to myths and folk tales about the care of frostbite. Never rub a frostbitten or frozen area. Never rub snow on a frostbitten or frozen area. Rubbing the area may cause serious damage to already injured tissues. Do not attempt to thaw a frozen area if there is any chance it will be re-frozen.

5. General cooling/Hypothermia: General cooling of the body is known as systemic hypothermia. This condition is not a common problem unless workers are exposed to cold for prolonged periods of time without any shelter.

Body Temp (°F)	Body Temp (°C)	Symptoms
99-96	37-35.5	Intense uncontrollable shivering
95-91	35.5-32.7	Violent shivering persists. If victim is conscious, has difficulty speaking.
90-86	32.6-30	Shivering decreases and is replaced by strong muscular rigidity. Muscle coordination is affected. Erratic or jerkey movements are produced. Thinking is less clear. General comprehension is dulled. There may be total amnesia. The worker is generally still able to maintain the appearance of psychological contact with his surroundings.
85-81	29.9-27.2	Victim becomes irrational, loses contact with his environment, and drifts into a stupor. Muscular rigidity continues. Pulse and respirations are slow and the worker may develop cardiac arrhythmias.
80-78	27.1-25.5	Victim becomes unconscious. He does not respond to the spoken word. Most reflexes cease to function. Heartbeat becomes erratic
Below 78	Below 25.5	Cardiac and respiratory centers of the brain fail. Ventricular fibrillation occurs; probably edema and hemorrhage in the lungs; death.

6. Treatment of hypothermia: Keep worker dry. Remove any wet clothing and replace with dry clothes, or wrap person in dry blankets. Keep person at rest. Do not allow him/her to move around. Transport the victim to a medical facility as soon as possible.

COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED AS AN EQUIVALENT TEMPERATURE (UNDER CALM CONDITIONS)

Estimated wind Speed (in mph)	Actual Temperature Reading (^{0}F)P											
	50	40	30	20	10	0	10	20	30	40	50	60
	Equivalent Chill Temperature (^{0}F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	15	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-146
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER in < hr with dry skin. Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute			GREAT DANGER Flesh may freeze within 30 seconds.				
	Trench foot and imersion foot may occur at any point on this chart											

Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

(1) Reproduced from American Conference of Governmental Industrial Hygienists, Threshold Limit Values and Biological Exposure Indices for 1985-1986, p.01.

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APPENDIX E
CHEMICAL HAZARDS

1,3,5-TRIMETHYLBENZENE

1155
March 2002

CAS No: 108-67-8
RTECS No: OX6825000
UN No: 2325
EC No: 601-025-00-5

Mesitylene
C_9H_{12}
Molecular mass: 120.2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	Alcohol-resistant foam, dry powder, carbon dioxide.
EXPLOSION	Above 50/C explosive vapour/air mixtures may be formed.	Above 50/C use a closed system, ventilation, and explosion-proof electrical equipment. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**PREVENT GENERATION OF MISTS!**	
Inhalation	Confusion. Cough. Dizziness. Drowsiness. Headache. Sore throat. Vomiting.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Redness. Dry skin.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
Eyes	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	(See Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING	
Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Personal protection: filter respirator for organic gases and vapours.	Xi Symbol N Symbol R: 10-37-51/53 S: (2-)61 UN Hazard Class: 3 UN Pack Group: III	Marine pollutant.

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-30S2325 NFPA Code: H0; F2; R0	Fireproof. Separated from strong oxidants. Well closed. Keep in a well-ventilated room.

IPCS
International Programme on Chemical Safety

Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission

IMPORTANT DATA

Physical State; Appearance
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

Chemical dangers
The substance decomposes on burning producing toxic and irritating fumes. Reacts violently with strong oxidants causing fire and explosion hazard.

Occupational exposure limits
TLV: 25 ppm as TWA; (ACGIH 2004).
MAK: (all isomers) 20 ppm, 100 mg/m^3; Peak limitation category: II(2); Pregnancy risk group: C; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation.

Inhalation risk
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20/C; on spraying or dispersing, however, much faster.

Effects of short-term exposure
The substance is irritating to the eyes, the skin and the respiratory tract. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. The substance may cause effects on the central nervous system.

Effects of long-term or repeated exposure
The liquid defats the skin. Lungs may be affected by repeated or prolonged exposure, resulting in chronic bronchitis. The substance may have effects on the central nervous system and blood. See Notes.

PHYSICAL PROPERTIES

Boiling point: 165/C
Melting point: -45/C
Relative density (water = 1): 0.86
Solubility in water: very poor
Vapour pressure, kPa at 20/C: 0.25
Relative vapour density (air = 1): 4.1
Relative density of the vapour/air-mixture at 20/C (air = 1): 1.01
Flash point: 50/C (c.c.)
Auto-ignition temperature: 550/C
Octanol/water partition coefficient as log Pow: 3.42

ENVIRONMENTAL DATA

The substance is harmful to aquatic organisms. Bioaccumulation of this chemical may occur in fish.

NOTES

Use of alcoholic beverages enhances the harmful effect.
Depending on the degree of exposure, periodic medical examination is suggested.
See ICSC 1433 1,2,4-Trimethylbenzene (Pseudocumene), ICSC 1362 1,2,3-Trimethylbenzene (Hemimellitene), ICSC 1389 Trimethyl benzene (mixed isomers).
Card has been partly updated in April 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

ACETONE

0087
April 1994

CAS No: 67-64-1
RTECS No: AL3150000
UN No: 1090
EC No: 606-001-00-8

2-Propanone
Dimethyl ketone
Methyl ketone
C_3H_6O / CH_3-CO-CH_3
Molecular mass: 58.1

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, alcohol-resistant foam, water in large amounts, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			
Inhalation	Sore throat. Cough. Confusion. Headache. Dizziness. Drowsiness. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
Eyes	Redness. Pain. Blurred vision. Possible corneal damage.	Safety spectacles or face shield. Contact lenses should not be worn.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Nausea. Vomiting. (Further see Inhalation). (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Ventilation. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Then wash away with plenty of water. Personal protection: self-contained breathing apparatus.	F Symbol Xi Symbol R: 11-36-66-67 S: (2-)9-16-26 UN Hazard Class: 3 UN Pack Group: II

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-30S1090 NFPA Code: H 1; F 3; R 0	Fireproof. Separated from strong oxidants.

IPCS
International Programme on Chemical Safety

Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission

IMPORTANT DATA

Physical State; Appearance
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

Physical dangers
The vapour is heavier than air and may travel along the ground; distant ignition possible.

Chemical dangers
The substance can form explosive peroxides on contact with strong oxidants such as acetic acid, nitric acid, hydrogen peroxide. Reacts with chloroform and bromoform under basic conditions, causing fire and explosion hazard. Attacks plastic.

Occupational exposure limits
TLV: 500 ppm as TWA, 750 ppm as STEL; A4 (not classifiable as a human carcinogen); BEI issued; (ACGIH 2004).
MAK: 500 ppm 1200 mg/m^3 Peak limitation category: I(2); Pregnancy risk group: IIc; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation and through the skin.

Inhalation risk
A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20/C ; on spraying or dispersing, however, much faster.

Effects of short-term exposure
The vapour irritates the eyes and the respiratory tract. The substance may cause effects on the central nervous system, liver, kidneys and gastrointestinal tract.

Effects of long-term or repeated exposure
Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the blood and bone marrow.

PHYSICAL PROPERTIES

Boiling point: 56/C
Melting point: -95/C
Relative density (water = 1): 0.8
Solubility in water: miscible
Vapour pressure, kPa at 20/C: 24
Relative vapour density (air = 1): 2.0
Relative density of the vapour/air-mixture at 20/C (air = 1): 1.2
Flash point: -18/C c.c.
Auto-ignition temperature: 465/C
Explosive limits, vol% in air: 2.2-13
Octanol/water partition coefficient as log Pow: -0.24

ENVIRONMENTAL DATA

NOTES

Use of alcoholic beverages enhances the harmful effect.
Card has been partly updated in October 2005. See sections Occupational Exposure Limits, EU classification.

ADDITIONAL INFORMATION

ETHYLBENZENE

0268
March 1995

CAS No: 100-41-4
RTECS No: DA0700000
UN No: 1175
EC No: 601-023-00-4

Ethylbenzol
Phenylethane
EB
C_8H_{10} / C_6H_5-C_2H_5
Molecular mass: 106.2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**PREVENT GENERATION OF MISTS!**	
Inhalation	Cough. Dizziness. Drowsiness. Headache.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain. Blurred vision.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	(Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Ventilation. Collect leaking liquid in covered containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Personal protection: A filter respirator for organic gases and vapours.	**EU classification** F Symbol Xn Symbol R: 11-20 S: (2-)16-24/25-29 **UN classification** UN Hazard Class: 3 UN Pack Group: II

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-30S1175 or 30GF1-I+II NFPA Code: H2; F3; R0	Fireproof. Separated from strong oxidants.

IPCS
International Programme on Chemical Safety

Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission

IMPORTANT DATA

Physical State; Appearance
COLOURLESS LIQUID, WITH AROMATIC ODOUR.

Physical dangers
The vapour mixes well with air, explosive mixtures are easily formed.

Chemical dangers
Reacts with strong oxidants. Attacks plastic and rubber.

Occupational exposure limits
TLV: 100 ppm as TWA, 125 ppm as STEL; A3 (confirmed animal carcinogen with unknown relevance to humans); BEI issued (ACGIH 2005).
MAK: skin absorption (H); Carcinogen category: 3A; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation of its vapour, through the skin and by ingestion.

Inhalation risk
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20/C.

Effects of short-term exposure
The substance is irritating to the eyes, the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system. Exposure far above the OEL could cause lowering of consciousness.

Effects of long-term or repeated exposure
Repeated or prolonged contact with skin may cause dermatitis.

PHYSICAL PROPERTIES

Boiling point: 136/C
Melting point: -95/C
Relative density (water = 1): 0.9
Solubility in water, g/100 ml at 20/C: 0.015
Vapour pressure, kPa at 20/C: 0.9
Relative vapour density (air = 1): 3.7
Relative density of the vapour/air-mixture at 20/C (air = 1): 1.02
Flash point: 18/C c.c.
Auto-ignition temperature: 432/C
Explosive limits, vol% in air: 1.0-6.7
Octanol/water partition coefficient as log Pow: 3.2

ENVIRONMENTAL DATA

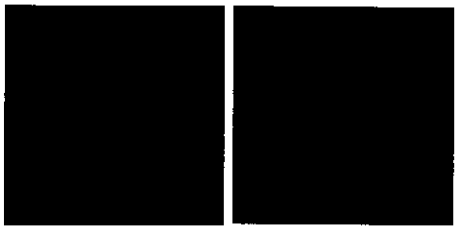
The substance is harmful to aquatic organisms.

NOTES

The odour warning when the exposure limit value is exceeded is insufficient.
Card has been partly updated in October 2005. See sections Occupational Exposure Limits, Emergency Response.

ADDITIONAL INFORMATION

Safety data for propylbenzene



Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1-propylbenzene, n-propylbenzene, propyl benzene, 1-phenylpropane, isocumene
Molecular formula: C_9H_{12}
CAS No: 103-65-1
EC No: 203-132-9
Annex I Index No: 601-024-00-X

Physical data

Appearance: colourless or light yellow liquid
Melting point: -99 C
Boiling point: 159 C
Vapour density: 4.14
Vapour pressure: 2 mm Hg at 20C
Specific gravity: 0.862
Flash point: 47 C
Explosion limits: 0.8 - 6%
Autoignition temperature: 450 C

Stability

Stable. Flammable. Incompatible with strong oxidizing agents.

Toxicology

Harmful if swallowed. Respiratory irritant.

Toxicity data
(The meaning of any toxicological abbreviations which appear in this section is given here.)
ORL-RAT LD50 6040 mg kg^{-1}
IHL-RAT LC50 65000 ppm/2h

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R10 R37 R51 R53 R65.

Environmental information

Harmful in the environment - may cause long-term damage to the aquatic environment.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
UN No 2364. Hazard class 3.0. Packing group III.

Personal protection

Safety glasses, adequate ventilation. Do not release into the environment.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S24 S37 S61 S62.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Material Safety Data Sheet

sec-BUTYLBENZENE

February 28, 2002
MSDS #: 47160
Revision #: 1

CHEVRON PHILLIPS CHEMICAL COMPANY LP
10001 Six Pines Drive
The Woodlands, TX 77380

PHONE NUMBERS
HEALTH:
Chevron Phillips Emergency
Information Center 866.442.9628
(North America) and
1.832.813.4984(International)
TRANSPORTATION:
North America: CHEMTREC 800.424.9300
or 703.527.3887
ASIA: 1.703.527.3887
EUROPE: BIG .32.14.584545 (phone)
or .32.14.583516 (telefax)
SOUTH AMERICA SOS-Cotec
Inside Brazil: 0800.111.767
Outside Brazil: 55.19.3467.1600
Technical Services: (832) 813-4862
For Additional MSDSs: (800) 852-5530

A. Product Identification

Synonyms: 2-Phenylbutane, secondary-Butylbenzene
Chemical Name: Benzene, (1-methylpropyl)-
Chemical Family: Aromatic hydrocarbon
Chemical Formula: C10H14
CAS Reg. No.: 135-98-8
Product No.: A66400

Product and/or Components Entered on EPA's TSCA Inventory: YES

This product is in U.S. commerce, and is listed in the Toxic Substances Control Act (TSCA) Inventory of Chemicals; hence, it may be subject to applicable TSCA provisions and restrictions.

B. Components

Ingredients	CAS Number	% By Wt.	OSHA PEL	ACGIH TLV
sec-Butylbenzene	135-98-8	100	NE	NE

C. Personal Protection Information

Ventilation: Use adequate ventilation.

Respiratory Protection: Not generally required unless needed to prevent respiratory irritation. In case of spill or leak resulting in unknown concentration, use NIOSH approved supplied air respirator.

Eye Protection: Use safety glasses with side shields and face shield for splash protection.

Skin Protection: Use protective garments to prevent skin contact.

NOTE: Personal protection information shown in Section C is based upon general information as to normal uses and conditions. Where special or unusual uses or conditions exist, it is suggested that the expert assistance of an industrial hygienist or other qualified professional be sought.

D. Handling and Storage Precautions

Do not swallow, may be aspirated into lungs. Avoid contact with eyes, skin or clothing. Avoid breathing vapors, mist, fume or dust. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Wash thoroughly after handling. Launder contaminated clothing before reuse. Use with adequate ventilation.

Keep away from heat, sparks, and flames. Store in well-ventilated area. Store in closed container. Bond and ground during transfer.

E. Reactivity Data

Stability: Stable
Conditions to Avoid: Not Applicable
Incompatibility (Materials to Avoid): Oxygen and strong oxidizing agents

Hazardous Polymerization: Will Not Occur
Conditions to Avoid: Not Applicable
Hazardous Decomposition Products: Carbon oxides formed when burned.

F. Health Hazard Data

Recommended Exposure Limits:

Not Established.

Acute Effects of Overexposure:

Eye: May cause mild irritation to the eyes.

Skin: May cause mild to moderate irritation to skin. Prolonged or repeated contact with the liquid may cause defatting of the skin resulting in drying, redness, and possibly blistering.
LD50 (rabbit) > 13 g/kg.

Inhalation: May cause slight to moderate upper airway irritatancy, with higher exposures causing central nervous system depression, headache, and dizziness.

Ingestion: May be slightly irritating to the gastrointestinal tract. If swallowed, may be aspirated resulting in inflammation and possible fluid accumulation in the lungs.
LD50 (rat) > 1.9 g/kg.

Subchronic and Chronic Effects of Overexposure:

No known applicable information.

Other Health Effects:

No known applicable information.

Health Hazard Categories:

	Animal	Human		Animal	Human
Known Carcinogen	___	___	Toxic	___	___
Suspect Carcinogen	___	___	Corrosive	___	___
Mutagen	___	___	Irritant	___	___
Teratogen	___	___	Target Organ Toxin	_X_	_X_
Allergic Sensitizer	___	___	Specify - Lung - Aspiration Hazard		
Highly Toxic	___	___			

First Aid and Emergency Procedures:

Eye: Flush eyes with running water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.

Skin: Wash skin with soap and water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.

Inhalation: Remove from exposure. If breathing is difficult, give oxygen. If breathing ceases, administer artificial respiration followed by oxygen. Seek immediate medical attention.

Ingestion: Do not induce vomiting. Seek immediate medical attention.

Note to Physician: Gastric lavage using a cuffed endotracheal tube may be performed at your discretion.

G. Physical Data

Appearance:	Colorless liquid
Odor:	Acrid
Boiling Point:	344F (173C)
Vapor Pressure:	0.2 psia @ 130F (54C)
Vapor Density (Air = 1):	4.6
Solubility in Water:	Negligible
Specific Gravity (H2O = 1):	0.866 @ 60/60F 16/16C
Percent Volatile by Volume:	100
Evaporation Rate (Ethyl Ether = 1):	

H. Fire and Explosion Data

Flash Point (Method Used):	126F (52C) (TOC, ASTM D 1310)
Flammable Limits (% by Volume in Air):	LEL - 0.8 UEL - 6.9
Fire Extinguishing Media:	Dry chemical, foam or carbon dioxide (CO2)
Special Fire Fighting Procedures:	Evacuate area of all unnecessary personnel. Shut off source if possible. Use NIOSH approved self-contained breathing apparatus and other protective equipment and/or garments described in Section C if conditions warrant. Water fog or spray may be used to cool exposed containers and equipment. Do not spray water directly on fire product will float and could be reignited on surface of water.
Fire and Explosion Hazards:	Carbon oxides formed when burned. Highly flammable vapors which are heavier than air may accumulate in low areas and/or spread along ground away from handling site.

I. Spill, Leak and Disposal Procedures

Precautions Required if Material is Released or Spilled:
Evacuate area of all unnecessary personnel. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Shut off source, if possible and contain spill. Protect from ignition. Keep out of water sources and sewers. Absorb in a dry, inert material (sand, clay, etc). Transfer to disposal drums using non-sparking equipment.

Waste Disposal (Insure Conformity with all Applicable Disposal Regulations):
Incinerate or place in permitted waste management facility.

J. DOT Transportation

Shipping Name: Butyl benzenes
Hazard Class: 3
ID Number: UN 2709
Packing Group: III
Marking: Butyl benzenes, UN 2709
Label: Flammable Liquid
Placard: Flammable/2709
Hazardous Substance/RQ: Not Applicable
Shipping Description: Butyl benzenes, 3, UN 2709,PG III
Packaging References: 49 CFR 173.150, 173.203, 173.241

K. RCRA Classification - Unadulterated Product as a Waste

Ignitable (D001)

Prior to disposal, consult your environmental contact to determine if TCLP (Toxicity Characteristic Leaching Procedure, EPA Test Method 1311) is required. Reference 40 CFR Part 261.

L. Protection Required for Work on Contaminated Equipment

Contact immediate supervisor for specific instructions before work is initiated. Wear protective equipment and/or garments described in Section C if exposure conditions warrant.

M. Hazard Classification

___ This product meets the following hazard definition(s) as defined by the Occupational Safety and Health Hazard Communication Standard (29 CFR Section 1910.1200):

_X_ Combustible Liquid	___ Flammable Aerosol	___ Oxidizer
___ Compressed Gas	___ Explosive	___ Pyrophoric
___ Flammable Gas	_X_ Health Hazard (Section F)	___ Unstable
___ Flammable Liquid	___ Organic Peroxide	___ Water Reactive
___ Flammable Solid		

___ Based on information presently available, this product does not meet any of the hazard definitions of 29 CFR Section 1910.1200.

N. Additional Comments

REVISION STATEMENT:

This revision updates Section J.

SARA 313

As of the preparation date, this product did not contain a chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

NFPA 704 Hazard Codes - - - - - - - - Signals

	Least - 0
Health : 0	Slight - 1
Flammability: 2	Moderate - 2
Reactivity : 0	High - 3
Special Haz.: -	Extreme - 4

Prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200) and the ANSI MSDS Standard (Z400.1) by EHS Product Stewardship Group, Chevron Phillips Chemical Company LP, 10001 Six Pines Drive, The Woodlands, TX 77380

TOLUENE

0078
October 2002

CAS No: 108-88-3
RTECS No: XS5250000
UN No: 1294
EC No: 601-021-00-3

Methylbenzene
Toluol
Phenylmethane
$C_6H_5CH_3$ / C_7H_8
Molecular mass: 92.1

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding). Do NOT use compressed air for filling, discharging, or handling. Use non-sparking handtools.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!**	
Inhalation	Cough. Sore throat. Dizziness. Drowsiness. Headache. Nausea. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
Eyes	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Burning sensation. Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area in large spill! Consult an expert in large spill! Remove all ignition sources. Ventilation. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Personal protection: self-contained breathing apparatus in large spill.	F Symbol Xn Symbol R: 11-38-48/20-63-65-67 S: (2-)36/37-46-62 UN Hazard Class: 3 UN Pack Group: II

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-30S1294 NFPA Code: H 2; F 3; R 0	Fireproof. Separated from strong oxidants.

IPCS
International Programme on Chemical Safety

Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission

IMPORTANT DATA

Physical State; Appearance
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

Physical dangers
The vapour mixes well with air, explosive mixtures are formed easily. As a result of flow, agitation, etc., electrostatic charges can be generated.

Chemical dangers
Reacts violently with strong oxidants causing fire and explosion hazard.

Occupational exposure limits
TLV: 50 ppm as TWA; (skin); A4; BEI issued; (ACGIH 2004).
MAK: 50 ppm, 190 mg/m^3; H; Peak limitation category: II(4); Pregnancy risk group: C; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

Inhalation risk
A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20/C.

Effects of short-term exposure
The substance is irritating to the eyes and the respiratory tract. The substance may cause effects on the central nervous system. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. Exposure at high levels may result in cardiac dysrhythmia and unconsciousness.

Effects of long-term or repeated exposure
The liquid defats the skin. The substance may have effects on the central nervous system. Exposure to the substance may enhance hearing damage caused by exposure to noise. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Boiling point: 111/C
Melting point: -95/C
Relative density (water = 1): 0.87
Solubility in water: none
Vapour pressure, kPa at 25/C: 3.8
Relative vapour density (air = 1): 3.1
Relative density of the vapour/air-mixture at 20/C (air = 1): 1.01
Flash point: 4/C c.c.
Auto-ignition temperature: 480/C
Explosive limits, vol% in air: 1.1-7.1
Octanol/water partition coefficient as log Pow: 2.69

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms.

NOTES

Depending on the degree of exposure, periodic medical examination is suggested.
Use of alcoholic beverages enhances the harmful effect.
Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

BENZ(a)ANTHRACENE

0385
October 1995

CAS No: 56-55-3
RTECS No: CV9275000
EC No: 601-033-00-9

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

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

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Personal protection: complete protective clothing including self-contained breathing apparatus.	T Symbol N Symbol R: 45-50/53 S: 53-45-60-61

EMERGENCY RESPONSE	SAFE STORAGE
	Well closed.

IPCS
International Programme on Chemical Safety

Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission

SEE IMPORTANT INFORMATION ON THE BACK.

IMPORTANT DATA

Physical State; Appearance
COLOURLESS TO YELLOW - BROWN FLUORESCENT FLAKES OR POWDER.

Physical dangers
Dust explosion possible if in powder or granular form, mixed with air.

Occupational exposure limits
TLV: A2 (suspected human carcinogen); (ACGIH 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

Inhalation risk
Evaporation at 20/C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

Effects of long-term or repeated exposure
This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES

Sublimation point: 435/C
Melting point: 162/C
Relative density (water = 1): 1.274

Solubility in water: none
Vapour pressure, Pa at 20/C: 292
Octanol/water partition coefficient as log Pow: 5.61

ENVIRONMENTAL DATA

Bioaccumulation of this chemical may occur in seafood.

NOTES

This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form.
Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken.
Do NOT take working clothes home.
Tetraphene is a common name.
Card has been partly updated in October 2005. See sections Occupational Exposure Limits, EU classification.

ADDITIONAL INFORMATION

BENZO(a)PYRENE

0104
October 2005

CAS No: 50-32-8
RTECS No: DJ3675000
EC No: 601-032-00-3

Benz(a)pyrene
3,4-Benzopyrene
Benzo(d,e,f)chrysene
$C_{20}H_{12}$
Molecular mass: 252.3

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, foam, powder, carbon dioxide.
EXPLOSION			
EXPOSURE	**See EFFECTS OF LONG-TERM OR REPEATED EXPOSURE.**	**AVOID ALL CONTACT! AVOID EXPOSURE OF (PREGNANT) WOMEN!**	
Inhalation		Local exhaust or breathing protection.	Fresh air, rest.
Skin	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes		Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area! Personal protection: complete protective clothing including self-contained breathing apparatus. Do NOT let this chemical enter the environment. Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place.	T Symbol N Symbol R: 45-46-60-61-43-50/53 S: 53-45-60-61

EMERGENCY RESPONSE	SAFE STORAGE
	Separated from strong oxidants.

IPCS
International Programme on Chemical Safety

Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission

IMPORTANT DATA

Physical State; Appearance
PALE-YELLOW CRYSTALS

Chemical dangers
Reacts with strong oxidants causing fire and explosion hazard.

Occupational exposure limits
TLV: Exposure by all routes should be carefully controlled to levels as low as possible A2 (suspected human carcinogen); (ACGIH 2005).
MAK: Carcinogen category: 2; Germ cell mutagen group: 2; (DFG 2005).

Routes of exposure
The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion.

Inhalation risk
Evaporation at 20/C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.

Effects of long-term or repeated exposure
This substance is carcinogenic to humans. May cause heritable genetic damage to human germ cells. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Boiling point: 496/C
Melting point: 178.1/C
Density: 1.4 g/cm^3

Solubility in water: none (<0.1 g/100 ml)
Vapour pressure : negligible
Octanol/water partition coefficient as log Pow: 6.04

ENVIRONMENTAL DATA

The substance is very toxic to aquatic organisms. Bioaccumulation of this chemical may occur in fish, in plants and in molluscs. The substance may cause long-term effects in the aquatic environment.

NOTES

Do NOT take working clothes home.
Benzo(a)pyrene is present as a component of polycyclic aromatic hydrocarbons (PAHs) in the environment, usually resulting from the incomplete combustion or pyrolysis of organic matters, especially fossil fuels and tobacco.

ADDITIONAL INFORMATION

BENZO(b)FLUORANTHENE

0720
March 1999

CAS No: 205-99-2
RTECS No: CU1400000
EC No: 601-034-00-4

Benz(e)acephenanthrylene
2,3-Benzofluoroanthene
Benzo(e)fluoranthene
3,4-Benzofluoranthene
$C_{20}H_{12}$
Molecular mass: 252.3

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE			In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION			
EXPOSURE		**AVOID ALL CONTACT!**	
Inhalation		Local exhaust or breathing protection.	Fresh air, rest.
Skin		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes		Safety spectacles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into covered containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	T Symbol N Symbol R: 45-50/53 S: 53-45-60-61

EMERGENCY RESPONSE	SAFE STORAGE
	Provision to contain effluent from fire extinguishing. Well closed.

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IMPORTANT DATA

Physical State; Appearance
COLOURLESS CRYSTALS

Chemical dangers
Upon heating, toxic fumes are formed.

Occupational exposure limits
TLV: A2 (suspected human carcinogen); (ACGIH 2004).
MAK: Carcinogen category: 2; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation of its aerosol and through the skin.

Inhalation risk
Evaporation at 20/C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

Effects of long-term or repeated exposure
This substance is possibly carcinogenic to humans. May cause genetic damage in humans.

PHYSICAL PROPERTIES

Boiling point: 481/C
Melting point: 168/C
Solubility in water: none
Octanol/water partition coefficient as log Pow: 6.12

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to air quality and water quality.

NOTES

Benzo(b)fluoranthene is present as a component of polycyclic aromatic hydrocarbons (PAH) content in the environment usually resulting from the incomplete combustion or pyrolysis of organic matters, especially fossil fuels and tobacco. ACGIH recommends environment containing benzo(b)fluoranthene should be evaluated in terms of the TLV-TWA for coal tar pitch volatile, as benzene soluble 0.2 mg/m^3.
Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken.
Card has been partly updated in October 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

Safety (MSDS) data for chrysene

General

Synonyms: 1,2-benzophenanthrene, benzo(a)phenanthrene, 1,2-benzphenanthrene, coal tar pitch, benz(a)phenanthrene, 1,2,5,6-dibenzonaphthalene
Molecular formula: $C_{18}H_{12}$
CAS No: 218-01-9
EC No: 205-923-4

Physical data

Appearance: crystalline powder
Melting point: 253 C
Boiling point: 448 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}): 1.27
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility: insoluble

Stability

Stable. Combustible. Incompatible with strong oxidizing agents.

Toxicology

Toxic. Confirmed animal carcinogen, possible human carcinogen. Harmful if

swallowed, inhaled or absorbed through the skin.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
IPR-MUS LD50 >320 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R20 R21 R22 R45 R46.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
UN No 2811. Packing group I. Hazard class 6.1. CDG UK Transport category 1. EMS No 6.1-04.

Personal protection

Safety glasses, good ventilation, gloves. Handle as a carcinogen. A COSHH assessment is required.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S3 S7 S9 S36 S37 S39 S45.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

DIBENZO(a,h)ANTHRACENE

0431

October 1995

CAS No: 53-70-3
RTECS No: HN2625000
EC No: 601-041-00-2

1,2:5,6-Dibenzanthracene
$C_{22}H_{14}$
Molecular mass: 278.4

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		**AVOID ALL CONTACT!**	
Inhalation		Local exhaust or breathing protection.	Fresh air, rest.
Skin	Redness. Swelling. Itching.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Personal protection: P3 filter respirator for toxic particles.	T Symbol N Symbol R: 45-50/53 S: 53-45-60-61

EMERGENCY RESPONSE	SAFE STORAGE
	Well closed.

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IMPORTANT DATA

Physical State; Appearance
COLOURLESS CRYSTALLINE POWDER.

Occupational exposure limits
TLV not established.

Routes of exposure
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

Inhalation risk
Evaporation at 20/C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

Effects of long-term or repeated exposure
The substance may have effects on the skin, resulting in photosensitization. This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 524/C
Melting point: 267/C
Relative density (water = 1): 1.28

Solubility in water: none
Octanol/water partition coefficient as log Pow: 6.5

ENVIRONMENTAL DATA

Bioaccumulation of this chemical may occur in seafood.

NOTES

This is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form.
Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken.
Do NOT take working clothes home.
DBA is a commonly used name.
This substance is one of many polycyclic aromatic hydrocarbons (PAH).
Card has been partly updated in October 2005. See section EU classification.

ADDITIONAL INFORMATION

INDENO(1,2,3-cd)PYRENE

0730
March 1999

CAS No: 193-39-5
RTECS No: NK9300000

o-Phenylenepyrene
2,3-Phenylenepyrene
$C_{22}H_{12}$
Molecular mass: 276.3

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE			In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION			
EXPOSURE		**AVOID ALL CONTACT!**	
Inhalation		Local exhaust or breathing protection.	Fresh air, rest.
Skin		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes		Safety spectacles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into covered containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	

EMERGENCY RESPONSE	SAFE STORAGE
	Provision to contain effluent from fire extinguishing. Well closed.

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IMPORTANT DATA

Physical State; Appearance
YELLOW CRYSTALS

Chemical dangers
Upon heating, toxic fumes are formed.

Occupational exposure limits
TLV not established.
MAK: Carcinogen category: 2; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation of its aerosol and through the skin.

Inhalation risk
Evaporation at 20/C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

Effects of long-term or repeated exposure
This substance is possibly carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 536/C
Melting point: 164/C

Solubility in water: none
Octanol/water partition coefficient as log Pow: 6.58

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to air quality and water quality. Bioaccumulation of this chemical may occur in fish.

NOTES

Indeno(1,2,3-cd)pyrene is present as a component of polycyclic aromatic hydrocarbons (PAH) content in the environment usually resulting from the incomplete combustion or pyrolysis of organic matters, especially fossil fuels and tobacco. ACGIH recommends environment containing Indeno(1,2,3-c,d)pyrene should be evaluated in terms of the TLV-TWA for coal tar pitch volatile, as benzene soluble 0.2 mg/m^3.
Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken.
Card has been partly updated in October 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

CADMIUM

0020
April 2005

CAS No: 7440-43-9
RTECS No: EU9800000
UN No: 2570
EC No: 048-002-00-0

Cd
Atomic mass: 112.4

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Flammable in powder form and spontaneously combustible in pyrophoric form. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking. NO contact with heat or acid(s).	Dry sand. Special powder. NO other agents.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	

EXPOSURE		**PREVENT DISPERSION OF DUST! AVOID ALL CONTACT!**	**IN ALL CASES CONSULT A DOCTOR!**
Inhalation	Cough. Sore throat.	Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. Diarrhoea. Headache. Nausea. Vomiting.	Do not eat, drink, or smoke during work.	Rest. Refer for medical attention.

SPILLAGE DISPOSAL	**PACKAGING & LABELLING**	
Evacuate danger area! Personal protection: chemical protection suit including self-contained breathing apparatus. Remove all ignition sources. Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place.	T+ Symbol N Symbol R: 45-26-48/23/25-62-63-68-50/53 S: 53-45-60-61 Note: E UN Hazard Class: 6.1	Airtight. Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs.

EMERGENCY RESPONSE	**SAFE STORAGE**
	Fireproof. Dry. Keep under inert gas. Separated from igntion sources, oxidants acids, food and feedstuffs.

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SEE IMPORTANT INFORMATION ON THE BACK.

IMPORTANT DATA

Physical State; Appearance
SOFT BLUE-WHITE METAL LUMPS OR GREY POWDER. MALLEABLE. TURNS BRITTLE ON EXPOSURE TO 80/C AND TARNISHES ON EXPOSURE TO MOIST AIR.

Physical dangers
Dust explosion possible if in powder or granular form, mixed with air.

Chemical dangers
Reacts with acids forming flammable/explosive gas (hydrogen - see ICSC0001). Dust reacts with oxidants, hydrogen azide, zinc, selenium or tellurium, causing fire and explosion hazard.

Occupational exposure limits
TLV: (Total dust) 0.01 mg/m^3; (Respirable fraction) 0.002 mg/m^3; as TWA; A2 (suspected human carcinogen); BEI issued; (ACGIH 2005).
MAK: skin absorption (H); Carcinogen category: 1; Germ cell mutagen group: 3A; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.

Inhalation risk
A harmful concentration of airborne particles can be reached quickly when dispersed, especially if powdered.

Effects of short-term exposure
The fume is irritating to the respiratory tract. Inhalation of fume may cause lung oedema (see Notes). Inhalation of fumes may cause metal fume fever. The effects may be delayed. Medical observation is indicated.

Effects of long-term or repeated exposure
Lungs may be affected by repeated or prolonged exposure to dust particles. The substance may have effects on the kidneys, resulting in kidney impairment. This substance is carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 765/C
Melting point: 321/C
Density: 8.6 g/cm^3

Solubility in water: none
Auto-ignition temperature: (cadmium metal dust) 250/C

ENVIRONMENTAL DATA

NOTES

Reacts violently with fire extinguishing agents such as water, foam, carbon dioxide and halons.
Depending on the degree of exposure, periodic medical examination is indicated.
The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential.
Do NOT take working clothes home.
Cadmium also exists in a pyrophoric form (EC No. 048-011-00-X), which bears the additional EU labelling symbol F, R phrase 17, and S phrases 7/8 and 43. UN numbers and packing group will vary according to the physical form of the substance.

ADDITIONAL INFORMATION

CHROMIUM

0029
October 2004

CAS No: 7440-47-3
RTECS No: GB4200000

Chrome
(powder)
Cr
Atomic mass: 52.0

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible under specific conditions.	No open flames if in powder form.	In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION		Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		**PREVENT DISPERSION OF DUST!**	
Inhalation	Cough.	Local exhaust or breathing protection.	Fresh air, rest.
Skin		Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
Eyes	Redness.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Rinse mouth.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Personal protection: P2 filter respirator for harmful particles.	

EMERGENCY RESPONSE	SAFE STORAGE

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IMPORTANT DATA

Physical State; Appearance
GREY POWDER

Physical dangers
Dust explosion possible if in powder or granular form, mixed with air.

Chemical dangers
Chromium is a catalytic substance and may cause reaction in contact with many organic and inorganic substances, causing fire and explosion hazard.

Occupational exposure limits
TLV: (as Cr metal, Cr(III) compounds) 0.5 mg/m^3 as TWA; A4; (ACGIH 2004).
MAK not established.

Inhalation risk
A harmful concentration of airborne particles can be reached quickly when dispersed.

Effects of short-term exposure
May cause mechanical irritation to the eyes and the respiratory tract.

PHYSICAL PROPERTIES

Boiling point: 2642/C
Melting point: 1900/C
Density: 7.15 g/cm^3
Solubility in water: none

ENVIRONMENTAL DATA

NOTES

The surface of the chromium particles is oxidized to chromium(III)oxide in air.
See ICSC 1531 Chromium(III) oxide.

ADDITIONAL INFORMATION

LEAD

0052
October 2002

CAS No: 7439-92-1
RTECS No: OF7525000

Lead metal
Plumbum
(powder)
Pb
Atomic mass: 207.2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE	**See EFFECTS OF LONG-TERM OR REPEATED EXPOSURE.**	**PREVENT DISPERSION OF DUST! AVOID EXPOSURE OF (PREGNANT) WOMEN!**	
Inhalation		Local exhaust or breathing protection.	Fresh air, rest.
Skin		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes		Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. Nausea. Vomiting.	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment. Personal protection: P3 filter respirator for toxic particles.	

EMERGENCY RESPONSE	SAFE STORAGE
	Separated from food and feedstuffs and incompatible materials. See Chemical Dangers.

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IMPORTANT DATA

Physical State; Appearance
BLUISH-WHITE OR SILVERY-GREY SOLID IN VARIOUS FORMS. TURNS TARNISHED ON EXPOSURE TO AIR.

Physical dangers
Dust explosion possible if in powder or granular form, mixed with air.

Chemical dangers
On heating, toxic fumes are formed. Reacts with oxidants. Reacts with hot concentrated nitric acid, boiling concentrated hydrochloric acid and sulfuric acid. Attacked by pure water and by weak organic acids in the presence of oxygen.

Occupational exposure limits
TLV: 0.05 mg/m^3 as TWA; A3 (confirmed animal carcinogen with unknown relevance to humans); BEI issued; (ACGIH 2004).
MAK: Carcinogen category: 3B; Germ cell mutagen group: 3A; (DFG 2004).
EU OEL: as TWA 0.15 mg/m^3; (EU 2002).

Routes of exposure
The substance can be absorbed into the body by inhalation and by ingestion.

Inhalation risk
A harmful concentration of airborne particles can be reached quickly when dispersed, especially if powdered.

Effects of long-term or repeated exposure
The substance may have effects on the blood, bone marrow, central nervous system, peripheral nervous system and kidneys, resulting in anaemia, encephalopathy (e.g., convulsions), peripheral nerve disease, abdominal cramps and kidney impairment. Causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Boiling point: 1740/C
Melting point: 327.5/C
Density: 11.34 g/cm^3
Solubility in water: none

ENVIRONMENTAL DATA

Bioaccumulation of this chemical may occur in plants and in mammals. It is strongly advised that this substance does not enter the environment.

NOTES

Depending on the degree of exposure, periodic medical examination is suggested.
Do NOT take working clothes home.
Card has been partly updated in April 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

1,2,4-TRIMETHYLBENZENE

1433
March 2002

CAS No: 95-63-6
RTECS No: DC3325000
UN No: 1993
EC No: 601-043-00-3

Pseudocumene
C_9H_{12}
Molecular mass: 120,2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	Alcohol-resistant foam, dry powder, carbon dioxide.
EXPLOSION	Above 44/C explosive vapour/air mixtures may be formed.	Above 44/C use a closed system, ventilation, and explosion-proof electrical equipment. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**PREVENT GENERATION OF MISTS!**	
Inhalation	Confusion. Cough. Dizziness. Drowsiness. Headache. Sore throat. Vomiting.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Redness. Dry skin.	Protective gloves.	Rinse skin with plenty of water or shower.
Eyes	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	(See Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Personal protection: filter respirator for organic gases and vapours.	Xn Symbol N Symbol R: 10-20-36/37/38-51/53 S: (2-)26-61 UN Hazard Class: 3 UN Pack Group: III

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-30GF1-III NFPA Code: H0; F2; R0	Fireproof. Separated from strong oxidants. Well closed. Keep in a well-ventilated room.

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IMPORTANT DATA

Physical State; Appearance
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

Chemical dangers
The substance decomposes on burning producing toxic and irritating fumes. Reacts violently with strong oxidants causing fire and explosion hazard.

Occupational exposure limits
TLV: (as mixed isomers) 25 ppm as TWA; (ACGIH 2004).
MAK: (as mixed isomers) 20 ppm, 100 mg/m^3; Peak limitation category: II(2); Pregnancy risk group: C; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation.

Inhalation risk
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20/C; on spraying or dispersing, however, much faster.

Effects of short-term exposure
The substance is irritating to the eyes the skin and the respiratory tract. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. The substance may cause effects on the central nervous system.

Effects of long-term or repeated exposure
The liquid defats the skin. Lungs may be affected by repeated or prolonged exposure, resulting in chronic bronchitis. The substance may have effects on the central nervous system and blood. See Notes.

PHYSICAL PROPERTIES

Boiling point: 169/C
Melting point: -44/C
Relative density (water = 1): 0.88
Solubility in water: very poor
Relative vapour density (air = 1): 4.1
Relative density of the vapour/air-mixture at 20/C (air = 1): 1.01
Flash point: 44/C c.c.
Auto-ignition temperature: 500/C
Explosive limits, vol% in air: 0.9-6.4
Octanol/water partition coefficient as log Pow: 3.8

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms. Bioaccumulation of this chemical may occur in fish.

NOTES

Use of alcoholic beverages enhances the harmful effect.
Depending on the degree of exposure, periodic medical examination is suggested.
See also ICSC 1155 1,3,5-Trimethylbenzene (Mesitylene), ICSC 1362 1,2,3-Trimethylbenzene (Hemimellitene), ICSC 1389 Trimethyl benzene (mixed isomers).
1,3,5-Trimethylbenzene (Mesitylene) is classified as a marine pollutant.
Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

NAPHTHALENE

0667
April 2005

CAS No: 91-20-3
RTECS No: QJ0525000
UN No: 1334 (solid); 2304 (molten)
EC No: 601-052-00-2

Naphthene
$C_{10}H_8$
Molecular mass: 128.18

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 80/C explosive vapour/air mixtures may be formed. Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		**PREVENT DISPERSION OF DUST!**	
Inhalation	Headache. Weakness. Nausea. Vomiting. Sweating. Confusion. Jaundice. Dark urine.	Ventilation (not if powder), local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	MAY BE ABSORBED! (Further see Inhalation).	Protective gloves.	Rinse skin with plenty of water or shower.
Eyes		Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. Diarrhoea. Convulsions. Unconsciousness. (Further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rest. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING	
Personal protection: filter respirator for organic gases and vapours. Do NOT let this chemical enter the environment. Sweep spilled substance into covered containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place.	Xn Symbol N Symbol R: 22-40-50/53 S: (2-)36/37-46-60-61 UN Hazard Class: 4.1 UN Pack Group: III	Do not transport with food and feedstuffs. Marine pollutant.

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-41S1334 (solid); 41GF1-II+III (solid); 41S2304 (molten) NFPA Code: H2; F2; R0	Separated from strong oxidants, food and feedstuffs. Store in an area without drain or sewer access.

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IMPORTANT DATA

Physical State; Appearance
WHITE SOLID IN VARIOUS FORMS, WITH CHARACTERISTIC ODOUR.

Physical dangers
Dust explosion possible if in powder or granular form, mixed with air.

Chemical dangers
On combustion, forms irritating and toxic gases. Reacts with strong oxidants.

Occupational exposure limits
TLV: 10 ppm as TWA; 15 ppm as STEL; (skin); A4 (not classifiable as a human carcinogen); (ACGIH 2005).
MAK: skin absorption (H); Carcinogen category: 2; Germ cell mutagen group: 3B; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

Inhalation risk
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20/C. See Notes.

Effects of short-term exposure
The substance may cause effects on the blood, resulting in lesions of blood cells (haemolysis). See Notes. The effects may be delayed. Exposure by ingestion may result in death. Medical observation is indicated.

Effects of long-term or repeated exposure
The substance may have effects on the blood, resulting in chronic haemolytic anaemia. The substance may have effects on the eyes, resulting in the development of cataract. This substance is possibly carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 218/C Sublimation slowly at room temperature
Melting point: 80/C
Density: 1.16 g/cm^3
Solubility in water, g/100 ml at 25/C: none
Vapour pressure, Pa at 25/C: 11
Relative vapour density (air = 1): 4.42
Flash point: 80/C c.c.
Auto-ignition temperature: 540/C
Explosive limits, vol% in air: 0.9-5.9
Octanol/water partition coefficient as log Pow: 3.3

ENVIRONMENTAL DATA

The substance is very toxic to aquatic organisms. The substance may cause long-term effects in the aquatic environment.

NOTES

Some individuals may be more sensitive to the effect of naphthalene on blood cells.

ADDITIONAL INFORMATION

PYRENE

1474
November 2003

CAS No: 129-00-0
RTECS No: UR2450000

Benzo (d,e,f) phenanthrene
beta-Pyrene
$C_{16}H_{10}$
Molecular mass: 202.26

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Water spray, carbon dioxide, dry powder, alcohol-resistant foam, or polymer foam.
EXPLOSION			
EXPOSURE			
Inhalation		Avoid inhalation of dust.	Fresh air, rest.
Skin	Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Do NOT induce vomiting. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder. Do NOT let this chemical enter the environment. (Extra personal protection: P2 filter respirator for harmful particles.)	Do not transport with food and feedstuffs.

EMERGENCY RESPONSE	STORAGE
	Separated from strong oxidants. Keep in a well-ventilated room.

IPCS
International Programme on Chemical Safety

Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission

IMPORTANT DATA

Physical State; Appearance
PALE YELLOW OR COLOURLESS SOLID IN VARIOUS FORMS

Chemical dangers
The substance decomposes on heating producing irritating fumes.

Occupational exposure limits
TLV not established.
MAK not established.

Routes of exposure
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

Inhalation risk
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.

Effects of short-term exposure
Exposure to sun may provoke an irritating effect of pyrene on skin and lead to chronic skin discoloration.

PHYSICAL PROPERTIES

Boiling point: 404°C
Melting point: 151°C
Density: 1.27 g/cm^3

Solubility in water: 0.135 mg/l at 25°C
Vapour pressure, Pa at °C: 0.08
Octanol/water partition coefficient as log Pow: 4.88

ENVIRONMENTAL DATA

Bioaccumulation of this chemical may occur in crustacea, in fish, in milk, in algae and in molluscs. It is strongly advised that this substance does not enter the environment.

NOTES

Pyrene is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, pyrene may be encountered as a laboratory chemical in its pure form.
Health effects of exposure to the substance have not been investigated adequately.
See ICSC 1415 Coal-tar pitch.

ADDITIONAL INFORMATION

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APPENDIX F
CONFINED SPACE ENTRY CHECKLIST/PERMIT

PWGC
Strategic Environmental Engineering Solutions

CONFINED SPACE ENTRY PERMIT

Confined Space ☐	Hazardous Area ☐	Non Permit Required ☐

Notes:
No work will be performed unless the space meets non permit requirements
Permit valid 8 hours only. All copies of permit will remain at this job site until job is completed.
A single entry permit can be filled out prior to start of daily work.
SAFETY STANDBY PERSON IS REQUIRED FOR ALL CONFINED SPACE WORK

Site Location and Description:_____
Purpose of Entry:_____
Supervisior(s) in charge of Crew:_____

Requirements	**Date**	**Time**	**Requirements**	**Date**	**Time**
Lock Out/De-energize/try-out			**Full Body Harness w/"D" Ring**		
Line(s) Broken-capped-blanked			**Emergency Escape Retrieval**		
Purged-Flush and Vent			**Lifelines**		
Ventilation			Fire Extinguishers		
Secure Area (Post and Flag)			Lighting (Explosive Proof)		
Breathing Apparatus			Protective Clothing		
Resuscitator-Inhalator			Respirator(s) (Air Purifying)		
Standby Safety Personnel			Burning and Welding Permit		

BOLD DENOTES MINIMUM REQUIREMENTS TO BE COMPLETED & REVIEWED PRIOR TO ENTRY
Items that do not apply enter N/A in the blank

Monitoring Tests	Permissible Entry Levels	Results (record every 30 minutes beginning ½ hour prior to entry)							
Oxygen	19.5 to 23.5%								
LEL	Below 10%								
Hydrogen sulfide (H_2S)	10ppm† 15ppm‡								

†Short term exposure limit (STEL)
‡8 hour Time weighted average (TWA)

Monitoring Equipment

_____
Type Model # Serial #

_____
Type Model # Serial #

Safety standby person(s):_____

Supervisor authorizing entry:_____

PWGC
Strategic Environmental Engineering Solutions

APPENDIX G
EMERGENCY INFORMATION

PWGC
Strategic Environmental Engineering Solutions

EMERGENCY PHONE NUMBERS

General Emergencies - New York City Police/Fire Department/Ambulance	911
Non-Emergency Hotline - New York City Police/Fire Department/Ambulance	311
Local Emergency Medical Center (UMD Williamsburg Urgent Care)	1-(347) 987-4144
National Response Center	1-800-424-8802
Poison Control	1-212-340-4494
NYSDEC Spills Division	1-800-457-7362
NYSDEC Hazardous Waste Division	1-718-482-4994
NYC Office of Environmental Remediation	1-212-788-8841
NYC Department of Health	1-212-788-4711
PWGC Project Director, Jennifer Lewis	1-631-589-6353
PWGC Project Manager, Michael Gaul	1-212-786-7420
PWGC Field team leader, Melissa Perri (or assignee)	1-516-315-2585

PWGC
Strategic Environmental Engineering Solutions

INCIDENT / NEAR MISS REPORT AND INVESTIGATION - PAGE 1 OF 2			
TYPE OF INCIDENT - CHECK ALL THAT APPLY			
☐ INJURY/ILLNESS	☐ VEHICLE DAMAGE	☐ PROPERTY DAMAGE	☐ FIRE
☐SPILL/RELEASE	☐ PERMIT EXCEEDENCE	☐ NEAR MISS	☐OTHER
GENERAL INFORMATION			
PROJECT NAME:	DATE OF REPORT:	REPORT NO.:	
DATE OF INCIDENT:	TIME:	DAY OF WEEK:	
LOCATION OF INCIDENT:			
WEATHER CONDITIONS:	ADEQUATE LIGHTING AT SCENE? ☐YES ☐NO ☐N/A		
DESCRIBE WHAT HAPPENED (STEP BY STEP - USE ADDITIONAL PAGES IF NECESSARY)			
AFFECTED EMPLOYEE INFORMATION			
NAME:	EMPLOYEE: ☐YES ☐NO		
HOME ADDRESS:			
SOCIAL SECURITY NO.:	HOME PHONE NO.:		
JOB CLASSIFICATION:	YEARS IN JOB CLASSIFICATION:		
HOURS WORKED ON SHIFT PRIOR TO INCIDENT:	AGE:		
DID INCIDENT RELATE TO ROUTINE TASK FOR JOB CLASSIFICATION? ☐YES ☐NO			
INJURY/ILLNESS INFORMATION			
NATURE OF INJURY OR ILLNESS:			
OBJECT/EQUIPMENT/SUBSTANCE CAUSING HARM:			
FIRST AID PROVIDED? ☐YES ☐NO			
IF YES, WHERE WAS IT GIVEN: ☐ON-SITE ☐OFF-SITE			
IF YES, WHO PROVIDED FIRST AID:			
WILL THE INJURY/ILLNESS RESULT IN: ☐RESTRICTED DUTY ☐LOST TIME ☐UNKNOWN			

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INCIDENT / NEAR MISS REPORT AND INVESTIGATION - PAGE 2 OF 2 REPORT NO.
MEDICAL TREATMENT INFORMATION
WAS MEDICAL TREATMENT PROVIDED? ☐YES ☐NO
IF YES, WAS MEDICAL TREATMENT PROVIDED: ☐ON-SITE ☐DR.'S OFFICE ☐HOSPITAL
NAME OF PERSON(S) PROVIDING TREATMENT:
ADDRESS WHERE TREATMENT WAS PROVIDED:
TYPE OF TREATMENT:
VEHICLE AND PROPERTY DAMAGE INFORMATION
VEHICLE/PROPERTY DAMAGED:
DESCRIPTION OF DAMAGE:
SPILL AND AIR EMISSIONS INFORMATION:
SUBSTANCE SPILLED OR RELEASED: FROM WHERE: TO WHERE:
ESTIMATED QUANTITY/DURATION:
CERCLA HAZARDOUS SUBSTANCE? ☐YES ☐NO
REPORTABLE TO AGENCY? ☐YES ☐NO SPECIFY:
WRITTEN REPORT: ☐YES ☐NO TIME FRAME:
RESPONSE ACTION TAKEN:
PERMIT EXCEEDENCE
TYPE OF PERMIT: PERMIT #:
DATE OF EXCEEDENCE: DATE FIRST KNOWLEDGE OF EXCEEDENCE:
PERMITTED LEVEL OR CRITERIA:
EXCEEDENCE LEVEL OR CRITERIA:
REPORTABLE TO AGENCY? ☐YES ☐NO SPECIFY:
WRITTEN REPORT: ☐YES ☐NO TIME FRAME:
RESPONSE ACTION TAKEN:
NOTIFICATIONS
NAMES OF PERSONNEL NOTIFIED: DATE/TIME:
CLIENT NOTIFIED: DATE/TIME:
AGENCY NOTIFIED: DATE/TIME:
CONTACT NAME:
PERSONS PREPARING REPORT
EMPLOYEE'S NAME:(PRINT) SIGN:
SUPERVISOR'S NAME:(PRINT) SIGN:

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INVESTIGATIVE REPORT			
DATE OF INCIDENT:	DATE OF REPORT:	REPORT NUMBER:	
INCIDENT COST: ESTIMATED: $_____	ACTUAL: $_____		
OSHA RECORDABLE(S): ☐YES ☐NO # RESTRICTED DAYS ____ # DAYS AWAY FROM WORK ____			
CAUSE ANALYSIS			
IMMEDIATE CAUSES - WHAT ACTIONS AND CONDITIONS CONTRIBUTED TO THIS EVENT?			
BASIC CAUSES - WHAT SPECIFIC PERSONAL OR JOB FACTORS CONTRIBUTED TO THIS EVENT?			
ACTION PLAN			
REMEDIAL ACTIONS - WHAT HAS AND OR SHOULD BE DONE TO CONTROL EACH OF THE CAUSES LISTED?			
ACTION	PERSON RESPONSIBLE	TARGET DATE	COMPLETION DATE
PERSONS PERFORMING INVESTIGATION			
INVESTIGATOR'S NAME: (PRINT)	SIGN:	DATE:	
INVESTIGATOR'S NAME: (PRINT)	SIGN:	DATE:	
INVESTIGATOR'S NAME: (PRINT)	SIGN:	DATE:	
MANAGEMENT REVIEW			
PROJECT MANAGER: (PRINT)	SIGN:	DATE:	
COMMENTS:			
H&S MANAGER: (PRINT)	SIGN:	DATE:	
COMMENTS:			

EXAMPLES OF IMMEDIATE CAUSES

Substandard Actions

1. Operating equipment without authority
2. Failure to warn
3. Failure to secure
4. Operating at improper speed
5. Making safety devices inoperable
6. Removing safety devices
7. Using defective equipment
8. Failure to use PPE properly
9. Improper loading
10. Improper placement
11. Improper lifting
12. Improper position for task
13. Servicing equipment in operation
14. Under influence of alcohol/drugs
15. Horseplay

Substandard Conditions

1. Guards or barriers
2. Protective equipment
3. Tools, equipment, or materials
4. Congestion
5. Warning system
6. Fire and explosion hazards
7. Poor housekeeping
8. Noise exposure
9. Exposure to hazardous materials
10. Extreme temperature exposure
11. Illumination
12. Ventilation
13. Visibility

EXAMPLES OF BASIC CAUSES

Personal Factors

1. Capability
2. Knowledge
3. Skill
4. Stress
5. Motivation
6. Work Standards
7. Wear and tear
8. Abuse or misuse

Job Factors

1. Supervision
2. Engineering
3. Purchasing
4. Maintenance
5. Tools/equipment

MANAGEMENT PROGRAMS FOR CONTROL OF INCIDENTS

1. Leadership and administration
2. Management training
3. Planned inspections
4. Task analysis and procedures
5. Task observation
6. Emergency preparedness
7. Organizational rules
8. Accident/incident analysis
9. Personal protective equipment
10. Health control
11. Program audits
12. Engineering controls
13. Personal communications
14. Group meetings
15. General promotion
16. Hiring and placement
17. Purchasing controls

APPENDIX C
COMMUNITY AIR MONITORING PLAN

145-65 WOLCOTT STREET
BROOKLYN, NEW YORK
NYSDEC BCP ID: C224256

COMMUNITY AIR MONITORING PLAN

SUBMITTED TO:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, New York 12233

PREPARED FOR:

145-65 Wolcott St. Realty Corp.
109 Southampton Place North
Venice, Florida 34298

PREPARED BY:

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MARCH 2018

COMMUNITY AIR MONITORING PLAN
145 WOLCOTT STREET
BROOKLYN, NEW YORK

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1.0 INTRODUCTION

This Community Air Monitoring Plan (CAMP) provides measures for the protection of on-site workers and the downwind community (i.e., off-site receptors including residences, businesses, and on-site workers not directly involved in the Remedial Investigation) from potential airborne contaminant releases resulting from Remedial Investigation (RI) at 145 Wolcott street, Brooklyn, New York.

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

Based on previous investigations at the site, the primary airborne concerns for this site are volatile organic compounds (VOCs) and dust particulates.

1.1 Regulatory Requirements

This CAMP was established in accordance with the following requirements:

- 29 CFR 1910.120(h): This regulation specifies that air shall be monitored to identify and quantify levels of airborne hazardous substances and health hazards, and to determine the appropriate level of protection for workers.
- New York State Department of Environmental Conservation's (NYSDEC) DER-10, Appendix 1A (New York State Department of Health's (NYSDOH) Generic Community Air Monitoring Plan): This guidance specifies that a community air-monitoring program shall be implemented to protect the surrounding community and to confirm that the work does not spread contamination off-site through the air.
- NYSDEC DER-10, Appendix 1B (Fugitive Dust and Particulate Monitoring): This guidance provides a basis for developing and implementing a fugitive dust suppression and particulate monitoring program as an element of a hazardous waste site's health and safety program.

2.0 AIR MONITORING

The following sections contain information describing the types, frequency, and location of real-time monitoring.

2.1 Real-Time Monitoring

This section addresses the real-time monitoring that will be conducted within the work area, and along the site perimeter, during intrusive activities such as excavation, product recovery, manipulation of soil piles, extraction of sheet piling, etc.

2.1.1 *Work Area*

The following instruments will be used for work area monitoring:

- Photo-ionization Detector (PID)

- Dust Monitor

Table 1-1 presents a breakdown of each main activity and provides the instrumentation, frequency, and location of the real-time monitoring for the site. Table 1-2 lists the Real-Time Air Monitoring Action Levels to be used in all work areas.

2.1.2 *Community Air Monitoring Requirements*

To establish ambient air background concentrations, air will be monitored at several locations around the site perimeter before investigation activities begin. These points will be monitored periodically in series during the site work.

Fugitive respirable dust will be monitored using a Thermo Personal DataRAM PDR-1000AN aerosol monitor or equivalent. Air will be monitored for VOCs with a portable MiniRAE 2000 PID or equivalent. Table 1-1 presents a breakdown of each main activity and provides the instrumentation, frequency, and location of the real-time monitoring for the site. Table 1-2 lists the Real-Time Air Monitoring Action Levels to be used in all work areas. All air monitoring data is documented in a site log book by the designated site safety officer. PWGC's site safety officer or delegate must ensure that air monitoring instruments are calibrated and maintained in accordance with manufacturer's specifications. All instruments will be zeroed daily and checked for accuracy. A daily log will be kept. If additional monitoring is required, the protocols will be developed and appended to this plan.

Table 1-1

Frequency and Location of Air Monitoring

ACTIVITY	AIR MONITORING INSTRUMENT	FREQUENCY AND LOCATION
Drilling, Sampling, Excavation	PID, Dust Monitor	Continuous in Breathing Zone (BZ) during intrusive activities or if odors become apparent; screening in the BZ every 30 minutes during non-intrusive activities

Table 1-2

Real-Time Air Monitoring Action Levels

AIR MONITORING INSTRUMENT	MONITORING LOCATION	ACTION LEVEL	SITE ACTION	REASON
PID	Breathing Zone	0-25 ppm, non-transient	None	Exposure below established exposure limits
PID	Breathing Zone	>25 ppm, non-transient	Stop work. Institute vapor/odor suppression measures. Notify HSM.	Based on potential exposure to VOCs
PID	Work Area Perimeter	< 5 ppm	None	Exposure below established exposure limits.
PID	Work Area Perimeter	> 5 ppm	Stop work and implement vapor release response plan until readings return to acceptable levels, Notify HSM.	Increased exposure to site contaminants, potential for vapor release to public areas
Aerosol Monitor	Work Area Perimeter	>100 µg/m^3	Institute dust suppression measures, Notify HSM.	Stop work and implement dust suppression techniques until readings return to acceptable levels, Notify HSM.

3.0 VAPOR EMISSION RESPONSE PLAN

This section is excerpted from the NYSDOH guidance for Community Air Monitoring Plan - Ground Intrusive Activities.

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the work area, activities will be halted and monitoring continued. Vapor suppression measures can also be taken at this time. If the organic vapor level decreases below 5 ppm above background, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided:

- The organic vapor level 200 feet downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background.

If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shut down. When work shutdown occurs, downwind air monitoring as directed by the Site Health & Safety Officer (SHSO) 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 Response Plan Section.

4.0 MAJOR VAPOR EMISSION RESPONSE PLAN

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

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 work area, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If efforts to abate the emission source (see Section 5.0) are unsuccessful and if organic vapor levels are approaching 5 ppm above background for more than 30 minutes in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect.

However, the Major Vapor Emission Response Plan shall be immediately placed in effect if organic vapor levels are greater than 10 ppm above background.

Upon activation, the following activities will be undertaken:

1. All emergency Response Contacts as listed in the Health & Safety Plan will go into effect.
2. The local police authorities will immediately be contacted by the Health & Safety Officer and advised of the situation.
3. 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 Health and Safety Officer.

5.0 VAPOR SUPPRESSION TECHNIQUES

Vapor suppression techniques must be employed when action levels warrant the use of these techniques.

The techniques to be implemented for control of VOCs from stockpiled soil or from the open excavation will include one or more of the following:

- cover with plastic
- cover with "clean soil"
- application of hydro-mulch material or encapsulating foam
- limit working hours to favorable wind and temperature conditions

6.0 DUST SUPPRESSION TECHNIQUES

Reasonable dust-suppression techniques must be employed during all work that may generate dust, such as drilling, excavation, grading, and placement of clean fill. The following techniques were shown to be effective for controlling the generation and migration of dust during remedial activities:

- Wetting equipment and excavation faces;
- Spraying water on buckets during excavation and dumping;
- Hauling materials in properly covered containers; and,
- Restricting vehicle speeds to 10 mph.

It is imperative that utilizing water for suppressing dust will not create surface runoff.

7.0 DATA QUALITY ASSURANCE

7.1 Calibration

Instrument calibration shall be documented in the designated field logbook. All instruments shall be calibrated before each shift. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response.

7.2 Operations

All instruments shall be operated in accordance with the manufacturer's specifications. Manufacturers' literature, including an operation manual for each piece of monitoring equipment will be maintained on-site by the FOL/HSO for reference.

7.3 Data Review

The Field Team Leader will interpret all monitoring data based on Table 1-2 and his/her professional judgment. The Field Team Leader shall review the data to evaluate the potential for worker exposure, upgrades/downgrades in level of protection, comparison to direct reading instrumentation and changes in the integrated monitoring strategy.

Monitoring and sampling data, along with all sample documentation will be periodically reviewed by the Project

Manager.

8.0 RECORDS AND REPORTING

All readings must be recorded and available for review by personnel from NYSDEC and NYSDOH. Should any of the action levels be exceeded, the NYSDEC Division of Air Resources must be notified in writing within five (5) working days.

The notification shall include a description of the control measures implemented to prevent further exceedances.