

491 WORTMAN AVENUE
BROOKLYN, NEW YORK
BCP SITE# C224139

SUPPLEMENTAL REMEDIAL INVESTIGATION WORK PLAN

SUBMITTED TO:

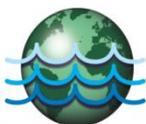


New York State Department of Environmental Conservation
Division of Environmental Remediation
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Albany, NY 12233-7016

PREPARED FOR:

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PWGC Project Number: WAT 1201

JUNE 11, 2013

P.W. GROSSER CONSULTING PC
PROJECT No. WAT 1201

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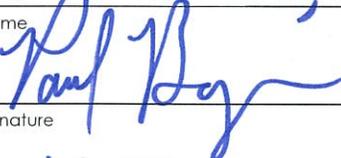
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CERTIFICATION

I PAUL BOYCE certify that I am currently a [NYS registered professional engineer or Qualified Environmental Professional as defined in 6 NYCRR Part 375] and that this Report [Remedial Design, Remedial Action Work Plan] was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

PAUL K. BOYCE, P.E.
QEP Name

QEP Signature
06.11.13
Date



1.0 INTRODUCTION

P.W. Grosser Consulting, PC (PWGC) has prepared the following Supplemental Remedial Investigation Work Plan (SRIWP) to outline procedures and a scope of work intended to delineate subsurface impacted areas of concern at the property located at 491 Wortman Avenue in Brooklyn, New York.

The current property owner has been accepted into the New York State Department of Environmental Conservation's (NYSDEC) Brownfield Cleanup Program (BCP) as a Participant. As such, the proposed Supplemental Remedial Investigation (SRI) is intended to delineate potential areas of concern within the property boundary and evaluate if off-site adjacent properties may be impacted.

1.1 Project Background

A Phase I ESA and a Phase II ESA were conducted at the site in 2008 to facilitate a property transaction. Elevated concentrations of chlorinated VOCs were detected in soil and groundwater samples in the western portion of the subject property. Based on these elevated concentrations, New York State Department of Environmental Conservation (NYSDEC) Spill #08-09879 was assigned to the site.

A Remedial Investigation was implemented in 2011 to further delineate the extent of VOC impact both on and off site. Based on the findings of the Remedial Investigation, which confirmed the presence of chlorinated VOCs in the soil, groundwater, sub-slab vapor, and indoor air, the site was entered into the BCP (Site # C224139).

1.2 Previous Investigations

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

1.2.1 Phase I ESA Report (9/30/2008)

Prepared by: Middleton Environmental, Inc.

A Phase I ESA was conducted by Middleton Environmental, Inc. (MEI) in September 2008. The purpose of the Phase I ESA was to facilitate a property transaction. The Phase I site inspection indicated the possible presence of a plating pit in the northwest corner of the building. Also, floor drains were observed in the building. MEI recommended that the potential plating pit be accessed and inspected, and that a dye flush test be performed for the pit and the floor drains to determine their discharge points. If on-site discharge points existed, it was recommended that they be sampled to determine if improper discharge has impacted the subsurface. MEI recommended that a Phase II ESA be performed to determine if the subsurface has been impacted.

A fill port and vent pipe were observed along the outside front wall of the building. The associated storage tank was not located. However, the basement of the building was not available for inspection during the Phase I ESA. MEI recommended that the basement be inspected and that, if an aboveground storage tank (AST) was located

in the basement, it be removed if not utilized. Further, MEI recommended that if an underground storage tank (UST) was found to be present, it should be precision tested to determine if it was leaking. It was also recommended that floor drains encountered in the basement be sampled to determine if improper discharge impacted the subsurface.

1.2.2 Phase II ESA Report (1/13/2009)

Prepared by: P. W. Grosser Consulting, Inc.

A Phase II ESA was conducted by PWGC in November 2008. The purpose of the Phase II ESA was to address the recognized environmental conditions specified in the MEI Phase I ESA Report. On November 17, 2008, PWGC conducted the Phase II ESA which consisted of the completion of seven (7) soil borings at the subject site for the collection of soil and groundwater samples. The soil and groundwater samples were analyzed for VOCs and metals.

PWGC accessed the partial basement located in the middle of the southern portion (front) of the building. The fill and vent lines observed along the front (south side) of the building entered a concrete block containment vault in the basement indicating that a fuel oil aboveground storage tank (AST) was present, but not visible. There was no staining observed outside the block containment vault in the basement.

One boring was performed manually in the partial basement adjacent to the AST utilizing a stainless steel hand auger. One soil sample was collected from the 0 to 2 feet below ground surface (bgs). The soil was classified as moist, poorly-graded, brown sand with silt. No floor drains were identified in the basement.

Analytical results indicated that the fuel oil AST in the basement has not impacted the subsurface. Based on an inspection of the AST vault, the vault appears to have been filled with concrete. PWGC recommended that the AST be properly closed, if it has not already been.

A floor drain was identified in the warehouse bathroom in the southern portion of the building. Upon inspection, it was determined the drain was clogged. A discharge point for the drain could not be determined.

The potential plating pit could not be accessed during the Phase II ESA. It was later identified by the owner of the property as a loading bay / truck scale which is no longer in use and had been covered over with large steel plates.

Elevated concentrations of chlorinated VOCs were detected in soil and groundwater samples in the western portion of the subject property. TCE in the soil exceeded the RSCO, with the highest concentration detected at 63,000 µg/Kg. MTBE was also detected at a concentration slightly exceeding the RSCO at one sampling location with a concentration of 201 µg/Kg. Other detected VOCs in soils were within RSCOs. The highest concentrations of VOCs in the groundwater were those of TCE (highest concentration of 24,000 µg/L) and PCE (highest

concentration of 544 µg/L). Based on the elevated TCE and PCE concentrations, New York State Department of Environmental Conservation (NYSDEC) Spill #08-09879 was assigned to the site. It appeared that TCE and PCE concentrations in the soil and the groundwater were the result of the usage of the compound in and around a degreasing tank which was reportedly located to the south of the former loading bay / truck scale. Metals were also detected in soils at concentrations exceeding Recommended Soil Cleanup Objectives (RSCOs). The copper, mercury, and zinc concentrations detected would also exceed current Unrestricted Use Soil Cleanup Objectives, but would not exceed Restricted Commercial Use Soil Cleanup Objectives.

PWGC recommended further investigation of the impacted soils and groundwater at the site, including additional soil borings to delineate the horizontal and vertical extent of on-site soil and groundwater impact. PWGC also recommended that the former loading bay / truck scale be accessed to identify drains which may have acted as conduits for contaminants.

PWGC also recommended that the indoor air quality be addressed with regard to the potential for vapor intrusion at the site.

1.2.3 Limited Subsurface Investigation Report (2/1/2009)

Prepared by: EnviroTrac Environmental Services

In January 2009, EnviroTrac Environmental Services (EnviroTrac) performed a subsurface soil and groundwater investigation to further delineate chlorinated VOC impact at the subject site.

Laboratory results identified elevated concentrations of TCE and PCE in the soil and groundwater primarily in the western portion of the site. The highest concentration of TCE in soil was 140,000 µg/Kg. The highest concentration of PCE in soil was 5,000 µg/Kg. The highest concentration of TCE in groundwater was 5,700 µg/L. The highest concentration of PCE in groundwater was 510 µg/L. PCE and TCE concentrations in samples collected at 25, 35, and 45 feet bgs were significantly lower than in the groundwater interface samples. Based on the sample location elevations and gradient levels of the TCE concentrations in the soil, EnviroTrac concluded that the subsurface soil contamination was a result of an on-site source area of TCE.

EnviroTrac recommended the preparation and submission of a Remedial Investigation Work Plan to the NYSDEC.

1.2.4 Draft Site Characterization Project Report (1/27/2012; incomplete)

Prepared by: Impact Environmental Remediation, Inc.

In 2011, Impact Environmental Remediation, Inc. (IER) performed subsurface investigation services which included soil, groundwater, sub-slab vapor and indoor air sampling in accordance with IER's NYSDEC-approved Proposed Corrective Action and Remedial Investigation Work Plan.

Draft versions of the Report were submitted to the NYSDEC. NYSDEC comments were not fully addressed by IER and a final Site Characterization Project Report was not completed. However, the NYSDEC obtained enough information from the Draft Report to admit the subject site into the BCP.

Four (4) indoor air samples (IAQ1 through IAQ4) from the breathing zone in four (4) separate locations in the building and one (1) background air sample (IAQ5) were collected from the air outside of the building, from the roof. The laboratory analyzed the indoor air samples and background air sample for VOCs in accordance with USEPA Method TO-15. Analytical results indicated that PCE and TCE were detected in each of the indoor air samples. TCE concentrations ranged from 140 to 250 $\mu\text{g}/\text{m}^3$. PCE concentrations ranged from 4.3 to 8.5 $\mu\text{g}/\text{m}^3$.

Six on-site sub-slab soil vapor monitoring points and three off-site vapor monitoring wells were installed at the subject site in March 2012. The on-site sub-slab soil vapor monitoring points were identified and labeled as on-site soil vapor monitoring points SV-1, SV-2, SV-3, SV-4, SV-5, and SV-6.

A total of three (3) off-site soil vapor monitoring wells were installed in the subsurface soil profile below the sidewalk outside the western portion of the building. The off-site soil vapor monitoring wells were identified and labeled as soil vapor monitoring wells SV-7, SV-8, and SV-9.

Analytical results indicated elevated concentrations of TCE in each of the sub-slab vapor samples. The most elevated concentration was at SV-2 in the western portion of the building (2,300,000 $\mu\text{g}/\text{m}^3$). TCE and PCE were also detected in the off-site soil vapor samples. Off-site TCE concentrations ranged from 130 to 63,000 $\mu\text{g}/\text{m}^3$ (SV-7, located on the west sidewalk adjacent to the subject building). Off-site PCE concentrations ranged from not detected to 3,200 $\mu\text{g}/\text{m}^3$ (SV-8, located on the south sidewalk adjacent to the building).

The IER soil boring investigation included the collection of 34 soil samples from 29 boring locations utilizing a Geoprobe. Analytical results from soils collected from the western portion of the site indicated elevated concentrations of TCE (highest concentration of 54,000 $\mu\text{g}/\text{Kg}$). The highest concentration of PCE detected was 0.48 $\mu\text{g}/\text{Kg}$. Detected VOC concentrations in samples collected from the perimeter of the site were relatively low, indicating that significantly impacted soils were most likely limited to the subsurface of the western portion of the building.

The IER groundwater investigation included the installation of six on-site groundwater monitoring wells (MW-1 through MW-5 and MW-3D) and three off-site monitoring wells (MW-6 through MW-8). Each of the monitoring wells, with the exception of MW-3D, is screened at the groundwater interface and is constructed of 2-inch diameter PVC. MW-3D is constructed of 1-inch diameter PVC and is screened between 9 feet and 69 feet below grade.

Analytical data from the monitoring well samples indicated TCE and PCE concentrations above NYSDEC Class GA Standards at each of the sampling locations, with the most elevated concentrations occurring in the western portion of the subject site. TCE concentrations ranged between 77 and 2,300 µg/L. PCE concentrations ranged between 260 and 3,500 µg/L.

Based on the findings of the investigation, IER recommended implementation of an interim remedial measure (IRM) consisting of remedial soil excavation in the western portion of the site, groundwater removal, and installation of a soil vapor mitigation system.

1.2.5 Phase I ESA Report (5/16/2012)

Prepared by: P.W. Grosser Consulting, Inc.

A Phase I ESA was conducted by PWGC in May 2012. The purpose of the Phase I ESA was to facilitate the completion of a NYSDEC BCP Application. The property has an extensive industrial history which included a machine shop, a steel tube manufacturer, and a water fixture manufacturer. These historical uses are considered a Recognized Environmental Condition (REC).

The property has an active NYSPIILL File (Spill #08-09879) associated with it. A review of the NYSPIILL File indicates that chlorinated VOCs have impacted the subsurface at the site. Based upon the nature of the spill, it is considered a REC.

At the time of the inspection, the basement and the AST in the basement, were not available for inspection. However, the AST was inspected by PWGC during the 2008 Phase II ESA, and a soil sample was collected from beneath the AST. Analytical results of the sample indicated that a release most likely did not occur from the AST. Based upon these conditions, it is no longer a REC.

There is a loading dock / truck scale located in the northwest area of the site. It is covered by steel plates. This structure is a potential pathway for surface discharge to enter the subsurface, and is therefore considered a REC.

The neighboring properties have a historical industrial background. A historical industrial use has the potential to affect the subsurface. A review of neighboring uses and common knowledge of the area has identified subsurface conditions to be contaminated with historic fill and petroleum constituents. Based upon historical uses and the presence of subsurface contaminants in the neighboring properties, they are considered a REC.

Based upon the findings of the Phase I ESA, PWGC recommended that a Remedial Investigation at the subject site be conducted in accordance with NYSDEC regulations.

The Remedial Investigation should consist of performing soil and groundwater sampling to further delineate chlorinated VOC contamination.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Description

The subject property is approximately 0.44 acres in area and is improved with a one-story slab-on-grade industrial concrete block, brick, and steel building with a partial basement. The building is 19,000 square feet and occupies the entire area of the property. The subject property is located in a manufacturing zoned area in Kings County, Brooklyn, New York. Wortman Avenue is the southern boundary of the subject property. The subject property is bordered to the east by Essex Street, to the west by Linwood Street, and to the north by a commercial and industrial property. No exposed soil or vegetation is present on the subject property.

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

2.2 Site History

J & H Holding Company, LLC has owned and operated the subject property since 1997. J & H Company, a NY General Partnership owned and operated the property from 1984 until 1997. These entities operated at the site under the names Sepco Industries and Watermark Designs between 1984 and 2007. The site was used to manufacture, store, package, and ship decorative fixtures and hardware for bathrooms and kitchens. The manufacturing processes at the subject property involved cleaning, painting, plating, etching, polishing, and specific machining of metals and metal products. Metals used consisted mainly of brass (primarily copper and zinc). Hazardous regulated chlorinated solvents, specifically trichloroethylene (TCE) and tetrachloroethylene (PCE), were used in the manufacturing process to clean various products. The chlorinated solvents were stored and used in the former Cleaning and Degreasing Area located along the west side of the building.

In 2007, Watermark Designs moved the operation from the subject property. Since 2007, the site has been leased by Crown Ministries International, Inc. for religious activities.

2.3 Regional Geology/Hydrogeology

The geologic setting of 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

The subject property is located over the Long Island aquifer system, which underlies all of Nassau, Suffolk, Kings (Brooklyn), and Queens Counties. The unconsolidated aquifer formations form a southward-dipping wedge that attains a maximum thickness in Kings County about eight-hundred (800) feet in southeast area of Brooklyn. Overlying bedrock in the area is the Lloyd, Magothy, Jameco, and Upper Glacial aquifer systems. The Upper Glacial aquifer, overlies all underlying units and are found at the surface in nearly all of Kings and Queens Counties. Portions of the Upper Glacial aquifer, which contain a generally thin soil mantle of Holocene age make up most of the Rockaway Peninsula and Coney Island.

The site overlies an interconnected aquifer system consisting of the upper glacial deposits and the underlying Magothy Formation. Depth to groundwater in the underlying glacial aquifer is approximately 12 feet below land surface (bls). The lithologic description of the sediments from soil borings installed during previous investigations at the site identifies the materials as fill material to approximately five feet below grade underlain by layers of fine to medium silty sands and silt.

Groundwater elevation data collected by PWGC in May 2012 determined groundwater flow to be toward the south-southwest. The nearest surface water body is the Spring Creek, located approximately 0.5-mile south-southwest of the site. Groundwater flow velocity has not yet been investigated at the site.

2.5 Site Features

The project site elevation is approximately 12 feet above mean sea level, and is generally level. The site is developed with one manufacturing building which occupies the entire area of the site. There are no exposed areas of vegetation.

2.6 Current and Future Site Use

The western portion of the building is currently unoccupied. The eastern portion of the building is occupied by a religious organization for church-related activities. The office area of the building is generally occupied by four adult individuals for approximately 40 hours per week each. These individuals manage the religious organization. Congregations of large groups occur in the eastern portion of the building for a period of approximately 1 hour

per week. Children are not present on-site for extended periods of time. There is no daycare on site. There are currently no plans to redevelop the site. The building layout, with room usage, is detailed in **Figure 2**.

3.0 STANDARDS, CRITERIA, AND GUIDANCE (SCGS)

Based on previous investigations at the site, the primary chemical of potential concern (COPC) to be encountered at the site is tetrachloroethene (PCE) and trichloroethene (TCE).

Applicable regulations at NYSDEC 6 NYCRR Part 375 provide soil cleanup objectives 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.

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

Sub-slab vapor and indoor air sample results will be compared to the NYSDOH Soil Vapor / Indoor Air Matrices specified in the Guidance for Evaluating Soil Vapor Intrusion in the State of New York.

4.0 OBJECTIVES, SCOPE AND RATIONALE

The primary objectives of the additional work detailed in this plan will be 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. Delineation of soil impact
2. Delineation of on-site groundwater impact
3. Delineation of off-site groundwater impact
4. Delineation of off-site soil vapor and indoor air impact

The data obtained will also be utilized to complete a Qualitative Human Health Exposure Assessment as per NYSDEC DER-10.

4.1 Soil Delineation

To further delineate the extent of PCE and TCE impacted soils, soil borings will be installed throughout the property to quantify the horizontal extent of subsurface impact. A minimum of five borings (GP008 through GP012) will be installed within the western portion of the building. Boring locations will be focused near areas in which impact was detected during previous investigations, where samples were not previously collected. The collected boring data can be used to determine the boundaries of future remedial excavation. Boring GP012 will be installed in the Truck Scale location. Proposed soil boring locations are illustrated in **Figure 3**.

Based on the proximity of the building's truck scale to area of detected contamination, the steel plate which covers the former scale will be removed to facilitate the performance of soil boring GP012. The truck scale represents a likely pathway for the introduction of chlorinated solvents to the subsurface.

Soil borings will be installed utilizing a Geoprobe® direct-push drill rig outfitted with a macro-core sampler and dedicated acetate liners. Soils will be collected continuously from ground surface to approximately 15 feet below grade. Soils will be field screened for the presence of VOCs using a PID. The terminal boring depth at each location will be determined based upon PID response and field observations in order to fully delineate soil contamination vertically.

Two soil samples will be collected at each boring location. Samples will be collected from the interval exhibiting the highest PID response, and the two foot interval immediately above the water table (estimated at ten feet below grade). If no PID response above background concentrations is observed, one sample will be collected from the boring; the sample will be collected from the two-foot interval immediately above the water table interface.

In addition to soil samples, a groundwater sample will be collected at each boring location.

In the event that field observations and PID responses identify the presence of impacted soils, step-out borings may be installed approximately 10 feet outward (with respect to the approximate source area location) or to the property boundary, from the boring in which impacted soil was identified. Additional step-out borings shall be installed, as necessary following consultation with NYSDEC, until field observations indicate that the horizontal extent of subsurface impact has been adequately delineated, or to the property boundary.

4.2 Delineation of On-Site and Off-Site Groundwater Impact

In order to delineate on-site and off-site groundwater quality and confirm site specific groundwater flow direction, additional monitoring wells will be installed on and off site. Proposed locations of the monitoring wells are illustrated in **Figure 4**.

Monitoring wells MW009, MW010, and MW011 will be screened at the water table. Monitoring well MW009 will be installed in the subject building near the north property boundary in order to monitor up-gradient water quality. Monitoring wells MW010 and MW011 will be installed off-site to the southwest of the site in order to determine groundwater quality further off-site.

In addition to the proposed water table monitoring wells, two multi-level monitoring wells will be installed, which will be screened at the water table, at 30 to 40 feet bgs, and at 50 to 60 feet bgs. Multi-level well ML001 will be installed in the western portion of the subject building, adjacent to the MW-3D location, in order to monitor groundwater quality at various depths in a highly impacted area of the site. Multi-level well ML002 will be installed down-gradient and off-site to determine if site contamination has migrated further off-site at various depths.

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. 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.

4.2.1 Monitoring Well Development

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. New monitoring wells along with existing wells will be surveyed relative to an arbitrary on-site datum.

4.2.2 Sampling Protocol

The new and the previously-existing monitoring wells will be sampled by a low stress (low flow) method to collect representative samples while producing a minimal amount of purge water. Sampling will be performed with dedicated instruments to prevent cross-contamination between well locations. Purging of each well will continue until the turbidity is less than or equal to 50 Nephelometric Turbidity Units (NTUs), and when pH, temperature, and conductivity measurements stabilize. Stabilization will be considered achieved when three consecutive readings within five percent of each other are collected in five minutes. Portable field instruments will be used to collect measurements. If turbidity cannot be reduced to 50 NTUs, but other parameters stabilize, the well will be considered developed. Samples will be collected directly from the polyethylene tubing into laboratory-supplied glassware upon stabilization of field parameters.

During the sampling event, depth to bottom and depth to water measurements will be collected at each monitoring well. Water level measurements will be obtained with an electronic water level probe relative to the marked measuring point. Measurements will be recorded in a dedicated bound project field notebook along with the time collected. Measuring equipment will be decontaminated between wells using a laboratory-grade detergent and water solution and tap water rinse.

4.3 AST Investigation

An aboveground storage tank (AST) is contained in a vault located in the building's partial basement. The exterior of the AST vault was inspected during the Phase II ESA, and no evidence of a release (i.e., staining) was observed. A soil boring was performed adjacent to the vault and a soil sample was collected. Analytical results did not indicate a release. At this time, it is not believed that the AST has been properly closed. However, to confirm that a release has not occurred and that the AST has been properly abandoned, the interior of the vault will be inspected. A portion of the vault wall or ceiling will be breached in order to perform an effective inspection.

4.4 Floor Drain Investigation

Further attempts will be made to determine if the floor drains located within the building's bathrooms discharge to the municipal sewer, or to the subsurface of the site. During the Phase II ESA, the floor drains were observed to be blocked, and such a determination could not be made.

4.5 Off-Site Sub-Slab Vapor and Indoor Air Sampling

In order to determine if VOC vapors from the Site's subsurface contamination has impacted the indoor air of the adjacent property to the north of the subject site, sub-slab vapor and indoor air sampling will be performed in the area directly to the north of the subject building. The sampling will consist of the collection of one sub-slab vapor sample, one indoor air sample, and one outdoor air sample. **Figure 5** indicates the proposed location of the off-site sub-slab vapor and indoor air samples to be collected. The outdoor air sampling location will be based on the wind direction at the time of sampling.

In order to comply with the NYSDOH guidance, a pre-sampling building inspection and chemical inventory will be performed for the off-site building. The objective of the inspection is to identify sources of chemicals located in the building which may impact the sampling analysis. For this purpose, the NYSDEC's "Structure Sampling Questionnaire and Building Inventory" form will be completed.

In order to facilitate the collection of a sub-slab vapor sample, PWGC will install a temporary sampling port adjacent to the initial port utilizing a hammer drill with a concrete bit. PWGC will perform a tracer gas test on the sub-slab vapor port both prior to and after the collection of the sub-slab vapor sample utilizing a helium detector. The sample will be collected at a depth less than two inches below the bottom of the slab.

The indoor air sample will be collected from the ambient air in the vicinity of the sub-slab vapor point, at a height between 3 and 5 feet above the floor. Additionally, one ambient air sample will be collected from outside and upwind of the building as a background or control sample. A total of 3 samples are assumed for this task.

As the adjacent site is an industrial building, the samples will be collected concurrently for an 8-hour duration. Samples will be collected into Summa canisters and submitted to a New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) certified laboratory for analysis of volatile organic compounds (VOCs) by EPA Method TO-15.

The sub-slab soil vapor and indoor air samples at this location will be collected following approval of site access from the property owner. PWGC will attempt to obtain site access to collect the samples initially. If unsuccessful at obtaining access, it is anticipated that NYSDEC and/or NYSDOH will assist the NYSDEC BCP applicant in obtaining site access to the neighboring site in order to obtain the requested samples. In the event that access

cannot be obtained in a timely fashion, the remainder of the proposed SRI Work Plan will be implemented and reported.

4.6 Off-Site Soil Vapor Sampling

In order to determine if VOC vapors from the Site migrate across Linwood Street and Wortman Avenue, soil vapor samples will be collected on the sidewalks in the locations indicated on **Figure 5**. Proper sampling protocols will be followed in accordance with the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006. A geoprobe will be utilized to install permanent soil vapor probes at a depth of approximately five feet bgs. The probes will consist of stainless steel screens attached to polyethylene tubing. The probe will be protected with a manhole cover.

These samples will be collected for a duration of 1 hour. Samples will be collected into Summa canisters and submitted to a New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) certified laboratory for analysis of volatile organic compounds (VOCs) by EPA Method TO-15.

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 SRIWP will be coordinated by PWGC on behalf of J&H Holding Company, LLC. The following identifies the responsibilities of various organizations supporting the SRI:

- The NYSDEC Project Manager (Alicia Barraza) 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 be responsible for the coordination of the overall BCP with the NYSDEC. 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 RI work plan are implemented. The project manager will also act as the Site Health and Safety Manager (HSM).
- PWGC Field Team Leader (Ryan Morley) 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. A summary of laboratory analyses to be performed is included as **Table 1**.

5.2.1 *Soil Samples*

Soil samples will be collected as described in Section 4.1. Soil samples will be analyzed for TCL VOCs by USEPA SW846 Method 5035/5035A. Analysis will conform to NYSDEC Analytical Services Protocol (ASP) Category B data deliverables will be submitted.

5.2.2 *Groundwater Samples*

Groundwater samples will be collected as described in Section 4.2. Groundwater samples will analyzed for TCL VOCs by USEPA Method 8260. Analysis will conform to NYSDEC ASP Category B data deliverables will be submitted.

5.2.3 *Sub-Slab Vapor and Ambient Air Samples*

Sub-Slab vapor, indoor air, and outdoor air samples will be collected as described in Section 4.5 and 4.6. Samples will be analyzed for VOCs by USEPA Method TO-15. Analysis will conform to NYSDEC ASP Category B data deliverables will be submitted.

5.3 **Field/Laboratory Data Control Requirements**

Quality Control (QC) procedures will be followed in the field and at the laboratory to facilitate that reliable data are obtained. 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. The QA/QC requirements are summarized on **Table 2**.

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.

- GP008 @ 8-10' (geoprobe sample, soil boring #8 from 8 to 10 feet)
- MW009 (groundwater sample from monitoring well #9)
- IA001 (indoor air sample at location #1)
- OA001 (indoor air sample at location #1)
- SV001 (soil vapor or sub-slab vapor sample at location #1)

Sample frequency, locations, depths, and nomenclature may change subject to field decisions and professional judgment. The estimated number of samples to be collected is summarized on **Table 3**.

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 samples from being tampered with.

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 SRI 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 manufacturers recommended schedules. Daily field response checks and calibrations will be performed as necessary (i.e. PID calibrations) following manufacturers 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, casing, augers, drill rods, temporary well material 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 visual contamination

- 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. Investigative derived waste (IDW) generated during field operations will be disposed of in accordance with DER-10, section 3.3(e).

Soil cuttings generated from soil boring and vertical profile 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 sampled to determine if spreading on-site is appropriate or off-site disposal is required. 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 off-site disposal is required. Following receipt of the groundwater sampling results, recommendations for disposition of the water will be provided to NYSDEC.

Based upon correspondence with NYSDEC Division of Solid and Hazardous Materials, investigation and remedial derived wastes will be disposed of as hazardous or non-hazardous waste based upon their characteristic qualities. Non-hazardous waste streams will be approved by NYSDEC in advance.

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 person making the entry.

6.0 SUPPLEMENTAL REMEDIAL INVESTIGATION REPORT PREPARATION

The Supplemental Remedial Investigation Report (SRIR) will incorporate the methods and findings of the Supplemental Investigation activities performed as outlined in this work plan. The report will identify specific contamination concentrations throughout each media (e.g. soil, groundwater, etc), 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. The SRIR will include the results of a Qualitative Human Health Exposure Assessment. Electronic copies of the Supplemental Investigation Report 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) will be prepared to provide measures for protection for on-site workers and the downwind community from potential airborne contaminants as a direct result of the Supplemental Investigation. The CAMP is included as **Appendix C**.

The Community Air Monitoring Plan will be implemented and executed in accordance with DER-10, Appendix 1A (NYSDOH Generic Camp) and Appendix 1B (Fugitive Dust and Particulate Monitoring).

9.0 CITIZEN PARTICIPATION PLAN

A site-specific Citizen Participation Plan (CPP) has been prepared for the Site. The CPP provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the site. The public information and involvement program will be carried out with assistance, as appropriate, from the BCP Applicant.

10.0 PROJECT SCHEDULE

The preliminary schedule for the major project milestones is presented in **Table 4**. The field work is anticipated to be performed in July 2013, following approval of this SRWP by NYSDEC. A draft RI Report should be submitted to the NYSDEC by January 2014.

11.0 REFERENCES

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

NYSDEC, Division of Environmental Remediation, December 2002, Draft DER-10, Technical Guidance for Site Investigation and Remediation.

NYSDEC, Division of Hazardous Waste Remediation, January 24, 1994, Memorandum # 4046, Technical and Administrative Guidance Memorandum #4046, Determination of Soil Cleanup Objectives and Cleanup Levels

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

NYSDOH, October 2006, Guidance for Evaluating Soil Vapor Intrusion in the State of New York

USEPA, Standard Operating Procedure SOP 2042, Soil Gas Sampling

TABLES

Table 1

Laboratory Analytical Methods
491 Wortman Avenue, Brooklyn, New York

Sample Location	Sample Matrix	Sample Type	Parameters	EPA Method	Sample Preservation	Holding Time	Sample Container
Soil Vapor	Soil Vapor	8-hour duration	VOCs	TO-15	Maintain Under Vacuum	14 days	Summa® Canister or equivalent
Indoor and Outdoor Air	Air	8-hour duration	VOCs	TO-15-SIM	Maintain Under Vacuum	14 days	Summa® Canister or equivalent
Soil Delineation	Soil	Grab	VOCs	5035/5035A	Cool to 4°C	7 days	En-core or Terra-core sampler
Groundwater Delineation	Groundwater	Grab	VOCs	8260	Cool to 4°C HCl to pH<2	14 days	40-ml vial

Table 2

Field/Laboratory QA/QC Requirements
3140 Coney Island Avenue, Brooklyn, New York

Sample Type	Frequency	Purpose
Blind Duplicate	One duplicate sample, or One per 20 samples of the same matrix.	To evaluate the precision of the field sampling and laboratory analyses.
Equipment Blank	One per day per matrix. Equipment blanks are collected in the field using analyte-free water supplied by the laboratory.	To assess the cleanliness of the sampling equipment and the effectiveness of the decontamination process.
Trip Blank	One VOA (volatile organic analysis) trip blank per sample cooler that contains site samples to be analyzed for VOAs.	To detect VOC cross-contamination during sample shipping and handling.
Method Blank	One per 20 samples of same matrix	To document contamination resulting from the analytical process.
Matrix Spike	One per 20 samples of same matrix	It is used to measure the efficiency of all steps of the sampling and analytical methods in recovering the target analytes from the sample. It is a sample spiked with known quantities of analytes and subjected to the entire analytical procedure.
Matrix Spike Duplicate	One per 20 samples of same matrix.	To reinforce the matrix spike information. It is a second aliquot of the same sample as the matrix spike.

Table 3

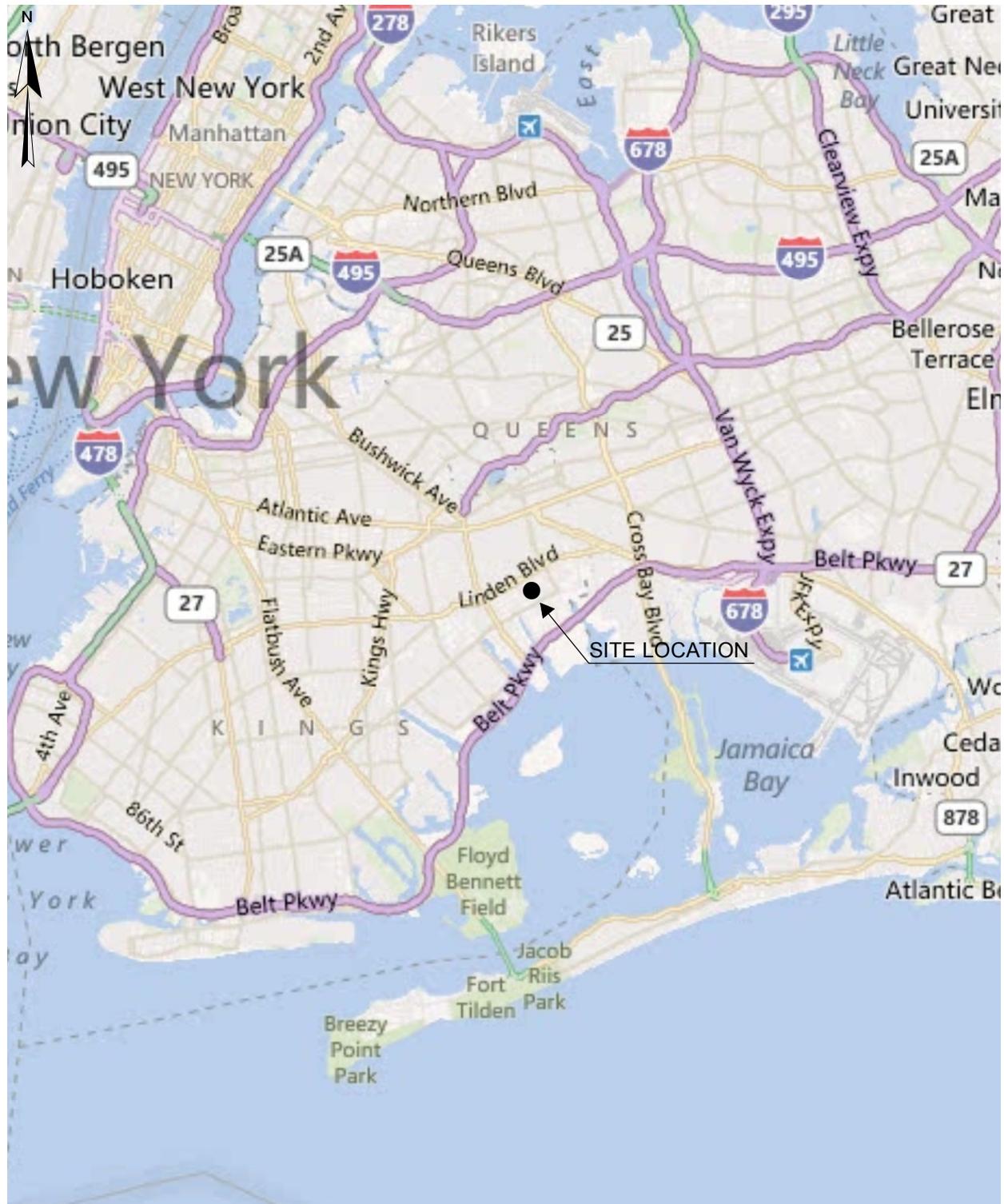
Estimated Number of Samples
491 Wortman Avenue, Brooklyn, New York

Sample Type	Sample Identification	Matrix	Estimated # of samples to be collected
Soil Vapor	SV001 and SV002	Soil Vapor	2
Sub-Slab Soil Vapor	SS001	Soil Vapor	1
Indoor Air	IA001	Air	1
Outdoor Air	OA001	Air	1
Soil	GP007 to GP010	Soil	8
Monitoring Well Groundwater	MW009 to MW011	Groundwater	3
Multi-Level Groundwater	ML001 and ML002	Groundwater	6
Geoprobe Groundwater	GP007 to GP010	Groundwater	4

TABLE 4
PROJECT SCHEDULE
SUPPLEMENTAL REMEDIAL INVESTIGATION

	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 SRI Report																	█	█	█	█	█	█	
Submission of Draft SRI Report to NYSDEC																							█

FIGURES



VICINITY MAP

● 491 Wortman Avenue, Brooklyn, NY




Project:	WAT1201
Designed by:	NCJ
Approved by:	JE
Drawn by:	NCJ
Date:	5/8/2012
Figure No.:	1



-  IER Indoor Air Quality Sample
-  IER Soil Vapor Monitoring Well
-  IER Soil Borings
-  IER Monitoring Wells
-  Enviro Trac Soil Borings
-  PWGC Soil Borings
-  Building Detail



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DRAWINGS PREPARED FOR:

REVISION DATE	INITIAL	COMMENTS

SHEET TITLE:

SITE PLAN
WITH HISTORIC
SAMPLE LOCATIONS

491 WORTMAN AVENUE
BROOKLYN, NEW YORK

FIGURE NO:

2

SHEET:



PWGC

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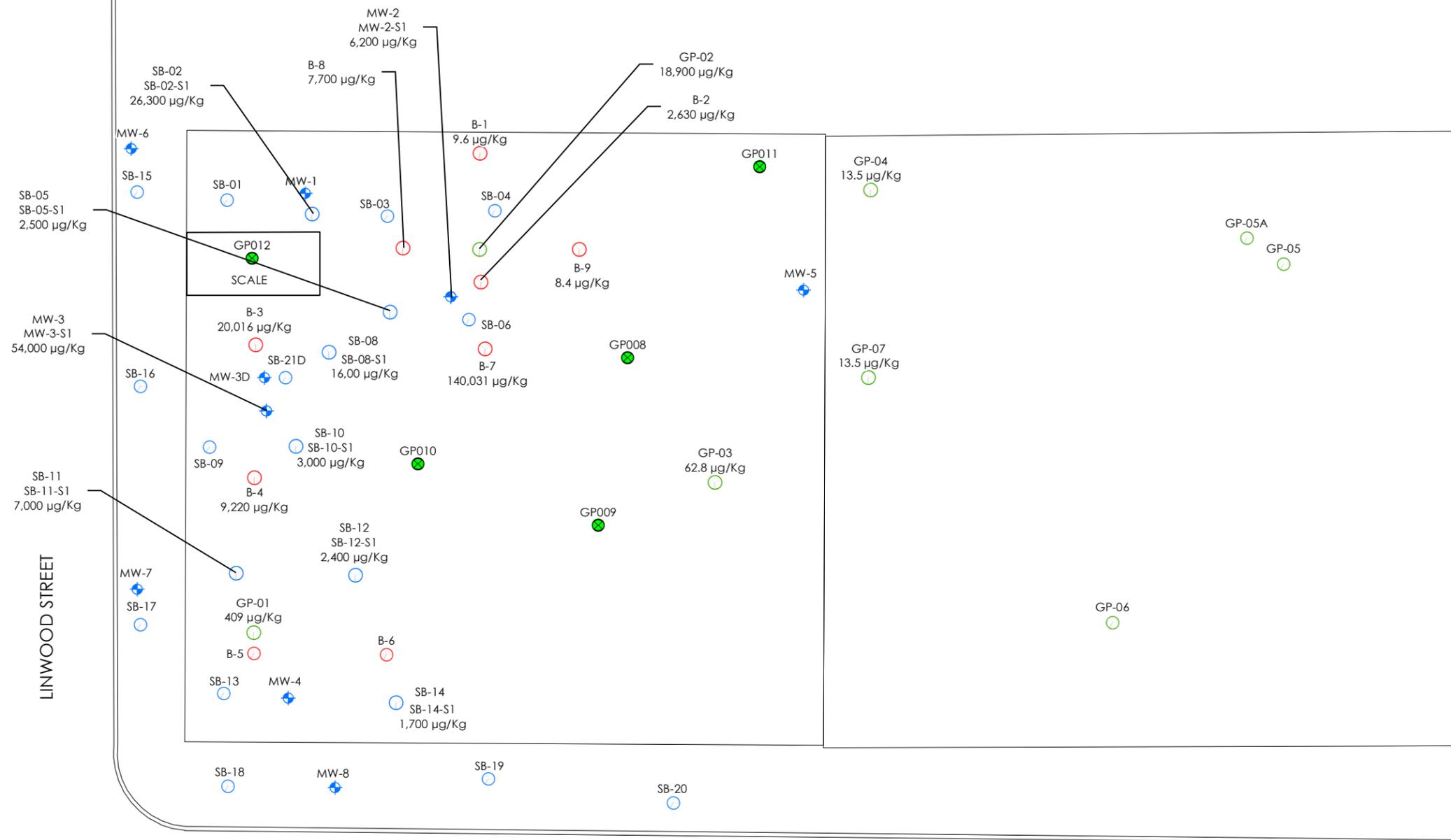
DRAWING INFORMATION:

Project:	WAT1201	Designed by:	JE
Date:	5/24/2013	Drawn by:	BB
Scale:	AS SHOWN	Approved by:	JE

FIGURE NO:

3

SHEET:



**PROPOSED SOIL SAMPLING LOCATIONS and
ELEVATED TOTAL CHLORINATED SOLVENTS**

491 WORTMAN AVENUE
BROOKLYN, NEW YORK



Note: Concentrations are reported as
Total Chlorinated Solvents.

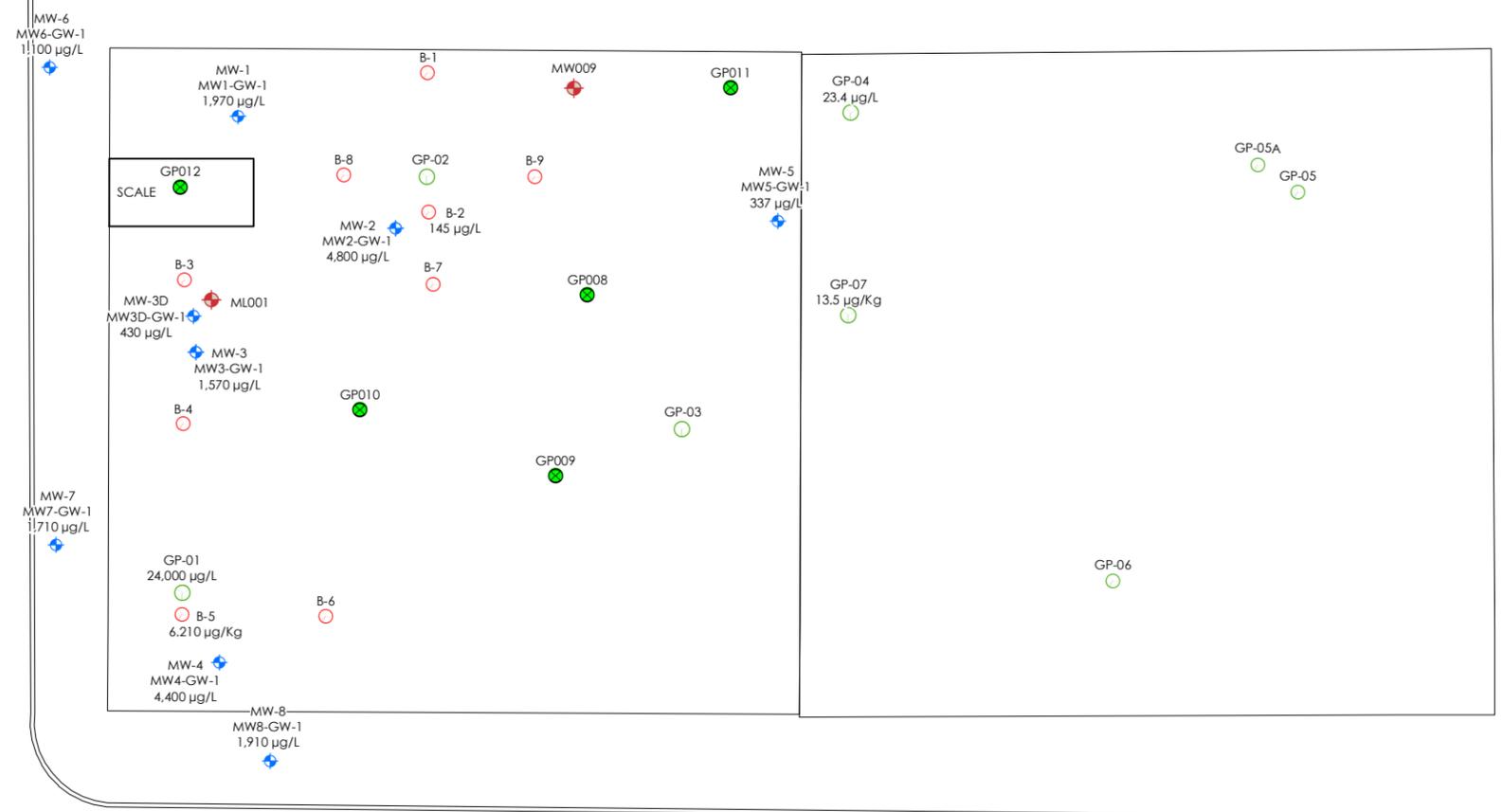
- Proposed Soil Boring Locations
- IER 2011 Soil Borings
- ◆ IER Monitoring Wells
- Enviro Trac 2009 Soil Borings
- PWGC 2008 Soil Borings
- Property Boundaries

Document Path: D:\GIS\Projects\12\WAT1201\Mapfiles_NEW\FG3_SoilSampleLocations.mxd



LINWOOD STREET

WORTMAN AVENUE



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Project:	WAT1201	Designed by:	JE
Date:	5/24/2013	Drawn by:	BB
Scale:	AS SHOWN	Approved by:	JE

FIGURE NO:

4

SHEET:

PROPOSED GROUNDWATER SAMPLING LOCATIONS and ELEVATED TOTAL CHLORINATED SOLVENTS

491 WORTMAN AVENUE
BROOKLYN, NEW YORK



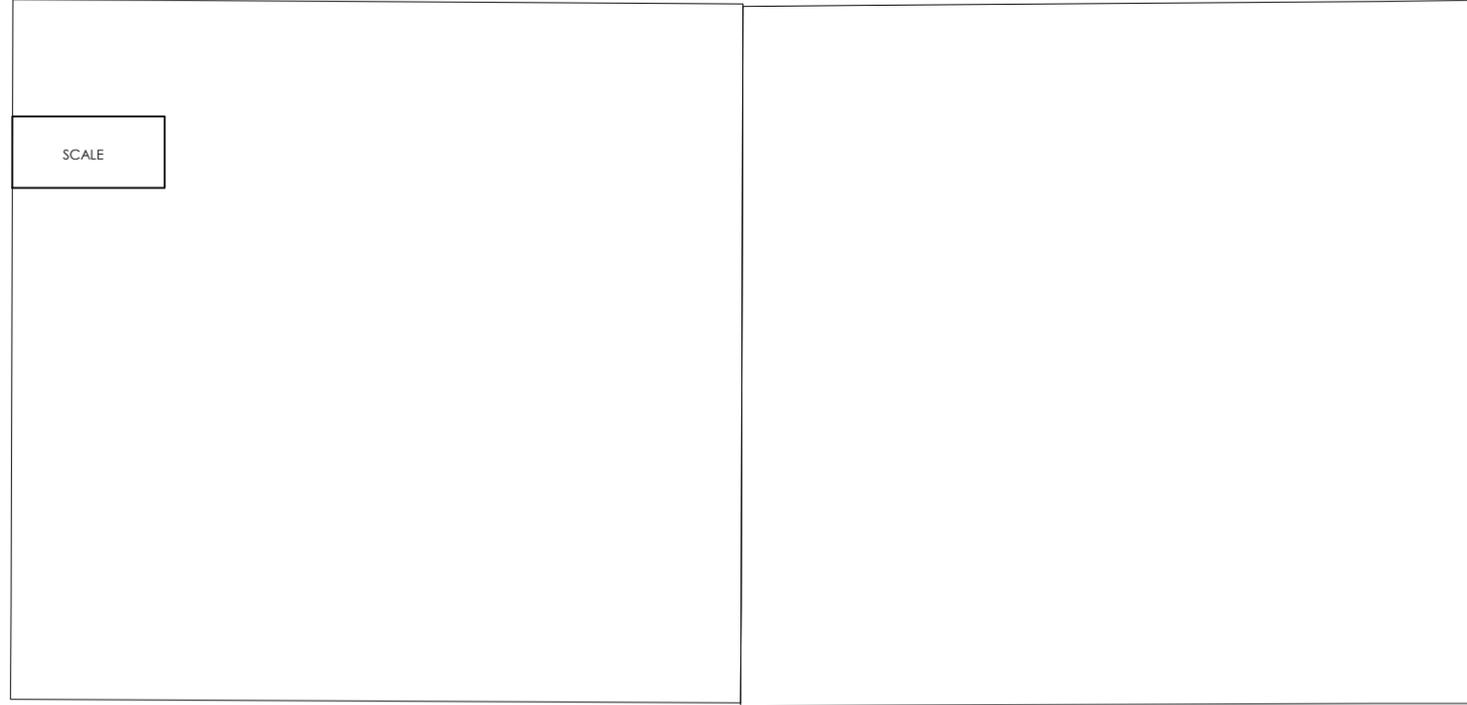
Note: Concentrations are reported as Total Chlorinated Solvents.

- ◆ Proposed Monitoring Well Locations
- Proposed Soil Boring Locations
- IER 2011 Soil Borings
- ◆ IER Monitoring Wells
- Enviro Trac 2009 Soil Borings
- PWGC 2008 Soil Borings
- Property Boundaries

Document Path: D:\GIS\Projects\12\WAT1\2013\Mapfiles_NEW\FGA_ProposedGWSampleLocations.mxd



LINWOOD STREET



WORTMAN AVENUE



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REVISION	DATE	INITIAL	COMMENTS
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DRAWING INFORMATION:

Project:	WAT1201	Designed by:	JE
Date:	4/8/2013	Drawn by:	BB
Scale:	AS SHOWN	Approved by:	JE

FIGURE NO:

5

SHEET:

-  Proposed Indoor Air
-  Proposed Soil Vapor
-  Proposed Sub-Slab Vapor
-  Subject Property Boundaries

**PROPOSED SOIL VAPOR AND INDOOR AIR
SAMPLING LOCATIONS**
491 WORTMAN AVENUE
BROOKLYN, NEW YORK



Document Path: D:\GIS\Projects\12\WAT1\2013\Mapfiles_NEW\FIG5_ProposedSVandIA\Locations.mxd

APPENDICIES

Paul K Boyce, PE, Vice President



PROFESSIONAL EXPERIENCE

PWGC: 19 years

PRIOR: 3 years

EDUCATION

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

PROFESSIONAL CERTIFICATION/TRAINING

- Professional Engineer, NYS
- 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

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 19 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 and sustainability consulting. At PWGC, he focuses on clients' environmental and engineering needs.

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, and 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 effectively implement, long-term strategies based on factual, comprehensive data.

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.

NOTABLE PROJECTS

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 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.

Paul K Boyce, PE, Vice President

aesthetically, and academically. Further, to meet 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 and meet 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.

Suffolk County Department of Public Works, NY

Timber Point Country Club, Great River, Water Supply System & Irrigation Well Upgrades – Directed the well’s condition assessment, including a 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 irrigation well with distribution and cross-connection to the Suffolk County Water Authority, and specified new variable frequency drive for well pump motor. Completed.

West Sayville Golf Course, Sanitary System Improvements - Supervised design and development of permitting, bidding, and construction documents to modernize and upgrade the existing administrative building’s sub-surface sanitary disposal system, and oversaw construction phase services (administration, observation) through to completion.

Peconic Dunes Park, Peconic, NY, Water Distribution System Improvements – 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 - 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 - Supervised design/development of bidding and construction documents for the re-circulated supply system. 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 - Performed 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 2 groundwater supply wells, a 12-acre storage lake, booster pumping station, and distribution piping, has been running smoothly since start-up.

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, he 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. Mr. Boyce managed civil/site concerns, which included grading, drainage, sanitary, water supply, utilities, parking, traffic controls, site lighting, and building locations/elevations. He 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, oversaw construction, and supervised wetlands delineation and permitting with the NYSDEC through to project completion.

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

Design/Engineering Management Services, Stormwater Collection & Conveyance System - Mr. Boyce was managed 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 DEIS (Draft Environmental Impact Statement).

Montauk Yacht Club, Star Island, Lake Montauk, NY

Sewage Treatment Plant Design – Managed the structural design of the key components of a sewage treatment plant for the Montauk Yacht Club. The plant, a sequential batch reactor (SBR) type with a peak design load of 50,000 gpd, featured a treatment process involving several large tanks made of reinforced concrete. Mr. Boyce 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.

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

North Shore Long Island Jewish Health System, NY

North Shore University Hospital (NSUH), Glen Cove, NY, Geothermal Wells Project – As project manager, he prepared the feasibility study, well permits, construction documents, and 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 of 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, he 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.

Heatherwood Communities, LLC, Manorville, NY

Ecologically Engineered STP Design & Engineering Study - 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).

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. Mr. Boyce 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

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was involved with the conceptual layout of sewage treatment locations and associated sewage collection systems. He helped develop and cost out the various viable alternatives and provided input into the report recommendations.

Ridge Mobil Gas Station, Ridge, NY

Soil & Groundwater Remediation System - 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

Geothermal Well System Design – Managed the site assessment, design, construction oversight, and preparation of O&M manuals for the systems, conducted a feasibility study of using open-loop geothermal systems to heat and cool 2 of the school's most prominent buildings - The Center for Well Being (Bldg 5) and the Media Pavilion (Bldg 2). Mr. Boyce 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. He 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.

Pratt Institute, Brooklyn, NY

Geothermal Feasibility Study - Oversaw and coordinated a test hole drilling, geological characterization, water quality sampling. 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. Project is on going as of September 2007.

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 another, and/or other nearby wells). He designed open loop geothermal system 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.

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. Mr. Boyce 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 as 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.

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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. Mr. Boyce 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.

Water Authority of Great Neck North, Nassau County, NY

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

SCADA System Design - Prepared design for new Supervisory Control and Data Acquisition System, prepared bidding and construction documents, providing construction administration and observation services, cost estimates, construction is about to begin in late 2007.

Emergency Water Main Replacement, Berkshire Road - Prepared design, construction and bidding documents for emergency water main replacements, expedited NCDOH review and approval, provided PE certification services, project is complete water mains have been installed in 2006.

Community Drive Treatment System Upgrades - Preparing design, construction and bidding documents for perchlorate removal, and Freon removal that includes new packed column air stripper and resin filtration units, project is on-going as of fall of 2007 and will be providing construction phase services which will include administration and observation.

Air Stripper Cap at Watermill Lane - Coordinated with contractor and WAGNN regarding design and sizing of appropriate air exit cap atop existing air stripper at Watermill Lane treatment plant. Project is on hold as substantial modifications are pending at the Watermill Lane plant due to threatening MTBE contamination.

Valve Book Review/Updates - Updated valve location sketches as new valves are being installed in the distribution system. Continually on-going project as new valves are installed continue to update valve location maps.

Municipal Supply Well Design, Well #14 - Design services for the new 1,400 gpm municipal supply well include engineering report for NYSDEC and NCDOH review/approval, preparation of plans and specifications for 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 - Lead the project team charged with designing new 500,000-gallon steel ground storage tank to replace deteriorated and dilapidated existing 400,000-gallon ground storage tank. Subsequent the team prepared bidding/construction documents, inclusive plans and specifications, obtained NCDOH approval, and provided construction administration and oversight services. Design is beginning Sept 2007.

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

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 hired PWGC to comply with a NYSDEC-issued 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 has led the on-going waste stream sampling program, and has been involved with the treatment process selections and cost estimates. The treatment system design is expected to receive NYSDEC approval based on the report's recommendations.

Hampton Bays Water District, Suffolk, NY

Well Field Construction & Integration - He prepared the structural, mechanical, and electrical designs for a new well field including 2 pump stations. In addition to construction plans and specifications, Mr. Boyce oversaw the integration of 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 8 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 the ambient pH of the groundwater withdrawn from the shallow aquifer system to between 7 and 8.5. He was

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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 as to how to isolate the zone and create a booster pumping station to raise pressures within the zone to acceptable levels. He 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 was constructed closely to Mr. Boyce's design and construction cost estimate.

Good Samaritan Hospital, West Islip NY

Well Turbidity Study - Based on his review of existing quality data, Mr. Boyce recommended sampling and analyzing 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 his study 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. 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.

Times Square Construction, New York, NY

Geotechnical Report for 47 East 34th Street Building Construction - Oversaw rock core boring program, characterized rock core samples, developed geotechnical report based upon findings of rock core boring program, provided foundation recommendations for a new 38 story residential building being erected upon Manhattan schist on the east side of mid town Manhattan. Assisted with the rock anchor design and specification. Supervised and managed field observation services for rock anchor testing. Supervised and managed the design and development of a foundation waterproofing system. Foundation is nearly complete as of September 2007.

Islip Resource Recovery Agency, Town of Islip, NY

Environmental Compliance and Permitting - Managed and supervised environmental compliance audits for three Town facilities that included a C&D landfill, a composting facility, and a recycling center. Managed the preparation of environmental permits and design upgrades to bring facilities into compliance with SCDHS and NYSDEC requirements. As of Sept 2007 project is awaiting regulatory agency approvals.

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, Contract Nos C-34742, C-34808, and E40803. 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

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 2^{ary} containment volume and dyke wall for the pad; and 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. Subsequent, he prepared structural calculations and construction documents (i.e. plans and specifications. Before construction, he submitted the plans to the NY/NJ Port Authority for review and comment. 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.

Stormwater Sediment & pH Control Investigation, LaGuardia Airport, Queens, NY - He was responsible for reviewing and investigating an on going 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

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suspended solids, which were temporary violations of the facility's SPDES 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. He 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. Mr. Boyce was responsible for investigating the cause of the problem and recommending a course of corrective action.

City of Long Beach, NY

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 such as flow rates, operating flow rates, velocities, pipe sizes, etc. 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.

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

Cooling Tower and Boiler Blow Down Discharges – SPDES Permitting - Led the investigation into alternatives for blow-down discharges that included discharge to either groundwater or sanitary sewer. 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. Oversaw and managed the preparation SPDES permit applications for groundwater discharges. As of Sept 2007, flow study continues, and SPDES permit application is still under review with the NYSDEC.

Roanoke Sand & Gravel, Mid Island, NY

Sand Mining Design and Permitting - Primary client contact for an application to the Town of Brookhaven and NYSDEC to expand mining operations at existing sand and gravel mine. 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. Project is ongoing as of Sept 2007.

Lawrence Livermore National Laboratory, Livermore, CA

CD 0/1 Document Peer Review - a member of a National Nuclear Security Administration (NNSA) team, Mr. Boyce was charged with 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, and reviewed/evaluated the work documents for coherency, completeness, and acceptable levels of detail for CD 0/1 stage requirements. He recommended the documents improvements and participated in a debriefing with the NNSA team and site staff.

NYC DOT, Kensico Reservoir Rte, Westchester, NY

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

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. He 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.

Brentwood Water District Air Stripper, Plant No. 2, 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, and architectural and site components. Specific

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design components: an 11' diameter by 30' packed bed depth aluminum air stripper, a 100,000-gallon ground storage clearwell, and booster pumps. Specific design aspects: Restaging an existing well pump, electrical service upgrade, a new natural gas engine generator set, stripping tower enclosure, and three existing pumping stations refinish. He 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 then 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 # 2 of the Brentwood Water District (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 # 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.

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 and 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.

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 foundation walls to serve as grade beams between pile caps. Mr. Boyce prepared construction documents including plans and specifications, and acted as the primary client contact throughout the project.

Village of Dering Harbor Water District

Corrosion Control - Responsible for preparing a study to evaluate various corrosion-control treatment options for the Village's water district. Based on his study, Mr. Boyce recommended adding soda ash to raise the groundwater's pH and allow for continued water supply to the Village. Following completion and 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.

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.

West Neck Water District, Shelter Island

New Well and Upgraded Pumping Station - Mr. Boyce was responsible for designing a new well and upgrade for an existing treatment plant for the West Neck Water District on Shelter Island. The existing plant was basically 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.

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AIL Systems Inc, Commack, NY

Recharge Basin Size Analysis – To assess the feasibility of reclaiming land used for recharge purposes, in order to sell or alter its use, Mr. Boyce analyzed the industrial facility's existing cooling/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 also 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.

AIL Systems, Deer Park, NY

Sewage Treatment Plant Evaluation Study - AIL 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 the condition and performance of the existing sewage treatment plant. Mr. Boyce performed a plant inspection, obtained, and reviewed operational records, annual operating costs, O&M manuals, plant influent and 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 (SBR) with a peak design flow of 250,000 gpd. His responsibilities include (1) providing on-call technical support to plant operators on how to troubleshoot operational and process problems, (2) review of plant effluent data, (3) analysis of flow and effluent quality conditions, and (4) provision of design services when needed.

Birchwood Nursing Home, Huntington, NY

Structural Design – 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 (SBR) 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 and specifications and coordinated with contractors during construction accordingly.

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.

Good Samaritan Hospital, West Islip NY

Well Turbidity Study - Based on his review of existing quality data, Mr. Boyce recommended sampling and analyzing 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 his study 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. 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.

Paul K Boyce, PE, Vice President

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.

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 the DOE used to select a feasible demolition methodology as well as a plan to construct a smaller replacement stack for any site activities that still needed a stack.

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 - 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 preparing 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.

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 the 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 (rad-con) 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

Paul K Boyce, PE, Vice President

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).

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, he 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, Mr. Boyce 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

MODELING EXPERIENCE

MODEL – CLIENT & APPLICATION
Groundwater Vistas - Environmental Simulations International
Glen Cove Hospital, Glen Cove, NY - Study of geothermal wells impacting each other, hazardous waste site, and water table
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 & East Meadow Brook headwaters
BNL, Western South Boundary, Upton, NY - Estimate capture zone of groundwater recovery wells for Remediation Project
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 & flow of Sewage Treatment Plant effluent to Long Island Sound using The County's Groundwater Model
WaterCAD - Haestad Methods
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
-Prickett Lonquist Aquifer Simulation Model & Hyperventilate Model (Int'l Ground Water Modeling Center (IGWMC))
-QuickFlow (Geraghty & Miller, Inc)
Minmilt Realty, East Farmingdale, NY - Well location & pumping rate selection; Soil vapor extraction system design; PLASM model results verification
Rothberg, Tamburini & Winsor Corrosion Control & Process Chemistry Model - American Water Works Association
Water Suppliers (Non-transient, non-community/community) Suffolk County, NY - Lead & copper desktop studies (water quality modeling)

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)

Paul K Boyce, PE, Vice President

GEOHERMAL SYSTEMS PROJECTS – Summary Table	
Glen Cove Hospital, Glen Cove, NY - 800 gpm Open Loop	
Feasibility Study Hydrogeological Study/Engineering Report Long Island Well Permit Application Groundwater Modeling	Design, Aquifer Testing, Water Quality Investigations Regulatory Agency Liaison (2) Existing Systems Rehabilitation, 650 gpm & 180 gpm – Physical/Chemical Rehab, New Well Screen Installation
Standard Microsystems, Hauppauge, NY - 600 gpm Open Loop	
Design Construction administration/oversight	Water quality investigation/iron related bacteria study Troubleshooting & Rehabilitation
C.W. Post College, Brookville, NY - 320 gpm Open Loop	
Feasibility Study Long Island Well Permit Application Regulatory Agency Liaison	Groundwater Modeling & Water Quality Investigation Design, Construction Administration/Oversight
Bear Mountain, Upstate NY - Closed Loop Lake System – Coils	
Evaluation of Thermal Effects on Lake Biota Bathymetric Survey	Analysis & Report Preparation
157 Central Ave, Greenport, NY - Closed Loop System 4 Ton	
Feasibility Study Open Loop vs. Closed Loop Closed Loop Boreholes Preliminary Design	Cost Estimating
Loeb Residence, East Hampton, NY - Open Loop S	
Supply & Recharge Well Design for Residential Air Conditioning System	Cost Estimating & Construction Oversight
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	Design Construction Admin/Oversight O&M Manual Preparation
Telyas Residence, Old Westbury, NY - 90 gpm Open Loop System	
Long Island Well Permit Application & Design	Construction Administration
New Lane Elementary School, Coram, NY – Open Loop	
Existing System Assessment Corrective Actions Recommendations	TV Inspections
Citibank, Melville, NY - 325 gpm Open Loop System	
Existing System Evaluation Corrective Actions Recommendations	TV Inspections
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	Standing Column Test Well Design, Evaluation Oversight Closed loop layout & preliminary sizing Pond/open loop system investigation/analysis
ALL Systems, Deer Park, NY - 2,650 gpm Open Loop System	
4 supply wells totaling 2,650 gpm discharging to a recharge basin hydrogeological analysis	Basin Capacity Study & Study for Land Reclamation Purposes
Lerner Residence, Lloyd Harbor, NY – 66 gpm Open Loop System	
Feasibility Study – hydrogeological & water quality investigations	Design & Permitting
30 Wheatley Road, Old Westbury, NY - 90 gpm Open Loop	
Iron Removal System Design	As-built Preparation & Construction Oversight
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	Improvements/Recovery Recommendations for Recharge Performance & Capacity
Kensington Public Library, NYC DDC (Brooklyn, NY) - 200 gpm open loop system	
Consult and advise on design and feasibility	Perform hydrogeological calculations
Cow Neck (Suffolk County, NY) - Closed loop system 40 tons	
Feasibility study, Field testing program+	Design – modeling using GLHEPRO Version 4.0
Queens Botanical Garden, NYC DDC (Queens, NY) - open loop system	
Consult and advise on construction Rehabilitation and re-development specification	Coordinate and observe rehab using impulse generation technology
Snug Harbor, NYC DDC (Staten Island, NY) – closed loop system 230 tons	
Field testing program Design – modeling using GLHEPRO Version 4.0	Construction administration and observation services
Bronx Zoo Lion House, NYC DDC (Bronx, NY) – standing column well 160 tons	
Investigation and troubleshooting analysis of malfunctioning well system	Recommendations to improve and recover performance and capacity
NYC DDC Geothermal Heat Pump Manual (NYC, NY)	
Update NYC Depart of Design and Construction Technical Manual on Geothermal Heat Pumps	

Kris E. Almskog, Vice President



PROFESSIONAL EXPERIENCE

PWGC 14 years

EDUCATION

- BS, Geology, Stony Brook University, NY

CERTIFICATIONS AND TRAINING

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

AREAS OF EXPERTISE

- Water Treatment System Construction Management/Oversight
- Remedial System (Construction, Installation, Start-up, Troubleshooting, O&M)
- Soil Excavations and Soil Logging
- Groundwater & Soil Investigations
- Health & Safety Oversight/Consulting
- Phase I, Phase II Investigations
- NYCDEP E Designation Zoning Compliance
- NYSDEC BCP Implementation

AFFILIATION

- Long Island Association of Professional Geologists (LIAPG)
- NYS Professional Geologists Association

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 geosciences 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 property buyers, sellers and developers to navigate the potential environmental concerns, petroleum spills, and the NYCDEP E designation zoning requirements during property transactions and site development. PWGC's role on these projects pertained to 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 Brownfields projects. Mr. Almskog's construction oversight background has allowed him to use his understanding of property development and environmental remediation to navigate unnecessary delays and costs. He coordinates with PWGC clients to prepare plans for approval by federal, state, and local agencies (i.e. Remedial Action Plans, Health and Safety Plans, Work Plans, Interim Remedial Measures) and monitors each project's day-to-day progress to meet the client's objectives and regulatory requirements on time and within budget.

NOTABLE PROJECTS

Brookhaven National Laboratory- Upton, NY

Mr. Almskog has worked for the Environmental Management Directorate (EM), and the Plant Engineering Construction Coordination Group/Modernization Project Office at BNL for 9 years. He provided support to the Groundwater, Surface, and Reactor Groups in various areas of construction management, system start-up and operation, investigation, characterization, remediation system operation, decontamination and decommissioning activities and technical reporting. Using his working knowledge of construction along with the EM Operational Procedure Manual (OPM), Standard Operating Procedures, BNL's Standards Based Management System and BNL's Work Control Procedures, he has completed tasks on time, within budget and without lost time to any of the personnel involved in these projects. 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, and reporting, surface soil excavation, decontamination and decommissioning of reactor structures, landfill inspections, disposal coordination of generated project waste, environmental procedural

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compliance, health & safety oversight, and oversight of subcontractors. He has worked closely with subcontractors and regulatory agencies to conduct field activities safely and efficiently.

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 of the monitoring and soil-gas well network. 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.

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 insuring 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 include 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 also provides administrative and invoice review to ensure that the project is documented properly to meet BNL's strict guidelines and that BNL receives a quality product.

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 also 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.

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 also responsible for construction observation and documentation for numerous monitoring well and remediation well installations. During the start-up phase of the system, he collected groundwater quality data for analysis to determine the effectiveness of the treatment system.

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 insuring 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.

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.

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 to ensure that the work was performed under a Radiological Work Permit and required strict health and safety, sampling, and QA/QC procedures.

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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.

BNL, BGRR Decontamination and Decommissioning Activities

Mr. Almskog provided management and field oversight for several 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 façade refurbishment and the replacement of a built-up-roof on the reactor structure. Because of the nature of the building as 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.

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 BCP program. As part of the remediation of the site, PWGC prepared a Interim Remedial Measure Work Plan to address significant chlorinated solvent contamination beneath the existing warehouse. As project manager, Mr. Almskog has been 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, Remedial Investigation Report, 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.

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, and cost and schedule estimates to conduct further investigation, remediation and administrative services to get the sites delisted by the various regulatory agencies involved.

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 meeting project environmental and safety requirements. The reports were then released to the PSC. Although reporting 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

Kris E. Almskog, Vice President

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.

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.

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 and provided engineering oversight during earth moving activities and during installation of engineering controls to mitigate vapor intrusion concerns at this NYSDEC spill site, for this eight story residential development project. Mr. Almskog provided project management services and coordinated remedial designs, and field efforts with NYCDEP and NYSDEC throughout construction. He also 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. Services included sub-surface investigation beneath existing buildings and 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.

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.

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.

John D. Eichler, Project Manager



PROFESSIONAL EXPERIENCE

PWGC: 8 years
PRIOR: 6 years

EDUCATION

- BS, Environmental Studies, University at Buffalo, NY

REGISTRATIONS/CERTIFICATES

- Lead-Based Paint Inspector (USEPA)
- 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 has included 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

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.

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.

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

Mr. Eichler manages BCP and ERP projects for both private (BCP) and municipal (ERP) 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 station sites 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.

John D. Eichler, Project Manager

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.

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.

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.

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.

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.

Phase I Environmental Site Assessments

Project Management – Mr. Eichler routinely performs Phase I ESA's for PWGC clients. Fluent in Phase I ASTM Standard E1527-00, 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.

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.

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.

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.

John D. Eichler, Project Manager

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.

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.

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.

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)
- 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)

491 WORTMAN AVENUE
BROOKLYN, NEW YORK

HEALTH AND SAFETY PLAN

SUBMITTED TO:

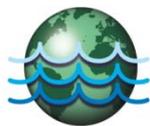


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Appendix D	Medical Data Sheet
Appendix E	General Health and Safety Work Practices
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Appendix G	Incident Report Form / Investigation Form
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1.0 STATEMENT OF COMMITMENT

This Health and Safety Plan (HASP) has been prepared to ensure that workers are not exposed to chemical, biological, and physical hazards during implementation of the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) at 491 Wortman Avenue, Brooklyn, New York. P.W. Grosser Consulting Engineer & Hydrogeologist, PC's (PWGC's) policy is to minimize the possibility of work-related exposure 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 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 persons present at the site actually or potentially exposed to safety or health hazards, describes emergency response procedures for actual and potential physical, biological, and chemical hazards. This HASP is also intended to inform and guide personnel entering the work area or exclusion zone. Persons are to acknowledge that they understand the potential hazards and the contents of this Health and Safety policy.

2.0 INTRODUCTION

2.1 Purpose

This HASP addresses the minimum health and safety practices that will be employed by site workers participating in implementation of NYSDEC BCP activities at the project site located at 491 Wortman Avenue, Brooklyn, New York.

The HASP takes into account the specific hazards inherent to the site and presents the minimum requirements which are to be met by PWGC, its subcontractors, and other on-site personnel in order to avoid and, if necessary, protect against health and/or safety hazards. PWGC sub-contractors will have the option of adopting this HASP or developing their own site-specific document. If a subcontractor chooses to prepare their own HASP, it must meet the minimum requirements as detailed in this HASP and must be made available to PWGC.

Activities performed under this HASP will comply with applicable parts of Occupational Safety and Health Administration (OSHA) Regulations, primarily 29 CFR Parts 1910 and 1926 and all other applicable federal, state, and local regulations. Modifications to the HASP may be made with the approval of the PWGC Health and Safety Manager (HSM) and/or Project Manager (PM). A copy of this HASP will be maintained on-site during all work activities.

Refusal to comply with the HASP or violation of any safety procedures by field personnel may result in their immediate removal from the site following consultation with the HSM and the Field Team Leader (FTL).

2.2 Scope

This HASP addresses the potential hazards related to implementation of NYSDEC BCP activities. The primary BCP activities may include the following:

- Site Mobilization/Demobilization;
- Drilling, and;
- Soil, Groundwater, and Soil-Vapor Sampling

The potential hazards associated with this scope are listed below and are discussed in more detail in this HASP after the project organization and responsibilities section.

- Chemical Hazards
- Biological Hazards
- Physical Hazards

2.3 Application

The HASP applies to all personnel involved in the above tasks who wish to gain access to active work areas, including but not limited to:

- PWGC employees and subcontractors;
- Client representatives; and
- Federal, state, or local representatives.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

This section specifies the project organization and responsibilities.

3.1 Project Manager

- Participates in major incident investigations;
- Ensures that the HASP has all of the required approvals before site work is conducted; and
- Has the overall project responsibility for project health and safety.

3.2 Field Team Leader (FTL)/ Site Health and Safety Officer (SHSO)

- Ensures that the HASP is implemented in conjunction with the Health and Safety Manager (HSM);
- Ensures that field work is scheduled with adequate equipment to complete the job safely;
- Enforces site health and safety rules;
- Ensures that proper personal protective equipment is utilized;
- Ensures that the HSM is informed of project changes that require modifications to the HASP;
- Ensures that the procedure modifications are implemented;
- Investigates incidents;
- Conducts the site safety briefing;
- Reports to HSM to provide summaries of field operations and progress; and
- Acts as Emergency Coordinator.

3.3 Health and Safety Manager

- Provides for the development of the HASP;
- Serves as the primary contact to review health and safety matters that may arise;
- Approves individuals who are assigned SHSO responsibilities;
- Coordinates revisions of this HASP with field personnel; and
- Assists in the investigation of major accidents.

3.4 Site Personnel

- Report any unsafe or potentially hazardous conditions to the FTL/SHSO;
- Maintain knowledge of the information, instructions and emergency response actions contained in this HASP; and
- Comply with rules, regulations and procedures as set forth in this HASP and any revisions.

4.0 SITE HISTORY AND PROJECT DESCRIPTION

4.1 Project Background

This Health and Safety Plan (HASP) has been prepared by PWGC, on behalf of J&H Holding Company, LLC. Previous investigations have identified volatile organic compounds (VOCs), specifically tetrachloroethene (PCE) and its degradation products, above guidance levels and/or standards in soil and groundwater at the site.

4.2 Site Description

The subject site is located at 491 Wortman Avenue in the City of Brooklyn, New York. The site is located within the Borough of Brooklyn (Kings County). The site is situated on the north side of Wortman Avenue, between Essex Street and Linwood Street. The property is identified as Block: 4384 Lots: 31 and 36 by the New York City Department of Assessment. The site is approximately 19,000 square feet (0.44 acre) and is currently improved with a one story industrial building composed of concrete, block, and brick.

4.3 Site History

J & H Holding Company, LLC has owned and operated the subject property since 1997. J & H Company, a NY General Partnership owned and operated the property from 1984 until 1997. These entities operated at the site under the names Sepco Industries and Watermark Designs between 1984 and 2007. The site was used to manufacture, store, package, and ship decorative fixtures and hardware for bathrooms and kitchens. The manufacturing processes at the subject property involved cleaning, painting, plating, etching, polishing, and specific machining of metals and metal products. Hazardous regulated chlorinated solvents, specifically trichloroethylene (TCE) and tetrachloroethylene (PCE), were used in the manufacturing process to clean various products. The chlorinated solvents were stored and used in the former Cleaning and Degreasing Area located along the west side of the building.

In 2007, Watermark Designs moved the operation from the subject property. Since 2007, the site has been leased by Crown Ministries International, Inc. for religious activities.

4.4 Site Features

The project site elevation is approximately 12 feet above mean sea level, and is generally level. The site is improved with a one-story industrial building which occupies the entire area of the subject site. The nearest surface water body is Spring Creek, located approximately 0.5-miles south-southwest of the site.

4.5 Current and Future Site Use

The site is currently leased by Crown Ministries International, Inc. for religious activities. There are no redevelopment plans for the property.

5.0 POTENTIAL HAZARDS OF THE SITE

This section presents an assessment of the chemical, biological, and physical hazards that may be encountered during the tasks specified under Section 1.0. Additional information can be found in **Appendix A** - Material Safety Data Sheets or in **Appendix B** - Activity Hazard Analyses.

5.1 Chemical Hazards

Review of historical information from the site indicates that the soil and groundwater at the site is contaminated with PCE, TCE, cis-1,2-dichloroethene (DCE), methyl-tert-butyl-ether (MTBE), 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, chloroform, benzo(a)pyrene, dibenzo(a,h)anthracene, calcium, chromium, copper, iron, manganese, mercury, sodium, and zinc. These compounds may present an occupational exposure hazard during site operations.

Specific information on the primary chemicals identified at the Site (PCE, TCE, and DCE) can be found in Table 5-1 and specific information on each chemical identified at the site can be found on the Material Safety Data Sheets found in **Appendix A**.

**Table 5-1
Chemical Hazards**

COMPOUND	CAS#	OSHA PEL	ROUTES OF EXPOSURE	SYMPTOMS OF EXPOSURE	TARGET ORGANS	PHYSICAL DATA
Tetrachloroethene	127-18-4	100 ppm	Inhalation Ingestion Skin Absorption Skin Contact	Irritates eyes, nose, throat; nausea; flushed face & neck; vertigo, dizziness, incoordination, headache, somnolence; skin erythema; potential human carcinogen.	Skin, eyes, respiratory system, kidneys, liver, CNS	Vapor pressure, 14 mm Hg Chloroform like odor, IP= 9.32 eV
Trichloroethene	79-01-6	100 ppm	Inhalation Ingestion Skin Contact	Irritates eyes, throat; redness, tearing, blurred vision, vertigo, dizziness, incoordination, irregular heart beat, potential human carcinogen.	Heart, liver, kidneys, CNS	Vapor pressure, 60 mm Hg Irritating odor at high concentrations
1,2-Dichloroethene	156-59-2	200 ppm	Inhalation Ingestion Skin Absorption Skin Contact	Irritates eyes, nose, and throat; nausea; drowsiness.	Skin, eyes, respiratory system	Colorless liquid, ether-like slightly acid odor

Abbreviations

C = Ceiling limit, not to be exceeded

CNS = Central Nervous System

PEL=Permissible Exposure Limit

TWA = Time-weighted average (8 hours)

OSHA = Occupational Safety and Health Administration

ppm = parts per million

VP = vapor pressure at approximately 68°F in mm Hg (mercury)

5.2 Biological Hazards

Work will be performed in an urban environment; however, during the course of the project there is potential for workers to come into contact with biological hazards such as animals, insects, and plants. The Activity Hazard Analyses found in **Appendix B** includes specific hazards and control measures for each task, if applicable.

5.2.1 Animals

The Site is located in a predominantly urban area. It is possible that dogs, cats, rats, and mice may be present. Workers shall use discretion and avoid all contact with animals.

5.2.2 Insects

Insects, such as mosquitoes, ticks, bees, and wasps may be present during certain times of the year. Workers will be encouraged to wear repellents and PPE, if deemed necessary, when working in areas where insects are expected to be present.

During the months of April through October, particular caution must be exercised to minimize exposure to deer ticks and the potential for contracting Lyme disease. Specific precautionary work practices that are recommended include the following:

- Cover your body as much as possible. Wear long pants and long sleeved shirts. Light color clothing makes spotting of ticks easier.
- Try to eliminate possible paths by which the Deer Tick may reach unprotected skin. For example, tuck bottoms of pants into socks or boots and sleeves into gloves. (Duct tape may be utilized to help seal cuffs and ankles). If heavy concentrations of ticks or insects are anticipated or encountered, Tyvek coveralls may be utilized for added protection when the potential for heat stress is not a concern.
- Conduct periodic and frequent, (e.g., hourly), surveys of your clothing for the presence of ticks. Remove any tick, save it and report to the clinic with the tick.
- Use insect / tick repellents that contain the chemical DEET (n,n-Diethyltoluamide). Apply repellents in accordance with manufacturers' recommendations. These repellents are readily available and include such brands as Deep Woods OFF and Maximum Strength OFF.

5.2.3 Plants

The site is currently improved with a one story industrial building that encompasses the entire footprint of the property. No exposure to plant life is expected.

5.3 Physical Hazards

Most safety hazards are discussed in the Activity Hazard Analyses (AHA) in **Appendix B** for the different phases of the project. In addition to the AHAs, general work rules and other safety procedures are described in Section 10 of this HASP.

5.3.1 *Temperature Extremes*

Heat Stress

Heat stress is a significant potential hazard, which is greatly exacerbated with the use of PPE in hot environments. The potential hazards of working in hot environments include dehydration, cramps, heat rash, heat exhaustion, and heat stroke.

Cold Stress

At certain times of the year, workers may be exposed to the hazards of working in cold environments. Potential hazards in cold environments include frostbite, trench foot or immersion foot, hypothermia as well as slippery surfaces, brittle equipment, and poor judgment.

PWGC's Heat/Cold Stress Protocols are specified in **Appendix C**.

5.3.2 *Steam, Heat and Splashing*

Exposure to steam/heat/splashing hazards can occur during steam cleaning activities. Splashing can also occur during well development and sampling activities. Exposure to steam/heat/splashing can result in scalding/burns, eye injury, and puncture wounds.

5.3.3 *Noise*

Noise is a potential hazard associated with the operation of heavy equipment, drill rigs, pumps and engines. Workers will wear hearing protection while in the work zone when these types of machinery are operating.

5.3.4 *Fire and Explosion*

When conducting excavation or drilling activities, the opportunity of encountering fire and explosion hazards may exist from encountering underground utilities, from the use of diesel engine equipment, and other potential ignition sources. During dry periods there is an increased chance of forest and brush fires starting at the job site. If these conditions occur no smoking will be permitted at the site and all operations involving potential ignition sources will be monitored continuously (fire watch).

5.3.5 *Manual Lifting/Material Handling*

Manual lifting of heavy objects may be required. Failure to follow proper lifting technique can result in back injuries and strains. Back injuries are a serious concern as they are the most common work place injury, often resulting in lost or restricted work time, and long treatment and recovery periods.

5.3.6 *Slips, Trips and Falls*

Working in and around the site will pose slip, trip and fall hazards due to slippery surfaces that may be oil covered, or from rough terrain, surfaces that are steep inclines, surfaced debris, or surfaces which are wet from rain or ice. Falls may result in twisted ankles, broken bones, head trauma or back injuries.

5.3.7 *Heavy Equipment Operation*

An excavator/backhoe will be used to excavate where required. Working with or near heavy equipment poses many potential hazards, including electrocution, fire/explosion, being struck by or against, or pinched/caught/crushed by, and can result in serious physical harm.

5.3.8 *Electrocution*

Encountering underground utilities may pose electrical hazards to workers. Additionally, overhead electrical lines can be a concern during drilling operations. Potential adverse effects of electrical hazards include burns and electrocution, which could result in death.

6.0 ACTIVITY HAZARD ANALYSES

The Activity Hazard Analysis (AHA) is a systematic way of identifying the potential health and safety hazards associated with major phases of work on the project and the methods to avoid, control, and mitigate those hazards. The AHAs will be used to train work crews in proper safety procedures during phase preparatory meetings.

AHAs have been developed by PWGC for the following phases of work:

1. Site Mobilization/Demobilization;
2. Excavation
3. Soil, Groundwater and Soil-Vapor sampling; and
4. Decontamination

Copies of these AHAs are included in **Appendix B** of this HASP.

7.0 PERSONAL PROTECTIVE EQUIPMENT

The personal protective equipment (PPE) specified in **Table 7-1** represents the hazard analysis and PPE selection required by 29 CFR 1910.132. Specific information on known potential hazards can be found under Section 4.0 and **Appendix B** - Activity Hazard Analyses. For the purposes of PPE selection, the HSM and FTL/SHSO are considered competent persons. The signatures on the approval page of the HASP constitute certification of the hazard assessment. For activities not covered by **Table 7-1**, the FTL/SHSO will conduct the hazard assessment, select the PPE, and document changes in the appropriate field logs. PPE selection will be made in consultation with the HSM.

Modifications for initial PPE selection may also be made by the FTL/SHSO in consultation with the HSM and changes documented accordingly. If major modifications occur, the HSM will notify the PM.

7.1 PPE Abbreviations

HEAD PROTECTION

HH = Hard Hat

HEARING PROTECTION

EP = ear plugs

EM = ear muffs

HAND PROTECTION

Cot = cotton

But = Butyl

LWG = Leather Work Gloves

Neo = Neoprene

Nit = Nitrile

Sur = Surgical

EYE/FACE PROTECTION

APR = Full Face Air Purifying
Respirator

MFS = Mesh Face shield

PFS = Plastic Face shield

SG = ANSI approved safety
glasses with side shields

BODY PROTECTION

WC = work clothes

Cot Cov = Cotton Coveralls

Poly = Polyethylene coated
Tyvek® coveralls

Saran = Saranex coated
coveralls

Tyvek® = Uncoated Tyvek®
coveralls

FOOT PROTECTION

Neo = Neoprene

OB = Overboot

Poly = polyethylene coated boot

Rub = rubber slush boots

STB = Leather work boots with steel
toe

RESPIRATORY PROTECTION

APR = Full-face air purifying respirator
with organic vapor cartridges

ASR = Full face air supplied respirator
with escape bottle

SCBA = Self-contained breathing
apparatus

7.2 Hazard Assessment for Selection of Personal Protective Equipment

The initial selection of personal protective equipment for each task was done by performing a hazard assessment taking into consideration the following:

- Potential chemical and physical present;
- Work operations to be performed;
- Potential routes of exposure;

- Concentrations of contaminants present; and
- Characteristics, capabilities and limitations of PPE and any hazard that the PPE presents or magnifies.

A review of the analytical data from previous sampling events indicates that VOCs identified in **Table 5-1** are the primary contaminants of concern.

The exposure routes for these chemicals are inhalation, skin absorption, skin/eye contact, and ingestion. Chemical protective gloves will be required for all activities that involve sample handling and the likelihood for skin contact. The proper use of PPE and strict adherence to decontamination and personal hygiene procedures will effectively minimize skin contact and ingestion as potential routes of exposure.

**Table 7-1
Personal Protective Equipment Selection**

TASK	HEAD	EYE/FACE	FEET	HANDS	BODY	HEARING	RESPIRATOR
Mobilization/ Demobilization	HH	SG	STB	WG	WC	None	None
Excavation, loading and backfilling	HH	SG	STB	WG	WC	EM or EP	None initially APR if action levels exceeded
Drilling Activities	HH	SG	STB	WG	WC	EM or EP	None initially APR if action levels exceeded
Soil/GW sampling	HH	SG	STB	WG, Nit & Sur as needed	WC, Tyvek® as needed	None	None initially APR if action levels exceeded
Decontamination	HH	SG	STB	Nit + Sur	WC, Tyvek® as needed	None	None initially APR if action levels exceeded

7.3 Respirator Cartridge Change-Out Schedule

A respirator cartridge change-out schedule has been developed in order to comply with 29 CFR 1910.134. If the use of respirators is necessary, the respirator cartridge change-out schedule for this project will be as follows:

1. Cartridges shall be removed and disposed of at the end of each shift, when cartridges become wet or wearer experiences breakthrough, whichever occurs first; and
2. If the humidity exceeds 85%, then cartridges shall be removed and disposed of after 4 hours of use.

Respirators shall not be stored at the end of the shift with contaminated cartridges left on. Cartridges shall not be worn on the second day, no matter how short of time period they were used the day before.

The schedule was developed based on the following scientific information and assumptions:

- Analytical data that is available regarding site contaminants;
- Using the Rule of Thumb provided by the AIHA;
- All of the chemicals have boiling points greater than 70°C;
- Total airborne concentration of contaminants is anticipated to be less than 200 ppm;
- The humidity is expected to be less than 85%; and
- Desorption of the contaminants (including those with poor warning properties) after partial use of the chemical cartridge can occur after a short period (hours) without use (eg, overnight) and result in a non-use exposure.

The following is a partial list of factors that may affect the usable cartridge service life and/or the degree of respiratory protection attainable under actual workplace conditions. These factors have been considered when developing the cartridge change-out schedule.

Type of contaminant(s);

- Contaminant concentration;
- Relative humidity;
- Breathing rate; Temperature; Changes in contaminant concentration, humidity, breathing rate and temperature;
- Mixtures of contaminants;
- Accuracy in the determination of the conditions;
- The contaminant concentration in the workplace can vary greatly. Consideration must be given to the quality of the estimate of the workplace concentration;
- Storage conditions between multiple uses of the same respirator cartridges. It is recommended that the chemical cartridges be replaced after each work shift. Contaminants adsorbed on a cartridge can migrate through the carbon bed without airflow;

- Age of the cartridge;
- Condition of the cartridge and respirator;
- Respirator and cartridge selection respirator fit;
- Respirator assembly, operation, and maintenance;
- User training, experience and medical fitness;
- Warning properties of the contaminant; and
- The quality of the warning properties should be considered when establishing the chemical cartridge change schedule. Good warning properties may provide a secondary or back-up indication for cartridge change-out.

8.0 AIR MONITORING

Air monitoring will be performed for protection for 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 work) from potential airborne contaminant releases resulting from remedial activities at the site in accordance with the project Community Air Monitoring Plan (CAMP). The site specific CAMP provides measures for protection for on-site workers and the downwind community from potential airborne contaminants as a direct result of the Supplemental Investigation. 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.

Real-time monitoring for dust and VOCs will be conducted both within the work area, and along the site perimeter, during intrusive activities such as excavation and drilling activities.

Detailed information on the types, frequency, and location of real-time monitoring and community air monitoring requirements are provided in the CAMP prepared for this project.

9.0 ZONES, PROTECTION AND COMMUNICATION

9.1 Site Control

Site zones are intended to control the potential spread of contamination throughout the site and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It shall include an Exclusion Zone (EZ), Contamination Reduction Zone (CRZ) and a Support Zone (SZ). Specific zones shall be established on the work site when operations begin.

This project is a hazardous waste remediation project, and any person working in an area where the potential for exposure to site contaminants exists, will only be allowed access after providing the FTL/SHSO with proper training and medical documentation.

The zones are based upon current knowledge of proposed site activities. It is possible that the zone configurations may be altered due to work plan revisions. Should this occur, the work zone will be adjusted accordingly, and documented through use of a field-change request form.

The following shall be used for guidance in revising these preliminary zone designations, if necessary.

Support Zone - The SZ is an uncontaminated area that will be the field support area for most operations. The SZ provides for field team communications and staging for emergency response. Appropriate safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples.

Contamination Reduction Zone - The CRZ is established between the EZ and the SZ. The CRZ contains the contamination reduction corridor and provides for an area for decontamination of personnel and portable hand-held equipment, tools and heavy equipment. A personnel decontamination area will be prepared at each exclusion zone. The CRZ will be used for EZ entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone - All activities, which may involve exposure to site contaminants, hazardous materials and/or conditions, should be considered an EZ. The FTL/SHSO may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the site HSO allowing adequate space for the activity to be completed, field members and emergency equipment.

9.2 Contamination Control

Decontamination areas will be established for the following activities.

- Drilling/Sampling Activities
- Excavation

9.2.1 Personnel Decontamination Station

All personnel and portable equipment used in the EZ shall be subject to a thorough decontamination process, as deemed necessary by the FTL/SHSO. Sampling equipment shall be decontaminated. As necessary, all boots and gloves will be decontaminated using soap and water solution and scrub brushes or simple removal and disposal. All used respiratory protective equipment will be decontaminated daily and sanitized with appropriate sanitizer solution.

All drums generated as a result of sampling and decontamination activities will be marked and stored at a designated area at the site until the materials can be property disposed of off-site.

All non-expendable sampling equipment will be decontaminated. This usually entails the use of Alconox, solvent and distilled/deionized water rinses to eliminate contaminants.

9.3 Communication

- Each team member will have a cell phone for communication with the PM, HSO, and other team members during field activities.
- Hand Signals - Hand signals shall be used by field teams, along with the buddy system. The entire field team shall know them before operations commence and their use covered during site-specific training. Typical hand signals are the following:

SIGNAL	MEANING
Hand gripping throat	Out of air, can't breathe
Grip on a partner's wrist or placement of both hands around a partner's waist.	Leave the area immediately, no debate.
Hands on top of head	Need assistance
Thumbs up	Okay, I'm all right, I understand.
Thumbs down	No, negative.

10.0 MEDICAL SURVEILLANCE PROCEDURES

All contractor and subcontractor personnel performing field work where potential exposure to contaminants exists at the site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120(f).

10.1 Medical Surveillance Requirements

A physician's medical release for work will be confirmed by the HSM before an employee can work in the exclusion zone. The examination will be taken annually at a minimum and upon termination of hazardous waste site work if the last examination was not taken within the previous six months. Additional medical testing may be required by the HSM in consultation with the Corporate Medical Consultant and the FTL/SHSO if an over-exposure or accident occurs, if an employee exhibits symptoms of exposure, or if other site conditions warrant further medical surveillance.

10.2 Medical Data Sheet

A medical data sheet is provided in **Appendix D**. This medical data sheet is voluntary and should be completed by all on-site personnel and will be maintained at the site. Where possible, this medical data sheet will accompany the personnel needing medical assistance. The medical data sheet will be maintained in a secure location, treated as confidential, and used only on a need-to-know basis.

11.0 SAFETY CONSIDERATIONS

11.1 General Health and Safety Work Practices

A list of general health and safety work practices is included as an included in **Appendix E**. The work rules will be posted in a conspicuous location at the site.

11.2 The Buddy System

At a minimum, employees shall work in groups of two in such a manner that they can observe each other and maintain line-of-sight for each employee within the work group. The purpose of the buddy system is to provide rapid assistance to employees in the event of an emergency.

11.3 Sample Handling

Personnel responsible for the handling of samples should wear the prescribed level of protection. Samples should be identified as to their hazard and packaged as to prevent spillage or breakage. Sample containers shall be decontaminated in the CRZ or EZ before entering a clean Support Zone area. Any unusual sample conditions, odors, or real-time readings should be noted. Laboratory personnel should be advised of sample hazard level and the potential contaminants present. This can be accomplished by a phone call to the lab coordinator and/or including a written statement with the samples reviewing lab safety procedures in handling, in order to assure that the practices are appropriate for the suspected contaminants in the sample.

11.4 Drill Rigs

When conducting drilling activities, the opportunity of encountering fire and explosion hazards exists from underground utilities and gases. The locations of underground utilities will be verified prior to performing any intrusive activities. Additionally, because of the inherently hazardous nature of drilling operations, safety and accident prevention are crucial when drilling operations are performed. Most drilling accidents occur as a direct result of lack of training and supervision, improper handling of equipment, and unsafe work practices. Hazards include: assembling and disassembling rigs, rotary and auger drilling, and grouting. The drilling contractor shall perform drilling in accordance with its own Health & Safety Program for Drill Rig Safety.

11.4.1 Safety During Drilling Operations

- Safety requires the attention and cooperation of every worker and site visitor.
- Do not drive the drill rig from hole to hole with the mast (derrick) in the raised position.
- Before raising the mast (derrick), look up to check for overhead obstructions.
- Maintain a minimum of 15 feet clearance from all overhead electric lines.
- Before raising the mast (derrick), all drill rig personnel (with the exception of the operator) and visitors shall be cleared from the areas immediately to the rear and the sides of the mast. All drill rig personnel and visitors shall be informed that the mast is being raised prior to raising it.
- Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing. Lower the mast (derrick) only when the leveling jacks are down and do not raise the leveling jack pads until the mast (derrick) is lowered completely.
- The operator of a drill rig shall only operate a drill rig from the position of the controls.

- Throwing or dropping tools shall not be permitted. All tools shall be carefully passed by hand between personnel or a hoist line shall be used.
- Do not consume alcoholic beverages or other depressants or chemical stimulants prior to starting work on a drill rig or while on the job.
- All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole.
- Terminate drilling operations during an electrical storm and move the entire crew away from the drill rig.

11.5 Excavation

Although extensive excavation is not anticipated for the scope of this project, excavations will be conducted in accordance with the requirements contained in 29 CFR 1926, Subpart P-Excavations. It provides for the designation of a "Competent Person" and general requirements for safe excavating practices. The program also incorporates company standards for the monitoring of potentially hazardous atmospheres; protection from water hazards; analyzing and maintaining the stability of adjacent structures; daily competent person inspections; soil classification; sloping and benching; protective systems; and training.

The Competent Person will be the FTL or other designee with appropriate training and experience. The Competent Person will be assisted in his/her duties by other technical personnel such as the HSM, geologists, structural engineers and soils engineers.

No entry into excavations will be allowed for this phase of the project.

12.0 DISPOSAL PROCEDURES

All discarded materials, waste materials or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard or causing litter to be left on site.

All potentially contaminated materials, e.g., clothing, gloves, etc., will be bagged or drummed as necessary, labeled and segregated for disposal. All non-contaminated materials will be collected and bagged for appropriate disposal as non-hazardous solid waste. Additional waste disposal procedures may be developed as applicable.

13.0 EMERGENCY RESPONSE PLAN

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require an immediate response; therefore, contingency planning and advanced training of staff is essential. Specific elements of emergency support procedures which are addressed in the following subsections include communications, local emergency support units, preparation for medical emergencies, first aid for injuries incurred on site, record keeping, and emergency site evacuation procedures.

13.1 Responsibilities

13.1.1 Health and Safety Manager (HSM)

The HSM oversees and approves the Emergency Response/Contingency Plan and performs audits to determine that the plan is in effect and that all pre-emergency requirements are met. The HSM acts as a liaison to applicable regulatory agencies and notifies OSHA of reportable accidents.

13.1.2 Field Team Leader/Site Health and Safety Officer (FTL/SHSO)

The FTL/SHSO is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The FTL/SHSO is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized) so that the HSM can ensure that OSHA is notified within the required time frame. The HSM will be notified of all OSHA recordable injuries, fires, spills, releases or equipment damage in excess of \$500 within 24 hours.

13.1.3 Emergency Coordinator

The Emergency Coordinator for the project is the FTL/SHSO.

The Emergency Coordinator shall make contact with Local Emergency Response personnel prior to beginning work on site. In these contacts the emergency coordinator will inform interested parties about the nature and duration of work expected on the site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants. The emergency coordinator will locate emergency phone numbers and identify hospital routes prior to beginning work on site. The emergency coordinator shall make necessary arrangements to be prepared for any emergencies that could occur.

The Emergency Coordinator will implement the Emergency Response/Contingency Plan whenever conditions at the site warrant such action.

13.1.4 Site Personnel

Site personnel are responsible for knowing the Emergency Response/Contingency Plan and the procedures contained herein. Personnel are expected to notify the Emergency Coordinator of situations that could constitute a site emergency.

13.2 Communication

A variety of communication systems may be utilized during emergency situations. These are discussed in the

following sections.

13.2.1 *Hand Signals*

Downrange field teams will employ hand signals where necessary for communication during emergency situations. Hand signals are found in Section 8.3.

13.2.2 *Field Radios and Cell Phones*

PWGC field personnel are provided cellular phones for site communication and emergency use.

13.3 Local Emergency Support Units

A route map from the site to the nearest hospital can be found in **Appendix F**. This map will be placed with the above emergency telephone numbers in all on-site vehicles.

13.4 Pre-Emergency Planning

PWGC will communicate directly with administrative personnel from the emergency room at the hospital to determine whether the hospital has the facilities and personnel needed to treat cases of trauma resulting from exposure to any of the contaminants expected to be found on the site. Instructions for finding the hospital will be posted conspicuously in the site office and in each site vehicle.

Before the field activities begin, the local emergency response personnel will be notified of the schedule for field activities and about the materials that are thought to exist on the site so that they will be able to respond quickly and effectively in the event of a fire, explosion, or other emergency. Before fieldwork on the site commences, each person who will be working there or observing the operations will complete a medical data sheet (**Appendix D**). These data sheets will be filled out during site-specific training and will be kept on the site.

In the event of an incident where a team member becomes exposed or suffers from an acute symptom of exposure to site materials and has to be taken to a hospital, a copy of his/her medical data sheet will be presented to the attending physician.

**Table 13-1
Emergency Telephone Numbers**

Contact	Firm or Agency	Telephone Number
Police		911
Fire		911
Hospital	Brookdale University Hospital	(718) 240-5000
Ambulance		911
Project Manager/Health and Safety Manager	Kris Almskog PWGC	(631) 589-6353
Health & Safety Officer	John Eichler PWGC	(631) 589-6353
NYSDEC Site Contact	Ian Beilby	(518) 402-9767
Poison Control Center		(800) 962-1253
Chemtrec		(800) 424-9300

13.5 Emergency Medical Treatment

The procedures and rules in this HASP are designed to prevent employee injury. However, should an injury occur, no matter how slight, it will be reported to the FTL/SHSO immediately. First aid equipment will be available on site at the following locations:

- First Aid Kit: Support Zone (or designated by FTL/SHSO upon arrival)
- Emergency Eye Wash: Support Zone (or designated by FTL/SHSO upon arrival)

During site-specific training, project personnel will be informed of the location of the first aid station(s) that has been set up. Unless they are in immediate danger, severely injured persons will not be moved until paramedics can attend to them. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. Any first aid instructions that can be obtained from doctors or paramedics, before an emergency-response squad arrives at the site or before the injured person can be transported to the hospital, will be followed closely.

There will be at least one person with current First Aid and CPR certification on each active work shift. When personnel are transported to the hospital, the FTL/SHSO will provide a copy of the Medical Data Sheet to the

paramedics and treating physician.

Only in non-emergency situations will an injured person be transported to the hospital by means other than an ambulance. **A map and directions to the hospital can be found in Appendix F.**

13.6 Emergency Site Evacuation Routes and Procedures

In order to mobilize the manpower resources and equipment necessary to cope with a fire or other emergency, a clear chain of authority will be established. The EC will take charge of all emergency response activities and dictate the procedures that will be followed for the duration of the emergency. The EC will report immediately to the scene of the emergency, assess the seriousness of the situation, and direct whatever efforts are necessary until the emergency response units arrive. At his/her discretion, the EC also may order the closure of the site for an indefinite period.

All project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs, including but not limited to fire, explosion or significant release of toxic gas into the atmosphere, an air horn will be sounded on the site. The horn will sound continuously for one blast, signaling that immediate evacuation of all personnel is necessary due to an immediate or impending danger. All heavy equipment will be shut down and all personnel will evacuate the work areas and assemble at the evacuation meeting point, which will be determined upon arrival at the site by the FTL/SHSO, prior to work beginning. This will then be conveyed to all crew members during the site-specific briefing.

The EC will give directions for implementing whatever actions are necessary. Any project team member may be assigned to be in charge of emergency communications during an emergency. He/she will attend the site telephone specified by the EC from the time the alarm sounds until the emergency has ended.

After sounding the alarm and initiating emergency response procedures, the EC will check and verify that access roads are not obstructed. If traffic control is necessary, as in the event of a fire or explosion, a project team member, who has been trained in these procedures and designated at the site safety meeting, will take over these duties until local police and fire fighters arrive.

The EC will remain at the site to provide any assistance requested by emergency-response squads as they arrive to deal with the situation. A map showing evacuation routes, meeting places and the location of emergency equipment will be posted in all trailers and used during site-specific training.

13.7 Fire Prevention and Protection

In the event of a fire or explosion, procedures will include immediately evacuating the site (air horn will sound for a single continuous blast), and notification of local fire and police departments. No personnel will fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

13.7.1 Fire Prevention

Adhering to the following precautions will prevent fires:

- Good housekeeping and storage of materials;
- Storage of flammable liquids and gases away from oxidizers;
- No smoking in the exclusion zone or any work area;
- No hot work without a properly executed hot work permit;
- Shutting off engines to refuel;
- Grounding and bonding metal containers during transfer of flammable liquids;
- Use of UL approved flammable storage cans;
- Fire extinguishers rated at least 10 pounds ABC located on all heavy equipment, in all trailers and near all hot work activities; and
- Monthly inspections of all fire extinguishers.

13.8 Overt Chemical Exposure

The following are standard procedures to treat chemical exposures. Other, specific procedures detailed on the Material Safety Data Sheet or recommended by the Corporate Medical Consultant will be followed, when necessary.

SKIN AND EYE CONTACT: Use copious amounts of soap and water. Wash/rinse affected areas thoroughly, and then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination. Skin should also be rinsed for 15 minutes if contact with caustics, acids or hydrogen peroxide occurs.

INHALATION: Move to fresh air. Decontaminate and transport to hospital or local medical provider.

INGESTION: Decontaminate and transport to emergency medical facility.

PUNCTURE WOUND OR LACERATION: Decontaminate and transport to emergency medical facility.

13.9 Decontamination during Medical Emergencies

If emergency life-saving first aid and/or medical treatment is required, normal decontamination procedures may need to be abbreviated or postponed. The FTL/SHSO or designee will accompany contaminated victims to the medical facility to advise on matters involving decontamination, when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed on-site, a plastic barrier placed between the injured individual and clean surfaces should be used to help prevent contamination of the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim if his/her injuries are life threatening, unless it is known that the individual has been contaminated with an extremely toxic or corrosive

material which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed.

13.10 Accident/Incident Reporting

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by telephone:

- Health and Safety Manager;
- Project Manager; and
- The employer of any injured worker who is not a PWGC employee.

Written confirmation of verbal reports are to be completed by the FTL/SHSO using the Incident Report Form and submitted within 24 hours. The incident report and investigation form is found in **Appendix G**. If the employee involved is not a PWGC employee, his employer will receive a copy of the report.

13.11 Adverse Weather Conditions

In the event of adverse weather conditions, the FTL/SHSO will determine if work can continue without potentially risking the safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries;
- Potential for cold stress and cold-related injuries;
- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds);
- Limited visibility (fog);
- Potential for electrical storms;
- Earthquakes; and
- Other major incidents.

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. The FTL/SHSO will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.

13.12 Spill Control and Response

All small hazardous spills/environmental releases shall be contained as close to the source as possible. Whenever possible, the MSDS will be consulted to assist in determining the best means of containment and cleanup. For small spills, sorbent materials such as sand, sawdust or commercial sorbents should be placed directly on the substance to contain the spill and aid recovery. Any acid spills should be diluted or neutralized carefully prior to attempting recovery. Berms of earthen or sorbent materials can be used to contain the leading edge of the spills. Drains or drainage areas should be blocked. All spill containment materials will be properly disposed. An exclusion zone of 50 to 100 feet around the spill area should be established depending on the size of the spill. The

following seven steps should be taken by the Emergency Coordinator:

- Determine the nature, identity and amounts of major spill components;
- Make sure all unnecessary persons are removed from the spill area;
- Notify appropriate response teams and authorities;
- Use proper PPE in consultation with the FTL/SHSO;
- If a flammable liquid, gas or vapor is involved, remove all ignition sources and use non-sparking and/or explosive proof equipment to contain or clean up the spill (diesel only vehicles, air operated pumps, etc.);
- If possible, try to stop the leak with appropriate material; and,
- Remove all surrounding materials that can react or compound with the spill.

13.13 Emergency Equipment

The following minimum emergency equipment shall be kept and maintained on-site:

- Industrial first aid kit;
- Burn kit and portable eye washes (one per field team);
- Fire extinguishers (one per work area); and
- Absorbent material /spill kit.

14.0 TRAINING

14.1 General Health and Safety Training

In accordance with PWGC corporate policy, and pursuant to 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations unless otherwise noted in the above reference. At a minimum, the training shall have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training shall not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical).

14.1.1 *Three Day Supervised On the Job Training*

In addition to the required initial hazardous waste operations training, each employee shall have received three days of directly supervised on-the-job training. This training will address the duties the employees are expected to perform.

14.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The training will cover a review of 1910.120 requirements and related company programs and procedures.

14.3 Site-Specific Training

Prior to commencement of field activities, all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the site operations. It will include site and facility layout, hazards and emergency services at the site, and will highlight all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity.

14.4 On-Site Safety Briefings

Project personnel and visitors will be given on-site health and safety briefings daily by the FTL/SHSO to assist site personnel in safely conducting their work activities. A copy of the Daily Briefing Sign-In Sheet is contained in **Appendix H**. The briefings will include information on new operations to be conducted, changes in work practices or changes in the site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. The meetings will also be an opportunity to periodically update the crews on monitoring results. Prior to starting any new activity, a training session using the Activity Hazard Analysis will be held for crew members involved in the activity.

14.5 First Aid and CPR

The HSM will identify those individuals requiring first aid and CPR training to ensure that emergency medical treatment is available during field activities. It is anticipated that a minimum of one field person on-site at any one time will have first aid and CPR training. The training will be consistent with the requirements of the American

Red Cross Association or American Heart Association. If none are available on-site, then the HSM shall be notified.

14.6 Supervisory Training

Supervisors and health and safety personnel shall have completed an additional eight hours of specialized training in accordance with 29 CFR 1910.120.

15.0 LOGS, REPORTS AND RECORDKEEPING

Changes to the HASP will be documented in the Health and Safety log book and as appropriate, the HSM and/or PM will be notified. Daily tailgate meetings will be documented in the H&S log book as well as personnel on-site.

15.1 Medical and Training Records

Copies or verification of training (40-hour, 8-hour, supervisor, site-specific training and documentation of three day OJT) and medical clearance for hazardous waste site work and respirator use will be maintained on-site. Records for all subcontractor employees will also be kept on-site.

15.2 Incident Report and Investigation Form

The incident report and investigation form is to be completed for all accidents and incidents, including near misses. The form can be found in **Appendix G**.

15.3 Health and Safety Logbooks

The FTL/SHSO will maintain a logbook during site work. The daily site conditions, personnel, monitoring results and significant events will be recorded. The original logbooks will become part of the exposure records file.

Appendix A

Material Safety Data Sheets

Safety data for 1,1-dichloroethylene



[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: 1,1-dce, NCI-C54262, vinylidene chloride, sconatex, asym-dichloroethylene, 1,1-dichloroethene, VDC, vinylidene dichloride

Molecular formula: $C_2H_2Cl_2$

CAS No: 75-35-4

EC No: 200-864-0

Annex I Index No: 602-025-00-8

Physical data

Appearance: colourless liquid

Melting point: -122 C

Boiling point: 31.7 C

Vapour density: 3.46 g/l

Vapour pressure: 500 mm Hg at 20 C

Density ($g\ cm^{-3}$): 1.218

Flash point: -10 C

Explosion limits: 6.5 - 15.5%

Autoignition temperature:

Water solubility: moderate

Stability

Stable. Very flammable - note low flash point. Vapour may travel considerable distances to a source of ignition. Incompatible with strong oxidizing agents, alcohols, halides, copper, aluminium. Rapidly absorbs oxygen from the air and forms explosive peroxides. Light and water promote self-polymerisation. May form explosive mixtures with air. Usually inhibited with a small amount (ca. 0.02%) of hydroquinone monomethyl ether.

Toxicology

Poison. Harmful if ingested, inhaled or absorbed through the skin. An experimental carcinogen, tumorigen, neoplastigen and teratogen. May cause systemic effects if inhaled. May cause reproductive damage. Note that a maximum exposure limit is defined for this material for use in the UK.

Toxicity data

(The meaning of any abbreviations which appear in this section is given [here.](#))

IHL-HMN TCLO 25 ppm

ORL-RAT LD50 200 mg kg⁻¹

ORL-MUS LD50 194 mg kg⁻¹

IVN-DOG LDLO 225 mg kg⁻¹

Risk phrases

(The meaning of any risk phrases which appear in this section is given [here.](#))

R12 R20 R40. (Note: Annex I does not quote risk phrase R19. However, this material is reported to form peroxides when stored in contact with the air and should be handled as though R19 applies.)

Transport information

(The meaning of any UN hazard codes which appear in this section is given [here.](#))

UN No 1303. Hazard class 3. Packing group I.

Personal protection

Safety glasses, gloves, good ventilation. Treat as a possible carcinogen. Remove all sources of ignition, including hot plates, from working area.

Safety phrases

(The meaning of any safety phrases which appear in this section is given [here.](#))

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

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1,1,1-TRICHLOROETHANE

0079

October 1994

CAS No: 71-55-6

RTECS No: KJ2975000

UN No: 2831

EC No: 602-013-00-2

Methyl chloroform

Methyltrichloromethane

alpha-Trichloroethane

C₂H₃Cl₃ / CCl₃CH₃

Molecular mass: 133.4

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible under specific conditions. Heating will cause rise in pressure with risk of bursting. See Notes. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION			In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT GENERATION OF MISTS!	
Inhalation	Headache. Dizziness. Drowsiness. Nausea. Ataxia. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness.	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	Diarrhoea. Nausea. Vomiting. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL

Ventilation. Collect leaking and spilled liquid in sealable, suitable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment. Personal protection: self-contained breathing apparatus.

PACKAGING & LABELLING

Xn Symbol
N Symbol
R: 20-59
S: (2-)24/25-59-61
Note: F
UN Hazard Class: 6.1
UN Pack Group: III

Do not transport with food and feedstuffs. Marine pollutant.

EMERGENCY RESPONSE

Transport Emergency Card: TEC (R)-61S2831
NFPA Code: H2; F1; R0

SAFE STORAGE

Provision to contain effluent from fire extinguishing. Separated from food and feedstuffs and incompatible materials. See Chemical Dangers. Cool. Dry. Ventilation along the floor.

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SEE IMPORTANT INFORMATION ON THE BACK.

IMPORTANT DATA

Physical State; Appearance

COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

Physical dangers

The vapour is heavier than air.

Chemical dangers

The substance decomposes on heating or on burning producing toxic and corrosive fumes including phosgene and hydrogen chloride. Reacts violently with aluminium, manganese and their alloys, alkalis, strong oxidants, acetone and zinc. Attacks natural rubber. Mixtures of 1,1,1-trichloroethane with potassium or its alloys are shock sensitive. Reacts slowly with water releasing corrosive hydrochloric acid.

Occupational exposure limits

TLV: 350 ppm as TWA, 450 ppm as STEL; A4 (not classifiable as a human carcinogen); BEI issued (ACGIH 2004). MAK: 200 ppm, 1100 mg/m³; Peak limitation category: II(1); skin absorption (H); Pregnancy risk group: C; (DFG 2004).

Routes of exposure

The substance can be absorbed into the body by inhalation of its vapour 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, the skin and the respiratory tract. The substance may cause effects on the heart, central nervous system and liver, resulting in cardiac disorders and respiratory failure. Exposure at high levels may result in death. Medical observation is indicated.

Effects of long-term or repeated exposure

The liquid defats the skin. The substance may have effects on the liver.

PHYSICAL PROPERTIES

Boiling point: 74/C

Melting point: -30/C

Relative density (water = 1): 1.34

Solubility in water: none

Vapour pressure, kPa at 20/C: 13.3

Relative vapour density (air = 1): 4.6

Flash point: see Notes

Auto-ignition temperature: 537/C

Explosive limits, vol% in air: 8-16

Octanol/water partition coefficient as log Pow: 2.49

ENVIRONMENTAL DATA

The substance is harmful to aquatic organisms. This substance may be hazardous to the environment; special attention should be given to air quality and ground water contamination.

NOTES

Combustible vapour/air mixtures difficult to ignite, may be developed under certain conditions.

The substance burns only in excess oxygen or if a strong source of ignition is present.

Use of alcoholic beverages enhances the harmful effect.

Depending on the degree of exposure, periodic medical examination is suggested.

An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert.

Do NOT use in the vicinity of a fire or a hot surface, or during welding.

Aerothene, Algylen, Trichloran, Chlorylen, Genklene, Chlorothene NU, Chlorothene VG, and Solvent 111 are trade names.

Card has been partly updated in April 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

LEGAL NOTICE

Neither the EC nor the IPCS nor any person acting on behalf of the EC or the IPCS is responsible

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

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 limitsTLV: (as Cr metal, Cr(III) compounds) 0.5 mg/m³ 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/CDensity: 7.15 g/cm³
Solubility in water: none

ENVIRONMENTAL DATA

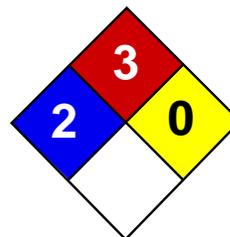
NOTES

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

ADDITIONAL INFORMATION

LEGAL NOTICE

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Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

1,2-Dichloroethane MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,2-Dichloroethane

Catalog Codes: SLD2521, SLD3721

CAS#: 107-06-2

RTECS: KH9800000

TSCA: TSCA 8(b) inventory: 1,2-Dichloroethane

CI#: Not available.

Synonym: Ethylene dichloride

Chemical Formula: C₂H₄CL₂

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{1,2-}Dichloroethane	107-06-2	100

Toxicological Data on Ingredients: 1,2-Dichloroethane: ORAL (LD50): Acute: 670 mg/kg [Rat]. 413 mg/kg [Mouse]. DERMAL (LD50): Acute: 2800 mg/kg [Rabbit]. VAPOR (LC50): Acute: 1414.2 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Extremely hazardous in case of ingestion. Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant). Corrosive to skin and eyes on contact. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:

Very hazardous in case of ingestion, of inhalation. **CARCINOGENIC EFFECTS:** Classified + (PROVEN) by OSHA. Classified 2B (Possible for human.) by IARC. Classified 2 (Reasonably anticipated.) by NTP. **MUTAGENIC EFFECTS:** Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not available. The substance is toxic to lungs, the nervous system, liver, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands : Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 413°C (775.4°F)

Flash Points: CLOSED CUP: 13°C (55.4°F). OPEN CUP: 18°C (64.4°F).

Flammable Limits: LOWER: 6.2% UPPER: 15.6%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances:

Flammable in presence of open flames and sparks. Slightly flammable to flammable in presence of oxidizing materials.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive to explosive in presence of oxidizing materials.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. **SMALL FIRE:** Use DRY chemical powder. **LARGE FIRE:** Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Flammable liquid. Corrosive liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage**Precautions:**

Keep locked up Keep container dry. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Never add water to this product In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 10 CEIL: 75 (ppm) from ACGIH (TLV) TWA: 40 CEIL: 300 (mg/m3) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 98.96 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 83.5°C (182.3°F)

Melting Point: -35.3°C (-31.5°F)

Critical Temperature: Not available.

Specific Gravity: 1.2351 (Water = 1)

Vapor Pressure: 61 mm of Hg (@ 20°C)

Vapor Density: 3.42 (Air = 1)

Volatility: Not available.

Odor Threshold: 26 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; $\log(\text{oil/water}) = 0$

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, n-octanol, acetone.

Solubility:

Easily soluble in methanol, diethyl ether, n-octanol, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 413 mg/kg [Mouse]. Acute dermal toxicity (LD50): 2800 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1414.2 ppm 4 hour(s) [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified 2B (Possible for human.) by IARC. Classified 2 (Reasonably anticipated.) by NTP. The substance is toxic to lungs, the nervous system, liver, mucous membranes.

Other Toxic Effects on Humans:

Extremely hazardous in case of ingestion. Very hazardous in case of inhalation. Hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in animal. Excreted in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Ethylene dichloride : UN1184 PG: II

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information**Federal and State Regulations:**

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: 1,2-Dichloroethane California prop.

65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: 1,2-Dichloroethane Pennsylvania RTK: 1,2-Dichloroethane Massachusetts RTK: 1,2-Dichloroethane TSCA 8(b) inventory: 1,2-Dichloroethane CERCLA: Hazardous substances.: 1,2-Dichloroethane

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:**WHMIS (Canada):**

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):

R11- Highly flammable. R20/22- Harmful by inhalation and if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:17 PM

Last Updated: 06/09/2012 12:00 PM

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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

C₂₂H₁₄

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

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.

PACKAGING & LABELLING

T Symbol
N Symbol
R: 45-50/53
S: 53-45-60-61

EMERGENCY RESPONSE**SAFE STORAGE**

Well closed.

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SEE IMPORTANT INFORMATION ON THE BACK.

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**LEGAL NOTICE**

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BENZO(a)PYRENE		ICSC: 0104	
Date of Peer Review: October 2005			
Benz(a)pyrene 3,4-Benzopyrene Benzo(d,e,f)chrysene			
CAS #	50-32-8	C₂₀H₁₂	 
RTECS #	DJ3675000	Molecular mass: 252.3	
UN #			
EC Annex 1 Index #	601-032-00-3		
EC/EINECS #	200-028-5		
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!	
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. Sweep spilled substance into sealable 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		STORAGE	

Separated from strong oxidants. Store in an area without drain or sewer access.

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SEE IMPORTANT INFORMATION ON BACK

BENZO(a)PYRENE		ICSC: 0104
IMPORTANT DATA		
<p>PHYSICAL STATE; APPEARANCE: PALE-YELLOW CRYSTALS</p> <p>CHEMICAL DANGERS: Reacts with strong oxidants causing fire and explosion hazard.</p> <p>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: skin absorption (H); Carcinogen category: 2; Germ cell mutagen group: 2 (DFG 2007).</p>	<p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion.</p> <p>INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.</p> <p>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.</p>	
PHYSICAL PROPERTIES		
<p>Boiling point: 496°C Melting point: 178.1°C Density: 1.4 g/cm³ Solubility in water: none (<0.1 g/100 ml) Vapour pressure : negligible</p>	<p>Octanol/water partition coefficient as log Pow: 6.04</p>	
ENVIRONMENTAL DATA		
<p>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.</p>		
NOTES		
<p>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. Card has been partially updated in April 2010: see Occupational Exposure Limits, Storage.</p>		
ADDITIONAL INFORMATION		
LEGAL NOTICE	<p>Neither the CEC nor the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information</p>	
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See Also:

[Toxicological Abbreviations](#)

[Benzo\(a\)Pyrene \(IARC Summary & Evaluation, Volume 3, 1973\)](#)



CALCIUM		ICSC: 1192	
Date of Peer Review: October 1994 Elemental Calcium			
CAS #	7440-70-2	Ca H19 Atomic mass	
RTECS #	EV8040000	Atomic mass: Atomic mass: 40.1	
UN #	1401; 1855 (calcium pyrophoric)		
EC Annex 1 Index #	020-001-00-X		
EC/EINECS #	231-179-5		
TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Not combustible but forms flammable gas on contact with water or damp air. Highly flammable when finely divided. Forms flammable gas on contact with water or damp air. Many reactions may cause fire or explosion.	NO open flames, NO sparks, and NO smoking. NO contact with water and incompatible substances (see Chemical Dangers).	Special powder, dry sand, NO other agents. NO water.
EXPLOSION	Risk of fire and explosion on contact with water and incompatible substances (see Chemical Dangers).		In case of fire: cool drums, etc., by spraying with water but avoid contact of the substance with water.
EXPOSURE		PREVENT DISPERSION OF DUST!	
Inhalation		Avoid inhalation of fine dust and mist.	Fresh air, rest. Refer for medical attention.
Skin		Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower. 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		Do not eat, drink, or smoke during work.	Refer for medical attention.
SPILLAGE DISPOSAL		PACKAGING & LABELLING	
Remove all ignition sources. Sweep spilled substance into containers. Do NOT wash away into sewer. Carefully collect remainder, then remove to safe place. Do NOT absorb in saw-dust or other combustible absorbents. (Extra personal protection: complete protective clothing including self-contained breathing apparatus).		Airtight. Unbreakable packaging; put breakable packaging into closed unbreakable container. EU Classification Symbol: <u>E</u> R: <u>15</u> S: <u>(2)-8-24/25-43</u> UN Classification UN Hazard Class: 4.3; 4.2 (calcium pyrophoric) UN Pack Group: II; I (calcium pyrophoric)	

EMERGENCY RESPONSE	STORAGE
Transport Emergency Card: TEC (R)-43G12; 42G13 (pyrophoric) NFPA Code: H1; F1; R2; W	Fireproof. Separated from incompatible substances (see Chemical Dangers). Dry. Keep under inert gas. Keep under petroleum oil.
<p data-bbox="165 338 245 367">IPCS</p> <p data-bbox="165 374 301 398">International</p> <p data-bbox="165 434 296 539">Programme on Chemical Safety</p>  <p data-bbox="876 358 1402 465">Prepared in the context of cooperation between the International Programme on Chemical Safety and the Commission of the European Communities © IPCS, CEC 2005</p> <p data-bbox="876 492 1374 517">SEE IMPORTANT INFORMATION ON BACK</p>	

CALCIUM		ICSC: 1192
IMPORTANT DATA		
<p>PHYSICAL STATE; APPEARANCE: LUSTROUS SILVER WHITE METAL (WHEN FRESHLY CUT); TURNS BLuish GREY ON EXPOSURE TO MOIST AIR.</p> <p>PHYSICAL DANGERS: Ignites in air when finely divided.</p> <p>CHEMICAL DANGERS: Reacts with water, alcohol diluted acids with evolution of highly flammable hydrogen gas. Reacts with halogens. Burns in air. Contact with alkali hydroxides or carbonates may cause detonation.</p> <p>OCCUPATIONAL EXPOSURE LIMITS: TLV not established.</p>	<p>EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes.</p>	
PHYSICAL PROPERTIES		
<p>Boiling point: 1440°C Melting point: 850°C Relative density (water = 1): 1.54 Solubility in water: reaction</p>		
ENVIRONMENTAL DATA		
NOTES		
<p>Reacts violently with fire extinguishing agents such as water, foam, halons and carbon dioxide. Do NOT take working clothes home.</p>		
ADDITIONAL INFORMATION		
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See Also:

[Toxicological Abbreviations](#)



CHLOROFORM	ICSC: 0027 Peer-Review Status: 04.11.2000 Validated
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Trichloromethane
Methane trichloride
Formyl trichloride

CAS #: 67-66-3 RTECS #: FS9100000 UN #: 1888 EC #: 602-006-00-4 EINECS #: 200-663-8	Formula: CHCl ₃ Molecular mass: 119.4
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TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Not combustible. See Notes. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings, use appropriate extinguishing media.
EXPLOSION			In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		STRICT HYGIENE! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	
Inhalation	Cough. Dizziness. Drowsiness. Headache. Nausea. Unconsciousness.	Use ventilation, local exhaust or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
Skin	Redness. Pain. Dry skin.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention .
Eyes	Redness. Pain.	Wear 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 refer for medical attention.
Ingestion	Abdominal pain. Vomiting. Further see Inhalation.	Do not eat, drink, or smoke during work.	Rinse mouth. Give one or two glasses of water to drink. Rest. Refer for medical attention .

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Personal protection: complete protective clothing including self-contained breathing apparatus. Do NOT let this chemical enter the environment. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent. Then store and dispose of according to local regulations.	Unbreakable packaging. Put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. EC Classification Symbol: Xn; R: 22-38-40-48/20/22; S: (2)-36/37 UN Classification UN Hazard Class: 6.1; UN Pack Group: III GHS Classification

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-61S1888. NFPA Code: H2; F0; R0.	Separated from food and feedstuffs and incompatible materials. See Chemical Dangers. Ventilation along the floor.

IMPORTANT DATA	
Physical State; Appearance VOLATILE COLOURLESS LIQUID WITH CHARACTERISTIC ODOUR. Physical dangers The vapour is heavier than air. Chemical dangers Decomposes on contact with hot surfaces or flames. This produces toxic and corrosive fumes of of hydrogen chloride (see ICSC 0163), phosgene (see ICSC	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 very quickly on evaporation of this substance at 20Å°C. Effects of short-term exposure

0007) and chlorine (see ICSC 0126). Reacts violently with strong bases, strong oxidants and some metals such as aluminium, magnesium and zinc. This generates fire and explosion hazard. Attacks plastics, rubber and coatings.

Occupational exposure limits

TLV: 10ppm as TWA; A3 (confirmed animal carcinogen with unknown relevance to humans); (ACGIH 2004).

MAK: 0.5 ppm, 2.5 mg/m³; Carcinogen category: 4; Peak limitation category: II (2); Pregnancy risk group: C; Skin absorption (H); (DFG 2004).

kidneys. This substance is possibly carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 62°C
 Melting point: -64°C
 Solubility in water, g/100ml at 20°C: 0.8
 Vapour pressure, kPa at 20°C: 212
 Relative vapour density (air = 1): 4.12
 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.7
 Octanol/water partition coefficient as log Pow: 1.97

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms.

NOTES

Turns combustible on addition of small amounts of a flammable substance or an increase in the oxygen content of the air.
 Use of alcoholic beverages enhances the harmful effect.
 Depending on the degree of exposure, periodic medical examination is indicated.
 The odour warning when the exposure limit value is exceeded is insufficient.
 Do NOT use in the vicinity of a fire or a hot surface, or during welding.
 Card has been partly updated in April 2005.
 See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

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See Also:

[Toxicological Abbreviations](#)
[Chloroform \(EHC 163, 1994\)](#)
[Chloroform \(HSG 87, 1994\)](#)
[Chloroform \(WHO Food Additives Series 14\)](#)
[CHLOROFORM \(JECFA Evaluation\)](#)
[Chloroform \(PIM 121\)](#)
[Chloroform \(CICADS 58, 2004\)](#)
[Chloroform \(IARC Summary & Evaluation, Supplement 7, 1987\)](#)
[Chloroform \(IARC Summary & Evaluation, Volume 1, 1972\)](#)
[Chloroform \(IARC Summary & Evaluation, Volume 20, 1979\)](#)
[Chloroform \(IARC Summary & Evaluation, Volume 73, 1999\)](#)



CHROMIUM (powder)	ICSC: 0029 Peer-Review Status: 27.10.2004 Validated
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Chrome

CAS #: 7440-47-3 RTECS #: GB4200000	Formula: Cr	
EINECS #: 231-157-5	Atomic mass: 52.0	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Combustible under specific conditions.	If powder: NO open flames	In case of fire in the surroundings, use appropriate extinguishing media.
EXPLOSION		Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent deposition of dust.	

EXPOSURE		PREVENT DISPERSION OF DUST!	
Inhalation	Cough.	Use local exhaust or breathing protection.	Fresh air, rest.
Skin		Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
Eyes	Redness.	Wear safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then refer for medical attention.
Ingestion		Do not eat, drink, or smoke during work.	Rinse mouth.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Personal protection: particulate filter respirator adapted to the airborne concentration of the substance. Sweep spilled substance into covered containers. If appropriate, moisten first to prevent dusting.	EC Classification UN Classification GHS Classification

EMERGENCY RESPONSE	SAFE STORAGE

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): 0.5mg/m ³ as TWA; A4 (not classifiable as a human carcinogen); (ACGIH 2004).	Routes of exposure 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 to the eyes and respiratory tract. Effects of long-term or repeated exposure

PHYSICAL PROPERTIES	ENVIRONMENTAL DATA
Boiling point: 2642Â°C	



VINYLDENE CHLORIDE	ICSC: 0083 <small>Peer-Review Status: 13.04.2000 Validated</small>
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1,1-Dichloroethene
1,1-Dichloroethylene
VDC

CAS #: 75-35-4 RTECS #: KV9275000 UN #: 1303 (stabilized) EC #: 602-025-00-8 EINECS #: 200-864-0	Formula: $C_2H_2Cl_2 / H_2C=CCl_2$ Molecular mass: 97
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TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Extremely flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks and NO smoking.	Use water spray, powder, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Use non-sparking handtools.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT GENERATION OF MISTS!	
Inhalation	Dizziness. Drowsiness. Unconsciousness.	Use ventilation, local exhaust or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
Skin	Redness. Pain.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Wear 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 refer for medical attention.
Ingestion	Abdominal pain. Sore throat. Further see Inhalation.	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Give one or two glasses of water to drink. Rest.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Personal protection: complete protective clothing including self-contained breathing apparatus. Remove all ignition sources. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent. Then store and dispose of according to local regulations.	Airtight. Unbreakable packaging. Put breakable packaging into closed unbreakable container. Marine pollutant. EC Classification Symbol: F+, Xn; R: 12-20-40; S: (2)-7-16-29-36/37-46; Note: D UN Classification UN Hazard Class: 3; UN Pack Group: I GHS Classification

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-30S1303. NFPA Code: H2; F4; R2.	Fireproof. Provision to contain effluent from fire extinguishing. Separated from incompatible materials. See Chemical Dangers. Cool. Keep in the dark. Store only if stabilized.

IMPORTANT DATA	
Physical State; Appearance VOLATILE COLOURLESS LIQUID WITH CHARACTERISTIC ODOUR.	Routes of exposure The substance can be absorbed into the body by inhalation and by ingestion.
Physical dangers The vapour is heavier than air and may travel along the ground; distant ignition possible. Vapours are uninhibited and may polymerize, causing blockage of vents.	Inhalation risk A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20Å°C.
	Effects of short-term exposure

possible. Vapours are uninhibited and may polymerize, causing blockage of vents.

Chemical dangers

The substance can readily form explosive peroxides. The substance readily polymerizes due to heating or under the influence of oxygen, sunlight, copper or aluminium. This generates fire or explosion hazard. May explode on heating or on contact with flames. Decomposes on burning. This produces toxic and corrosive fumes of hydrogen chloride and phosgene. Reacts violently with oxidants.

Occupational exposure limits

TLV: 5ppm as TWA; A4 (not classifiable as a human carcinogen); (ACGIH 2004).

MAK: 2 ppm, 8.0 mg/m³; Carcinogen category: 3B; Peak limitation category: II (2); Pregnancy risk group: C; (DFG 2004).

may have effects on the kidneys and liver.

PHYSICAL PROPERTIES

Boiling point: 32Å°C
 Melting point: -122Å°C
 Relative density (water = 1): 1.2
 Solubility in water, g/100ml at 25Å°C: 0.25
 Vapour pressure, kPa at 20Å°C: 66.5
 Relative vapour density (air = 1): 3.3
 Relative density of the vapour/air-mixture at 20Å°C (air = 1): 2.5
 Flash point: -25Å°C c.c.
 Auto-ignition temperature: 570Å°C
 Explosive limits, vol% in air: 5.6-16
 Octanol/water partition coefficient as log Pow: 1.32

ENVIRONMENTAL DATA

The substance is harmful to aquatic organisms.

NOTES

Depending on the degree of exposure, periodic medical examination is suggested.
 An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert.
 The odour warning when the exposure limit value is exceeded is insufficient.
 Do NOT use in the vicinity of a fire or a hot surface, or during welding.
 Card has been partly updated October 2004 and in April 2005.
 See section Occupational Exposure Limits.

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See Also:

- [Toxicological Abbreviations](#)
- [Vinylidene chloride \(EHC 100, 1990\)](#)
- [Vinylidene chloride \(HSG 36, 1989\)](#)
- [Vinylidene Chloride \(IARC Summary & Evaluation, Volume 71, 1999\)](#)



MANGANESE (powder)		ICSC: 0174 Peer-Review Status: 27.11.2003 Validated
CAS #: 7439-96-5 RTECS #: OO9275000	Formula: Mn	
EINECS #: 231-105-1	Atomic mass: 54.9	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Use dry sand, special powder.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent deposition of dust.	
EXPOSURE		PREVENT DISPERSION OF DUST! AVOID EXPOSURE OF (PREGNANT) WOMEN!	
Inhalation	Cough.	Use local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin		Protective gloves.	Rinse and then wash skin with water and soap.
Eyes		Wear safety goggles or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then refer for medical attention.
Ingestion	Abdominal pain. Nausea.	Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention .

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Personal protection: P2 filter respirator for harmful particles. Sweep spilled substance into covered containers. Carefully collect remainder. Then store and dispose of according to local regulations.	EC Classification UN Classification GHS Classification

EMERGENCY RESPONSE	SAFE STORAGE
	Separated from acids. Dry.

IMPORTANT DATA	
<p>Physical State; Appearance GREY-WHITE POWDER.</p> <p>Physical dangers Dust explosion possible if in powder or granular form, mixed with air.</p> <p>Chemical dangers Reacts slowly with water. Reacts more rapidly with steam and acids. This produces flammable/explosive gas (hydrogen - see ICSC 0001). This generates fire and explosion hazard.</p> <p>Occupational exposure limits TLV: 0.2mg/m³ as TWA; (ACGIH 2003). MAK (inhalable fraction): 0.5 mg/m³; Pregnancy risk group: C; (DFG 2007).</p>	<p>Routes of exposure The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.</p> <p>Inhalation risk Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.</p> <p>Effects of short-term exposure The aerosol is irritating to the respiratory tract.</p> <p>Effects of long-term or repeated exposure The substance may have effects on the lungs and central nervous system. This may result in increased susceptibility to bronchitis, pneumonitis and neurologic and neuropsychiatric disorders (manganism). Animal tests show that this substance possibly causes toxicity to human reproduction or development.</p>

PHYSICAL PROPERTIES	ENVIRONMENTAL DATA
Boiling point: 1962Å°C Melting point: 1244Å°C Density: 7.47 g/cmÅ³ Solubility in water: none	This substance may be hazardous to the environment. Special attention should be given to aquatic organisms.

NOTES
Depending on the degree of exposure, periodic medical examination is suggested. The recommendations on this Card also apply to ferro manganese.

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See Also:

[Toxicological Abbreviations](#)
[Manganese \(EHC 17, 1981\)](#)



COPPER (powder)	ICSC: 0240 Peer-Review Status: 24.09.1993 Validated
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CAS #: 7440-50-8 RTECS #: GL5325000 EINECS #: 231-159-6	Formula: Cu Atomic mass: 63.5
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TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Use special powder, dry sand. NO other agents.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST!	
Inhalation	Cough. Headache. Shortness of breath. Sore throat.	Use local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Wear safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then refer for medical attention.
Ingestion	Abdominal pain. Nausea. Vomiting.	Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention .

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Personal protection: particulate filter respirator adapted to the airborne concentration of the substance. Sweep spilled substance into covered containers. Carefully collect remainder. Then store and dispose of according to local regulations.	EC Classification UN Classification GHS Classification

EMERGENCY RESPONSE	SAFE STORAGE
	See Chemical Dangers.

IMPORTANT DATA	
Physical State; Appearance RED POWDER. TURNS GREEN ON EXPOSURE TO MOIST AIR. Physical dangers No data. Chemical dangers Mixtures with acetylenic compounds, ethylene oxide and azides are shock-sensitive. Reacts with strong oxidants such as chlorates, bromates and iodates. This generates explosion hazard. Occupational exposure limits MAK (inhalable fraction): 0.1 mg/m ³ ; Peak limitation category: II(2); Pregnancy risk group: C; (DFG 2007).	Routes of exposure The substance can be absorbed into the body by inhalation 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 Inhalation of fume may cause metal fume fever. See Notes. Effects of long-term or repeated exposure Repeated or prolonged contact may cause skin sensitization.

PHYSICAL PROPERTIES	ENVIRONMENTAL DATA
Boiling point: 2505 Å°C	



DIBENZO(a,h)ANTHRACENE	ICSC: 0431 <small>Peer-Review Status: 23.10.1995 Validated</small>
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1,2:5,6-Dibenzanthracene	
CAS #: 53-70-3 RTECS #: HN2625000 EC #: 601-041-00-2 EINECS #: 200-181-8	Formula: 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.	Use water spray, powder.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT!	
Inhalation		Use 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.	Wear 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 refer for medical attention.
Ingestion		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Personal protection: particulate filter respirator adapted to the airborne concentration of the substance. Sweep spilled substance into covered sealable containers. If appropriate, moisten first to prevent dusting. Carefully collect remainder. Then store and dispose of according to local regulations.	EC Classification Symbol: T, N; R: 45-50/53; S: 53-45-60-61 UN Classification GHS Classification

EMERGENCY RESPONSE	SAFE STORAGE
	Well closed.

IMPORTANT DATA	
Physical State; Appearance COLOURLESS CRYSTALLINE POWDER. Physical dangers Chemical dangers Occupational exposure limits TLV (NOT-ESTABLISHED):. MAK: Carcinogen category: 2; Germ cell mutagen group: 3A; Skin absorption (H); (DFG 2007).	Routes of exposure The substance can be absorbed into the body by inhalation, through the skin and by ingestion. Inhalation risk Evaporation at 20Â°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. Effects of short-term exposure Effects of long-term or repeated exposure The substance may have effects on the skin. This may result in photosensitization. This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES	ENVIRONMENTAL DATA
Boiling point: 524 Â°C	Bioaccumulation of this chemical may occur in seafood



SODIUM	ICSC: 0717 <small>Peer-Review Status: 06.04.2006 Validated</small>
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Natrium
CAS #: 7440-23-5 RTECS #: VY0686000 Formula: Na UN #: 1428 Atomic mass: 23.0 EC #: 011-001-00-0 EINECS #: 231-132-9

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Highly flammable. Many reactions may cause fire or explosion. Gives off irritating or toxic fumes (or gases) in a fire.	NO contact with water, acids or halogens. NO open flames, NO sparks and NO smoking.	Use special powder, dry sand. NO other agents.
EXPLOSION	Risk of fire and explosion on contact with acids, halogens or water.		Combat fire from a sheltered position.
EXPOSURE			
Inhalation	Cough. Sore throat. Burning sensation.	Use closed system or ventilation.	Fresh air, rest. Half-upright position. Artificial respiration may be needed. Refer for medical attention.
Skin	Pain. Blisters. Serious skin burns.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention .
Eyes	Severe deep burns. Loss of vision.	Wear face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then refer for medical attention.
Ingestion	Burning sensation. Shock or collapse.	Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention .

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Personal protection: chemical protection suit including self-contained breathing apparatus. Cover the spilled material with dry powder.	Airtight. Unbreakable packaging. Put breakable packaging into closed unbreakable container. EC Classification Symbol: F, C; R: 14/15-34; S: (1/2)-5-8-43-45 UN Classification UN Hazard Class: 4.3; UN Pack Group: I GHS Classification Signal: Danger In contact with water releases flammable gases which may ignite spontaneously Causes severe skin burns and eye damage <div style="text-align: center;">  </div>

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-43S1428A. NFPA Code: H3; F3; R2.	Fireproof. Keep under mineral oil. Dry. Well closed.

IMPORTANT DATA	
Physical State; Appearance SILVERY SOLID IN VARIOUS FORMS. <small>Physical dangers</small>	Routes of exposure Serious by all routes of exposure.

Physical dangers**Chemical dangers**

Reacts violently with water. This generates fire and explosion hazard.
Decomposes rapidly under the influence of air and moisture. This produces flammable/explosive gas (hydrogen - see ICSC 0001).

Occupational exposure limits

TLV (NOT-ESTABLISHED):.

PHYSICAL PROPERTIES

Boiling point: 880Å°C
Melting point: 97.4Å°C
Density: 0.97 g/cmÅ³
Solubility in water: reaction
Vapour pressure at 20Å°C: negligible
Auto-ignition temperature: 120-125Å°C

ENVIRONMENTAL DATA**NOTES**

Sodium is always kept under mineral oil.
Reacts violently with fire extinguishing agents such as water and carbon dioxide.

ADDITIONAL INFORMATION

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See Also:

[Toxicological Abbreviations](#)



METHYL TERT-BUTYL ETHER		ICSC: 1164 Peer-Review Status: 04.11.2000 Validated
tert-Butyl methyl ether MTBE Methyl-1,1-dimethylethyl ether 2-Methoxy-2-methyl propane		
CAS #: 1634-04-4 RTECS #: KN5250000 UN #: 2398 EC #: 603-181-00-X EINECS #: 216-653-1	Formula: $(CH_3)_3COCH_3 / C_5H_{12}O$ Molecular mass: 88.2	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks and NO smoking. NO contact with oxidizing agents.	Use 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			
Inhalation	Drowsiness. Dizziness. Headache. Weakness. Unconsciousness.	Use ventilation, local exhaust or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness.	Wear safety goggles or face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then refer for medical attention.
Ingestion	Abdominal pain. Nausea. Vomiting. Further see Inhalation.	Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Do NOT induce vomiting. Refer for medical attention .

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Personal protection: filter respirator for organic gases and vapours adapted to the airborne concentration of the substance. Remove all ignition sources. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent. Then store and dispose of according to local regulations. Do NOT wash away into sewer.	EC Classification Symbol: F, Xi; R: 11-38; S: (2)-9-16-24 UN Classification UN Hazard Class: 3; UN Pack Group: II GHS Classification

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-30GF1-I+II.	Fireproof. Separated from strong oxidants and strong acids.

IMPORTANT DATA	
Physical State; Appearance COLOURLESS LIQUID WITH CHARACTERISTIC ODOUR.	Routes of exposure The substance can be absorbed into the body by inhalation and by ingestion.
Physical dangers The vapour is heavier than air and may travel along the ground; distant ignition possible.	Inhalation risk A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C.
Chemical dangers Reacts violently with strong oxidants. This generates fire hazard. Decomposes on contact with acids.	Effects of short-term exposure The substance is irritating to the skin. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. Exposure far above the OEL

Chemical dangers

Reacts violently with strong oxidants. This generates fire hazard. Decomposes on contact with acids.

Occupational exposure limits

TLV: 50ppm as TWA; A3 (confirmed animal carcinogen with unknown relevance to humans); (ACGIH 2004).

MAK: 50 ppm, 180 mg/m³; Carcinogen category: 3B; Pregnancy risk group: C; (DFG 2004).

PHYSICAL PROPERTIES

Boiling point: 55Å°C
 Melting point: -109Å°C
 Relative density (water = 1): 0.7
 Solubility in water, g/100ml at 20Å°C: 4.2
 Vapour pressure, kPa at 20Å°C: 27
 Relative vapour density (air = 1): 3.0
 Relative density of the vapour/air-mixture at 20Å°C (air = 1): 1.5
 Flash point: -28Å°C c.c.
 Auto-ignition temperature: 375Å°C
 Explosive limits, vol% in air: 1.6-15.1
 Octanol/water partition coefficient as log Pow: 1.06

ENVIRONMENTAL DATA

It is strongly advised not to let the chemical enter into the environment because it is persistent.

NOTES

Much less likely to form peroxides than other ethers.
 Card has been partly updated in October 2004.
 See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

IPCS
 International
 Programme on
 Chemical Safety



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

Neither the EC nor the IPCS nor any person acting on behalf of the EC or the IPCS is responsible for the use which might be made of this information.

See Also:

[Toxicological Abbreviations](#)

[Methyl tert-Butyl Ether \(IARC Summary & Evaluation, Volume 73, 1999\)](#)

Material Safety Data Sheet

Iron

ACC# 11490

Section 1 - Chemical Product and Company Identification

MSDS Name: Iron**Catalog Numbers:** S71953, S71953-1, S71953-2, S93268, I60-3, I60-500, I62-500**Synonyms:** Iron Dust; Iron Metal; Iron Powder.**Company Identification:**

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100**Emergency Number:** 201-796-7100**For CHEMTREC assistance, call:** 800-424-9300**For International CHEMTREC assistance, call:** 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7439-89-6	IRON	>97	231-096-4

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: black to gray solid.

Warning! Flammable solid. May cause mechanical eye and skin irritation. May cause blood abnormalities. May cause lung damage. Inhalation of fumes may cause metal-fume fever. May cause cardiac disturbances. May cause liver damage.**Target Organs:** Liver, respiratory system, cardiovascular system, pancreas.**Potential Health Effects****Eye:** Exposure to particulates or solution may cause conjunctivitis, ulceration, and corneal abnormalities.**Skin:** May cause skin irritation.**Ingestion:** May cause gastrointestinal irritation with nausea, vomiting and diarrhea. Acute toxicity may include weakness, shock, cyanosis and acidosis. Delayed symptoms may include liver**Inhalation:** Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count. May cause lung damage.**Chronic:** Chronic exposure may lead to liver and lung damage. Repeated exposure may cause pancreatic damage, diabetes, and cardiac abnormalities.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.**Skin:** Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists.**Ingestion:** If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear.**Notes to Physician:** Treat symptomatically and supportively.**Antidote:** The use of Deferoxamine as a chelating agent should be determined only by qualified medical personnel.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. Combustion generates toxic fumes.**Extinguishing Media:** Use only graphite powder, soda ash, powdered sodium chloride, or an appropriate metal-fire-extinguishing dry powder.**Flash Point:** Not applicable.**Autoignition Temperature:** Not applicable.**Explosion Limits, Lower:**Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 2; Flammability: 1; Instability: 1

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Sweep up or absorb material, then place into a suitable clean, dry, closed container for disposal. Avoid generating dusty conditions. Remove all sources of ignition.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage: Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
IRON	none listed	none listed	none listed

OSHA Vacated PELs: IRON: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear impervious gloves.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance: black to gray

Odor: none reported

pH: Not available.

Vapor Pressure: 1 mm Hg @ 1787 deg C

Vapor Density: Not available.

Evaporation Rate: Negligible.

Viscosity: Not available.

Boiling Point: 2750 deg C

Freezing/Melting Point: 1535 deg C

Decomposition Temperature: Not available.

Solubility: Insoluble in water.

Specific Gravity/Density: 7.86 @ 20°C

Molecular Formula: Fe

Molecular Weight: 55.847

Section 10 - Stability and Reactivity

Chemical Stability: Decomposes when heated. Oxidizes when exposed to air.

Conditions to Avoid: Incompatible materials, moisture, exposure to air, excess heat.

Incompatibilities with Other Materials: Acetaldehyde, ammonium peroxodisulfate, chloroformamidinium, chloric acid, ammonium nitrate, halogens, dinitrogen tetroxide, nitryl fluoride, polystyrene, sodium acetylide, potassium dichromate, peroxyformic acid, nitryl fluoride, sulfuric acid, sodium carbide.

Hazardous Decomposition Products: Oxides of iron.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 7439-89-6: NO4565500; NO8225000

LD50/LC50:

CAS# 7439-89-6:

Oral, rat: LD50 = 30 gm/kg;

Carcinogenicity:

CAS# 7439-89-6: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information available.**Teratogenicity:** No information available.**Reproductive Effects:** No information available.**Mutagenicity:** No information available.**Neurotoxicity:** No information available.**Other Studies:**

Section 12 - Ecological Information

Ecotoxicity: No data available. No information available.**Environmental:** No information reported.**Physical:** No information available.**Other:** None.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.**RCRA U-Series:** None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	METAL POWDERS, FLAMMABLE, N.O.S.	METAL POWDER FLAMMABLE NOS (IRON)
Hazard Class:	4.1	4.1
UN Number:	UN3089	UN3089
Packing Group:	II	III

Section 15 - Regulatory Information

US FEDERAL**TSCA**

CAS# 7439-89-6 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

None of the chemicals in this material have an RQ.

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 7439-89-6: immediate, fire.

Section 313 No chemicals are reportable under Section 313.**Clean Air Act:**

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7439-89-6 can be found on the following state right to know lists: California.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations**European Labeling in Accordance with EC Directives****Hazard Symbols:**

Not available.

Risk Phrases:**Safety Phrases:****WGK (Water Danger/Protection)**

CAS# 7439-89-6: 0

Canada - DSL/NDSL

CAS# 7439-89-6 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of B4, D2B.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List**Section 16 - Additional Information**

MSDS Creation Date: 12/12/1997

Revision #4 Date: 11/06/2007

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

MERCURY

0056
April 2004

CAS No: 7439-97-6
RTECS No: OV4550000
UN No: 2809
EC No: 080-001-00-0

Quicksilver
Liquid silver
Hg
Atomic mass: 200.6

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	Risk of fire and explosion.		In case of fire: keep drums, etc., cool by spraying with water.

EXPOSURE		STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	IN ALL CASES CONSULT A DOCTOR!
Inhalation	Abdominal pain. Cough. Diarrhoea. Shortness of breath. Vomiting. Fever or elevated body temperature.	Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
Skin	MAY BE ABSORBED! Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
Eyes		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.	Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area in case of a large spill! Consult an expert! Ventilation. Collect leaking and spilled liquid in sealable non-metallic containers as far as possible. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Chemical protection suit including self-contained breathing apparatus.	T Symbol N Symbol R: 23-33-50/53 S: (1/2-)7-45-60-61 UN Hazard Class: 8 UN Pack Group: III Special material. Do not transport with food and feedstuffs.

EMERGENCY RESPONSE	STORAGE
Transport Emergency Card: TEC (R)-80GC9-II+III	Provision to contain effluent from fire extinguishing. Separated from food and feedstuffs. Well closed.

IMPORTANT DATA

Physical State; Appearance

ODOURLESS, HEAVY AND MOBILE SILVERY LIQUID METAL.

Chemical dangers

Upon heating, toxic fumes are formed. Reacts violently with ammonia and halogens causing fire and explosion hazard. Attacks aluminium and many other metals forming amalgams.

Occupational exposure limits

TLV: 0.025 mg/m³ as TWA; (skin); A4; BEI issued; (ACGIH 2004).
MAK: 0.1 mg/m³; Sh; Peak limitation category: II(8); Carcinogen category: 3B; (DFG 2003).

Routes of exposure

The substance can be absorbed into the body by inhalation of its vapour and through the skin, also as a vapour!

Inhalation risk

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

Effects of short-term exposure

The substance is irritating to the skin. Inhalation of the vapours may cause pneumonitis. The substance may cause effects on the central nervous system and kidneys. The effects may be delayed. Medical observation is indicated.

Effects of long-term or repeated exposure

The substance may have effects on the central nervous system and kidneys, resulting in irritability, emotional instability, tremor, mental and memory disturbances, speech disorders. May cause inflammation and discoloration of the gums. Danger of cumulative effects. Animal tests show that this substance possibly causes toxic effects upon human reproduction.

PHYSICAL PROPERTIES

Boiling point: 357/C
Melting point: -39/C
Relative density (water = 1): 13.5
Solubility in water: none

Vapour pressure, Pa at 20/C: 0.26
Relative vapour density (air = 1): 6.93
Relative density of the vapour/air-mixture at 20/C (air = 1): 1.009

ENVIRONMENTAL DATA

The substance is very toxic to aquatic organisms. In the food chain important to humans, bioaccumulation takes place, specifically in fish.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated.
No odour warning if toxic concentrations are present.
Do NOT take working clothes home.

ADDITIONAL INFORMATION

LEGAL NOTICE

Neither the EC nor the IPCS nor any person acting on behalf of the EC or the IPCS is responsible

TETRACHLOROETHYLENE

0076
April 2000

CAS No: 127-18-4
RTECS No: KX3850000
UN No: 1897
EC No: 602-028-00-4

1,1,2,2-Tetrachloroethylene
Perchloroethylene
Tetrachloroethene
C₂Cl₄ / Cl₂C=CCl₂
Molecular mass: 165.8

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			

EXPOSURE		STRICT HYGIENE! PREVENT GENERATION OF MISTS!	
Inhalation	Dizziness. Drowsiness. Headache. Nausea. Weakness. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Safety goggles, face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Give plenty of water to drink. Rest.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Ventilation. 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 let this chemical enter the environment. Personal protection: filter respirator for organic gases and vapours.	Xn Symbol N Symbol R: 40-51/53 S: (2-)23-36/37-61 UN Hazard Class: 6.1 UN Pack Group: III Do not transport with food and feedstuffs. Marine pollutant.

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-61S1897 NFPA Code: H2; F0; R0	Separated from metals, (see Chemical Dangers), food and feedstuffs. Keep in the dark. Ventilation along the floor.

IMPORTANT DATA

Physical State; Appearance

COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

Physical dangers

The vapour is heavier than air.

Chemical dangers

On contact with hot surfaces or flames this substance decomposes forming toxic and corrosive fumes (hydrogen chloride, phosgene, chlorine). The substance decomposes slowly on contact with moisture producing trichloroacetic acid and hydrochloric acid. Reacts with metals such as aluminium, lithium, barium, beryllium.

Occupational exposure limits

TLV: 25 ppm as TWA, 100 ppm as STEL; A3 (confirmed animal carcinogen with unknown relevance to humans); BEI issued; (ACGIH 2004).

MAK: skin absorption (H); Carcinogen category: 3B; (DFG 2004).

Routes of exposure

The substance can be absorbed into the body by inhalation 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. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. The substance may cause effects on the central nervous system. Exposure at high levels may result in unconsciousness.

Effects of long-term or repeated exposure

Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the liver and kidneys. This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 121/C

Melting point: -22/C

Relative density (water = 1): 1.6

Solubility in water, g/100 ml at 20/C: 0.015

Vapour pressure, kPa at 20/C: 1.9

Relative vapour density (air = 1): 5.8

Relative density of the vapour/air-mixture at 20/C (air = 1): 1.09

Octanol/water partition coefficient as log Pow: 2.9

ENVIRONMENTAL DATA

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

NOTES

Depending on the degree of exposure, periodic medical examination is suggested.

The odour warning when the exposure limit value is exceeded is insufficient.

Do NOT use in the vicinity of a fire or a hot surface, or during welding.

An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert.

Card has been partly updated in April 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

LEGAL NOTICE

Neither the EC nor the IPCS nor any person acting on behalf of the EC or the IPCS is responsible

CAS No: 79-01-6
 RTECS No: KX4550000
 UN No: 1710
 EC No: 602-027-00-9

1,1,2-Trichloroethylene
 Trichloroethene
 Ethylene trichloride
 Acetylene trichloride
 C_2HCl_3 / $CICH=CCl_2$
 Molecular mass: 131.4

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible under specific conditions. See Notes.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION		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! STRICT HYGIENE!	
Inhalation	Dizziness. Drowsiness. Headache. Weakness. Nausea. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration may be needed. 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.	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	Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Give plenty of water to drink. Rest.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Ventilation. 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. Personal protection: filter respirator for organic gases and vapours. Do NOT let this chemical enter the environment.	T Symbol R: 45-36/38-52/53-67 S: 53-45-61 UN Hazard Class: 6.1 UN Pack Group: III Do not transport with food and feedstuffs. Marine pollutant.

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-61S1710 NFPA Code: H2; F1; R0	Separated from metals (see Chemical Dangers), strong bases, food and feedstuffs. Dry. Keep in the dark. Ventilation along the floor.

IMPORTANT DATA

Physical State; Appearance

COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

Physical dangers

The vapour is heavier than air. As a result of flow, agitation, etc., electrostatic charges can be generated.

Chemical dangers

On contact with hot surfaces or flames this substance decomposes forming toxic and corrosive fumes (phosgene, hydrogen chloride). The substance decomposes on contact with strong alkali producing dichloroacetylene, which increases fire hazard. Reacts violently with metal powders such as magnesium, aluminium, titanium, and barium. Slowly decomposed by light in presence of moisture, with formation of corrosive hydrochloric acid.

Occupational exposure limits

TLV: 50 ppm as TWA; 100 ppm as STEL; A5; BEI issued; (ACGIH 2004).

MAK: Carcinogen category: 1; Germ cell mutagen group: 3B; (DFG 2004).

Routes of exposure

The substance can be absorbed into the body by inhalation 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 skin. 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, resulting in respiratory failure. Exposure could cause lowering of consciousness.

Effects of long-term or repeated exposure

Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the central nervous system, resulting in loss of memory. The substance may have effects on the liver and kidneys (see Notes). This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 87/C

Melting point: -73/C

Relative density (water = 1): 1.5

Solubility in water, g/100 ml at 20/C: 0.1

Vapour pressure, kPa at 20/C: 7.8

Relative vapour density (air = 1): 4.5

Relative density of the vapour/air-mixture at 20/C (air = 1): 1.3

Auto-ignition temperature: 410/C

Explosive limits, vol% in air: 8-10.5

Octanol/water partition coefficient as log Pow: 2.42

ENVIRONMENTAL DATA

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

NOTES

Combustible vapour/air mixtures difficult to ignite, may be developed under certain conditions.

Use of alcoholic beverages enhances the harmful effect.

Depending on the degree of exposure, periodic medical examination is suggested.

The odour warning when the exposure limit value is exceeded is insufficient.

Do NOT use in the vicinity of a fire or a hot surface, or during welding.

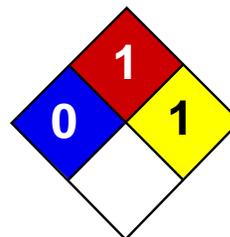
An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert.

Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

LEGAL NOTICE

Neither the EC nor the IPCS nor any person acting on behalf of the EC or the IPCS is responsible



Health	1
Fire	1
Reactivity	1
Personal Protection	E

Material Safety Data Sheet Zinc Metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Zinc Metal

Catalog Codes: SLZ1054, SLZ1159, SLZ1267, SLZ1099, SLZ1204

CAS#: 7440-66-6

RTECS: ZG8600000

TSCA: TSCA 8(b) inventory: Zinc Metal

CI#: Not applicable.

Synonym: Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips

Chemical Name: Zinc Metal

Chemical Formula: Zn

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Zinc Metal	7440-66-6	100

Toxicological Data on Ingredients: Zinc Metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances:

Slightly flammable to flammable in presence of open flames and sparks, of heat, of oxidizing materials, of acids, of alkalis, of moisture. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:

Zinc + NaOH causes ignition. Oxidation of zinc by potassium proceeds with incandescence. Residues from zinc dust /acetic acid reduction operations may ignite after long delay if discarded into waste bins with paper. Incandescent reaction when Zinc and Arsenic or Tellurium, or Selenium are combined. When hydrazine mononitrate is heated in contact with zinc, a flaming decomposition occurs at temperatures a little above its melting point. Contact with acids and alkali hydroxides (sodium hydroxide, potassium hydroxide, calcium hydroxide, etc.) results in evolution of hydrogen with sufficient heat of reaction to ignite the hydrogen gas. Zinc foil ignites if traces of moisture are present. It is water reactive and produces flammable gases on contact with water. It may ignite on contact with water or moist air.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Flammable solid that, in contact with water, emits flammable gases. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.

Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area. Keep from any possible contact with water. Do not allow water to get into container because of violent reaction.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid. Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 65.39 g/mole

Color: Bluish-grey

pH (1% soln/water): Not applicable.

Boiling Point: 907°C (1664.6°F)

Melting Point: 419°C (786.2°F)

Critical Temperature: Not available.

Specific Gravity: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials, moisture

Incompatibility with various substances:

Reactive with oxidizing agents, acids, alkalis. Slightly reactive to reactive with moisture. The product may react violently with water to emit flammable but non toxic gases.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with acids, halogenated hydrocarbons, NH_4NO_3 , barium oxide, $\text{Ba}(\text{NO}_3)_2$, Cadmium, CS_2 , chlorates, Cl_2 , CrO_3 , F_2 , Hydroxylamine, $\text{Pb}(\text{N}_3)_2$, MnCl_2 , HNO_3 , performic acid, KClO_3 , KNO_3 , N_2O_2 , Selenium, NaClO_3 , Na_2O_2 , Sulfur, Te, water, $(\text{NH}_4)_2\text{S}$, As_2O_3 , CS_2 , CaCl_2 , chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide, HCl , H_2SO_4 , $(\text{Mg} + \text{Ba}(\text{NO}_3)_2 + \text{BaO}_2)$, (ethyl acetoacetate +tribromoneopentyl alcohol. Contact with Alkali Hydroxides(Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide, etc) results in evolution of hydrogen. Ammonium nitrate + zinc + water causes a violent reaction with evolution of steam and zinc oxide. May react with water.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD_{50} : Not available. LC_{50} : Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: May cause skin irritation. Dermal exposure to zinc may produce leg pains, fatigue, anorexia and weight loss. Eyes: May cause eye irritation. Ingestion: May be harmful if swallowed. May cause digestive tract irritation with tightness in throat, nausea, vomiting, diarrhea, loss of appetite, malaise, abdominal pain. fever, and chills. May affect behavior/central nervous system and autonomic nervous system with ataxia, lethargy, staggering gait, mild derrangement in cerebellar function, lightheadness, dizziness, irritability, muscular stiffness, and pain. May also affect blood. Inhalation: Inhalation of zinc dust or fumes may cause respiratory tract and mucous membrane irritation with cough and chest pain. It can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headached fever, maliase, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis. The toxicological properties of this substance have not been fully investisgated.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: Not available.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

New York release reporting list: Zinc Metal Rhode Island RTK hazardous substances: Zinc Metal Pennsylvania RTK: Zinc Metal Florida: Zinc Metal Michigan critical material: Zinc Metal Massachusetts RTK: Zinc Metal New Jersey: Zinc Metal California Director's List of Hazardous Substances: Zinc Metal TSCA 8(b) inventory: Zinc Metal TSCA 12(b) one time export: Zinc Metal SARA 313 toxic chemical notification and release reporting: Zinc Metal CERCLA: Hazardous substances.: Zinc Metal: 1000 lbs. (453.6 kg)

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not Available

DSCL (EEC):

R15- Contact with water liberates extremely flammable gases. R17- Spontaneously flammable in air. S7/8- Keep container tightly closed and dry.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 1

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 1

Reactivity: 1

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Appendix B Activity Hazard Analyses

Project Identification 491 Wortman Ave	Location Various	Estimated Dates TBD
Phase of Work Mobilization/ Demobilization	Page 1 of 1	Analysis Approved by Kris Almskog, PM/HSM
TASKS	HAZARDS	CONTROL MEASURES
1. Mobilization and demobilization of equipment site tools, personnel	Slips/trips/falls	<ul style="list-style-type: none"> Maintain alertness to slip/trip/fall hazards; Maintain good housekeeping; Walk, do not run; Wear footwear with soles that grip; Unloading areas should be on even terrain; and Mark and repair if possible tripping hazards.
	Manual lifting and material handling	<ul style="list-style-type: none"> Instruct personnel on proper lifting techniques; Use proper lifting techniques; and Team lifting will be used for heavy loads or use mechanical lifting devices.
	Temperature extremes	<ul style="list-style-type: none"> Drink plenty of fluids; Train personnel of signs/symptoms of heat/cold stress; Monitor air temperatures when extreme weather conditions are present; and Stay in visual and verbal contact with your buddy.
	Vehicular traffic	<ul style="list-style-type: none"> Spotters will be used when backing up trucks and heavy equipment and when moving equipment.
	Overhead hazards	<ul style="list-style-type: none"> Personnel will be required to wear hard hats that meet ANSI Standard Z89.1; Ground personnel will stay clear of suspended loads; Equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects; and Overhead hazards will be identified prior to commencing work operations.
	Noise	<ul style="list-style-type: none"> Ear plugs or ear muffs shall be worn for operations that exceed 85 decibels.
	Electrocution	<ul style="list-style-type: none"> Equipment will be equipped with GFCI; A licensed electrician will conduct electrical work; Equipment will stay a minimum of 15 feet from overhead-energized electrical lines and the electrified third rail (up to 50 kV). This distance will increase 0.4 inches for each 1 kV above 50 kV.
	Biological hazards	<ul style="list-style-type: none"> Be alert to the presence of biological hazards; Wear insect repellent; Follow procedures in Section 4.2.2 for tick bites; FTL/SHSO should be aware of on-site personnel with allergic reactions in insect bites and stings.

Project Identification 3140 Coney Island Ave	Location Various	Estimated Dates TBD
Phase of Work Excavation	Page 1 of 2	Analysis Approved by Kris Almskog, PM/HSM
TASKS	HAZARDS	CONTROL MEASURES
1. Excavate to required depths; soil handling and transport	Chemical hazards	<ul style="list-style-type: none"> Wear appropriate PPE per Table 6-1; Perform air monitoring per Community Air Monitoring Plan; Practice contamination avoidance; Follow proper decontamination procedures; and Wash hands/face before eating, drinking or smoking.
	Hand and power tool usage	<ul style="list-style-type: none"> Equip electrical equipment with GFCI's; Inspect electrical equipment and tools prior to use; Daily inspections will be performed; Remove broken or damaged tools from service; Use the tool for its intended purpose; Use in accordance with manufacturer instructions; and Tag and remove defective equipment.
	Temperature extremes	<ul style="list-style-type: none"> Drink plenty of fluids; Train personnel of signs/symptoms of heat/cold stress; Monitor air temperatures when extreme weather conditions are present; and, Stay in visual and verbal contact with your buddy.
	Manual lifting and material handling	<ul style="list-style-type: none"> Instruct personnel on proper lifting techniques; Use proper lifting techniques; and Team lifting will be used for heavy loads or use mechanical lifting devices.
	Fire/Explosion	<ul style="list-style-type: none"> ABC type fire extinguishers shall be readily available; No smoking in work area.
	Biological hazards	<ul style="list-style-type: none"> Be alert to the presence of biological hazards; Wear insect repellent; Follow procedures in Section 4.2.2 for tick bites; FTL/SHSO should be aware of on-site personnel with allergic reactions in insect bites and stings.
	Heavy equipment	<ul style="list-style-type: none"> Ground personnel will stay clear of suspended loads; Ground personnel will stay out of the swing radius; Eye contact with operators will be made before approaching equipment; Equipment will not be approached on blind sides; Equipment will be equipped with backup alarms or spotters shall be used.
	Slips/Trips/Falls	<ul style="list-style-type: none"> Maintain alertness to slip/trip/fall hazards; Maintain good housekeeping; Walk, do not run; Wear footwear with soles that grip; Unloading areas should be on even terrain; and mark and repair if possible tripping hazards are present.
	Electrocution	<ul style="list-style-type: none"> Equipment will be equipped with GFCI; A licensed electrician will conduct electrical work; Equipment will stay a minimum of 15 feet from overhead-energized electrical lines and the electrified third rail (up to 50 kV). This distance will increase 0.4 inches for each 1 kV above 50 kV.

Project Identification 491 Wortman Ave	Location Various	Estimated Dates TBD
Phase of Work Drilling	Page 2 of 2	Analysis Approved by Kris Almskog, PM/HSM
TASKS	HAZARDS	CONTROL MEASURES
	Noise	<ul style="list-style-type: none"> Hearing protection mandatory at or above 85 dBA. Instruct personnel how to properly wear hearing protective devices. Disposable ear plugs or other hearing protection required when working near noisy equipment..
	Steam/Heat/Splashing	<ul style="list-style-type: none"> Use face shield and safety glasses or goggles; Stay out of the splash/steam radius; Do not direct steam at anyone; Do not hold objects with your foot and steam area near it; Direct spray to minimize spread of constituents of concern; and Use shielding as necessary.
	Excavation hazards	<ul style="list-style-type: none"> Follow 29 CFR 1926 Subpart P.
	Overhead hazards	<ul style="list-style-type: none"> Personnel will be required to wear hard hats that meet ANSI Standard Z89.1; Ground personnel will stay clear of suspended loads; Equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects; and Overhead hazards will be identified prior to commencing work operations.
	Electrocution	<ul style="list-style-type: none"> Equipment will be equipped with GFCI; A licensed electrician will conduct electrical work; Equipment will stay a minimum of 15 feet from overhead-energized electrical lines and the electrified third rail (up to 50 kV). This distance will increase 0.4 inches for each 1 kV above 50 kV.
	Track Hazards	<ul style="list-style-type: none"> Caution will be used when working in close proximity to the electrified third rail (see "Electrocution" above). Workers are required to have completed NYCT Track Safety Training Flag men will be used when necessary (e.g., working in limited access track areas).

Project Identification 491 Wortman Ave	Location Various	Estimated Dates TBD
Phase of Work Soil/Groundwater Sampling	Page 1 of 1	Analysis Approved by Kris Almskog, PM/HSM
TASKS	HAZARDS	CONTROL MEASURES
1. Collect soil/groundwater samples.	Chemical hazards	<ul style="list-style-type: none"> Wear appropriate PPE per Table 6-1; Practice contamination avoidance; Follow proper decontamination procedures; and Wash hands/face before eating, drinking or smoking.
	Temperature extremes	<ul style="list-style-type: none"> Drink plenty of fluids; Train personnel of signs/symptoms of heat/cold stress; Monitor air temperatures when extreme weather conditions are present; and Stay in visual and verbal contact with your buddy.
	Manual lifting and material handling	<ul style="list-style-type: none"> Site personnel will be instructed on proper lifting techniques; mechanical devices should be used to reduce manual handling of materials; team lifting should be utilized if mechanical devices are not available.
	Slips/Trips/Falls	<ul style="list-style-type: none"> Maintain alertness to slip/trip/fall hazards; Maintain good housekeeping; Walk, do not run; Wear footwear with soles that grip; Unloading areas should be on even terrain; and Mark and repair if possible tripping hazards.
	Electrocution	<ul style="list-style-type: none"> Equipment will be equipped with GFCI; A licensed electrician will conduct electrical work; Equipment will stay a minimum of 15 feet from overhead-energized electrical lines and the electrified third rail (up to 50 kV). This distance will increase 0.4 inches for each 1 kV above 50 kV.
	Track Hazards	<ul style="list-style-type: none"> Caution will be used when working in close proximity to the electrified third rail (see "Electrocution" above). Workers are required to have completed NYCT Track Safety Training Flag men will be used when necessary (e.g., working in limited access track areas).

Project Identification 491 Wortman Ave	Location Various	Estimated Dates TBD
Phase of Work Decontamination	Page 1 of 1	Analysis Approved by Kris Almskog, PM/HSM
TASKS	HAZARDS	CONTROL MEASURES
1. Decontaminate equipment	Chemical hazards	<ul style="list-style-type: none"> Wear appropriate PPE per Table 6-1; Practice contamination avoidance; Follow proper decontamination procedures; and Wash hands/face before eating, drinking or smoking.
	Temperature extremes	<ul style="list-style-type: none"> Drink plenty of fluids; Train personnel of signs/symptoms of heat/cold stress; Monitor air temperatures when extreme weather conditions are present; and Stay in visual and verbal contact with your buddy.
	Manual lifting and material handling	<ul style="list-style-type: none"> Site personnel will be instructed on proper lifting techniques; mechanical devices should be used to reduce manual handling of materials; team lifting should be utilized if mechanical devices are not available.
	Slips/Trips/Falls	<ul style="list-style-type: none"> Maintain alertness to slip/trip/fall hazards; Maintain good housekeeping; Walk, do not run; Wear footwear with soles that grip; Unloading areas should be on even terrain; and Mark and repair if possible tripping hazards.
	Electrocution	<ul style="list-style-type: none"> Equipment will be equipped with GFCI; A licensed electrician will conduct electrical work; Equipment will stay a minimum of 15 feet from overhead-energized electrical lines and the electrified third rail (up to 50 kV). This distance will increase 0.4 inches for each 1 kV above 50 kV.
	Track Hazards	<ul style="list-style-type: none"> Caution will be used when working in close proximity to the electrified third rail (see "Electrocution" above). Workers are required to have completed NYCT Track Safety Training Flag men will be used when necessary (e.g., working in limited access track areas).

Appendix C

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.

TABLE 1

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 1-2°
- 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 104° or above
- Coma

TABLE 2

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)	Shorten next work period by 33%
		100.6°F	Prohibit work in impermeable clothing
Body weight	1. Before workday begins (a.m.) 2. After workday ends (p.m.)		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 98.6°F 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 in Table 3, 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-gray to gray

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 Temperature	°C	Symptoms
99-96	37-35.5	Intense, uncontrollable shivering
95-91	35.5-32.7	Violent shivering persists. If victim is conscious, he has difficulty speaking.
90-86	32-30	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	29.4-27.2	Victim becomes irrational, loses contact with his environment, and drifts into a stuporous state. Muscular rigidity continues. Pulse and respirations are slow and the worker may develop cardiac arrhythmias.
80-78	26.6-18.5	Victim becomes unconscious. He does not respond to the spoken word. Most reflexes cease to function. Heartbeat becomes erratic
Below 78	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.

TABLE 3⁽¹⁾
COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED
AS AN EQUIVALENT TEMPERATURE (UNDER CALM CONDITIONS)

Estimated wind Speed (in mph)	Actual Temperature Reading (°F)P											
	50	40	30	20	10	0	10	20	30	40	50	60
	Equivalent Chill Temperature (°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 immersion 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.

Appendix D Medical Data Sheet

MEDICAL DATA SHEET

The brief medical data sheet shall be completed by on-site personnel and will be kept in the Support Zone by the HSO as a project record during the conduct of site operations. It accompanies any personnel when medical assistance is needed or if transport to a hospital is required.

Project: _____

Name: _____ Home Telephone: _____

Address: _____

Age: _____ Height: _____ Weight: _____ Blood Type: _____

Name and Telephone Number of Emergency Contact: _____

Drug or Other Allergies: _____

Particular Sensitivities: _____

Do You Wear Contacts? _____

Provide A Check List Of Previous Illnesses: _____

What Medications Are You Presently Using? _____

Do You Have Any Medical Restrictions? _____

Name, Address, And Phone Number Of Personal Physician: _____

Appendix E

General Health and Safety Work Practices

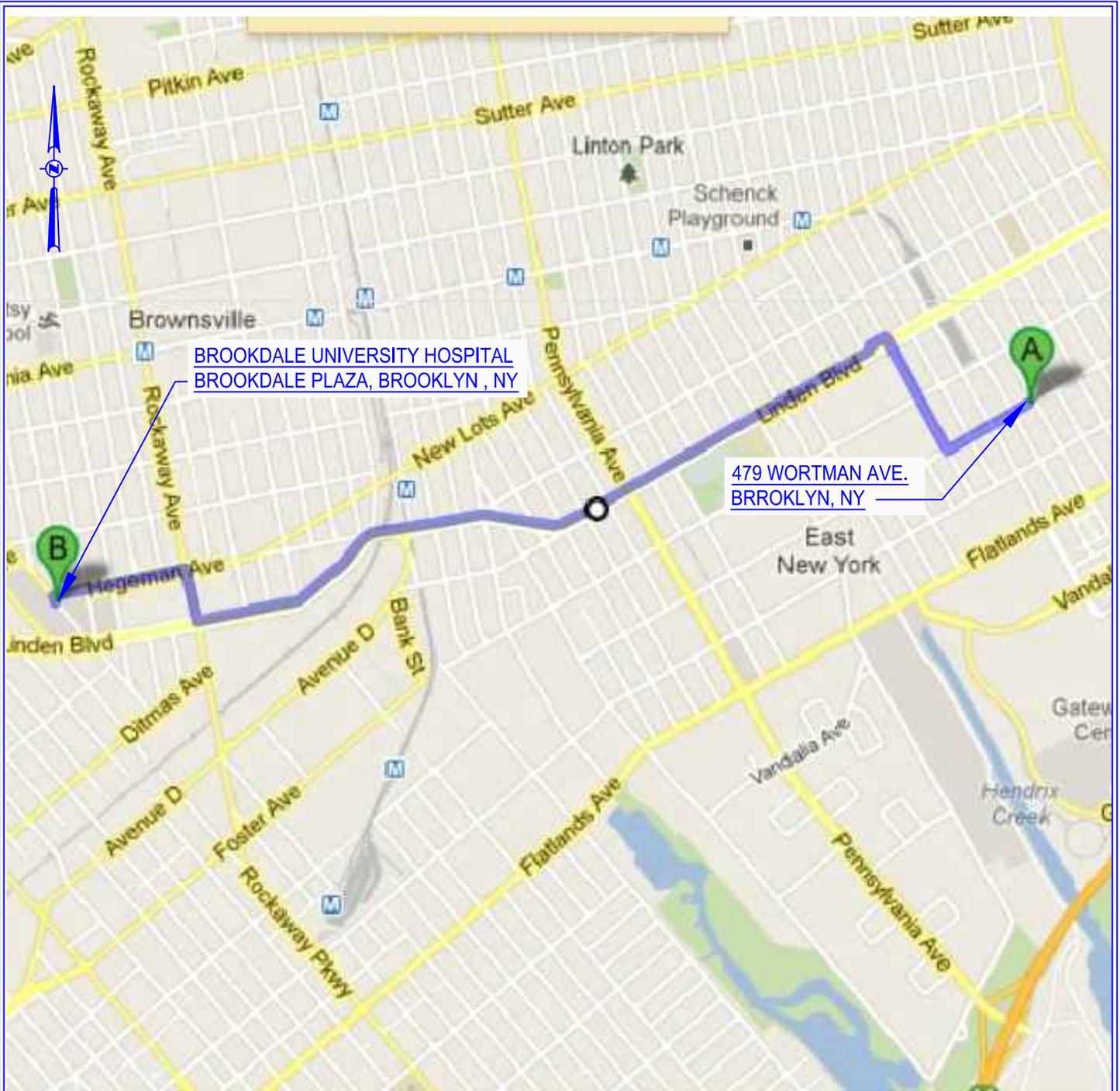
GENERAL HEALTH AND SAFETY WORK PRACTICES

1. Site personnel must attend each day's Daily Briefing and sign the attendance sheet.
2. Any individual taking prescribed drugs shall inform the FTL/HSO of the type of medication. The FTL/HSO will review the matter with the HSM and the Corporate Medical Consultant (CMC), who will decide if the employee can safely work on-site while taking the medication.
3. The personal protective equipment specified by the FTL/HSO and/or associated procedures shall be worn by site personnel. This includes hard hats and safety glasses which must be worn in active work areas.
4. Facial hair (beards, long sideburns or mustaches) which may interfere with a satisfactory fit of a respirator mask is not allowed on any person who may be required to wear a respirator.
5. Personnel must follow proper decontamination procedures and shower as soon as possible upon completion of work shift.
6. Eating, drinking, chewing tobacco or gum, smoking and any other practice that may increase the possibility of hand-to-mouth contact is prohibited in the exclusion zone or the contamination reduction zone. (Exceptions may be permitted by the HSM to allow fluid intake during heat stress conditions).
7. Lighters, matches, cigarettes and other forms of tobacco are prohibited in the Exclusion Zone.
8. Signs and demarcations shall be followed. Such signs and demarcation shall not be removed, except as authorized by the FTL/HSO.
9. No one shall enter a permit-required confined space without a permit and appropriate training. Confined space entry permits shall be implemented as issued.
10. Personnel must follow Hot Work Permits as issued.
11. Personnel must use the Buddy System in the Exclusion Zone.
12. Personnel must follow the work-rest regimens and other practices required by the heat stress program.
13. Personnel must follow lockout/tagout procedures when working on equipment involving moving parts or hazardous energy sources.
14. No person shall operate equipment unless trained and authorized.
15. No one may enter an excavation greater than four feet deep unless authorized by the Competent Person. Excavations must be sloped or shored properly. Safe means of access and egress from excavations must be maintained.
16. Ladders and scaffolds shall be solidly constructed, in good working condition, and inspected prior to use. No one may use defective ladders or scaffolds.
17. Fall protection or fall arrest systems must be in place when working at elevations greater than six feet for temporary working surfaces and four feet for fixed platforms.

18. Safety belts, harnesses and lanyards must be selected by the Supervisor. The user must inspect the equipment prior to use. No defective personal fall protection equipment shall be used. Personal fall protection that has been shock loaded must be discarded.
19. Hand and portable power tools must be inspected prior to use. Defective tools and equipment shall not be used.
20. Ground fault interrupters shall be used for cord and plug equipment used outdoors or in damp locations. Electrical cords shall be kept out walkways and puddles unless protected and rated for the service.
21. Improper use, mishandling, or tampering with health and safety equipment and samples is prohibited.
22. Horseplay of any kind is prohibited.
23. Possession or use of alcoholic beverages, controlled substances, or firearms on any site is forbidden.
24. Incidents, no matter how minor, must be reported immediately to the Supervisor.
25. Personnel shall be familiar with the Site Emergency Action Plan, which is contained in Section 12 of the HASP/EAP.

The above Health and Safety Rules are not all inclusive and it is your responsibility to comply with regulations set forth by OSHA, the client, PWGC Supervisors, and the FTL/HSO.

Appendix F Hospital Route Map and Directions



**BROOKDALE UNIVERSITY HOSPITAL
BROOKDALE PLAZA, BROOKLYN , NY**

**479 WORTMAN AVE.
BRROKLYN, NY**

DIRECTIONS

1.	HEAD SOUTHWEST ON WORTMAN AVE TOWARD LINWOOD ST	0.2 MI
2.	TURN RIGHT ONTO ASHFORD ST	0.3 MI
3.	TAKE THE 3RD LEFT ONTO LINDEN BLVD	167 FT
4.	CONTINUE STRAIGHT TO STAY ON LINDEN BLVD	1.5 MI
5.	TURN RIGHT ONTO ROCKAWAY AVE	0.1 MI
6.	TAKE THE 2ND LEFT ONTO HEGEMAN AVE	0.3 MI
7.	TURN LEFT ONTO E 98TH ST	79 FT
8.	DESTINATION WILL BE ON THE RIGHT	

HOSPITAL ROUTE
NOT TO SCALE

Project:	WAT1201
Designed by:	JL
Approved by:	JL
Drawn by:	PR
Date:	10-25-12
Figure No:	1

C:\Projects\Site Plans\11-11-12\11-11-12-01-02-03-04-05-06-07-08-09-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100-101-102-103-104-105-106-107-108-109-110-111-112-113-114-115-116-117-118-119-120-121-122-123-124-125-126-127-128-129-130-131-132-133-134-135-136-137-138-139-140-141-142-143-144-145-146-147-148-149-150-151-152-153-154-155-156-157-158-159-160-161-162-163-164-165-166-167-168-169-170-171-172-173-174-175-176-177-178-179-180-181-182-183-184-185-186-187-188-189-190-191-192-193-194-195-196-197-198-199-200-201-202-203-204-205-206-207-208-209-210-211-212-213-214-215-216-217-218-219-220-221-222-223-224-225-226-227-228-229-230-231-232-233-234-235-236-237-238-239-240-241-242-243-244-245-246-247-248-249-250-251-252-253-254-255-256-257-258-259-260-261-262-263-264-265-266-267-268-269-270-271-272-273-274-275-276-277-278-279-280-281-282-283-284-285-286-287-288-289-290-291-292-293-294-295-296-297-298-299-300-301-302-303-304-305-306-307-308-309-310-311-312-313-314-315-316-317-318-319-320-321-322-323-324-325-326-327-328-329-330-331-332-333-334-335-336-337-338-339-340-341-342-343-344-345-346-347-348-349-350-351-352-353-354-355-356-357-358-359-360-361-362-363-364-365-366-367-368-369-370-371-372-373-374-375-376-377-378-379-380-381-382-383-384-385-386-387-388-389-390-391-392-393-394-395-396-397-398-399-400-401-402-403-404-405-406-407-408-409-410-411-412-413-414-415-416-417-418-419-420-421-422-423-424-425-426-427-428-429-430-431-432-433-434-435-436-437-438-439-440-441-442-443-444-445-446-447-448-449-450-451-452-453-454-455-456-457-458-459-460-461-462-463-464-465-466-467-468-469-470-471-472-473-474-475-476-477-478-479-480-481-482-483-484-485-486-487-488-489-490-491-492-493-494-495-496-497-498-499-500-501-502-503-504-505-506-507-508-509-510-511-512-513-514-515-516-517-518-519-520-521-522-523-524-525-526-527-528-529-530-531-532-533-534-535-536-537-538-539-540-541-542-543-544-545-546-547-548-549-550-551-552-553-554-555-556-557-558-559-560-561-562-563-564-565-566-567-568-569-570-571-572-573-574-575-576-577-578-579-580-581-582-583-584-585-586-587-588-589-590-591-592-593-594-595-596-597-598-599-600-601-602-603-604-605-606-607-608-609-610-611-612-613-614-615-616-617-618-619-620-621-622-623-624-625-626-627-628-629-630-631-632-633-634-635-636-637-638-639-640-641-642-643-644-645-646-647-648-649-650-651-652-653-654-655-656-657-658-659-660-661-662-663-664-665-666-667-668-669-670-671-672-673-674-675-676-677-678-679-680-681-682-683-684-685-686-687-688-689-690-691-692-693-694-695-696-697-698-699-700-701-702-703-704-705-706-707-708-709-710-711-712-713-714-715-716-717-718-719-720-721-722-723-724-725-726-727-728-729-730-731-732-733-734-735-736-737-738-739-740-741-742-743-744-745-746-747-748-749-750-751-752-753-754-755-756-757-758-759-760-761-762-763-764-765-766-767-768-769-770-771-772-773-774-775-776-777-778-779-780-781-782-783-784-785-786-787-788-789-790-791-792-793-794-795-796-797-798-799-800-801-802-803-804-805-806-807-808-809-810-811-812-813-814-815-816-817-818-819-820-821-822-823-824-825-826-827-828-829-830-831-832-833-834-835-836-837-838-839-840-841-842-843-844-845-846-847-848-849-850-851-852-853-854-855-856-857-858-859-860-861-862-863-864-865-866-867-868-869-870-871-872-873-874-875-876-877-878-879-880-881-882-883-884-885-886-887-888-889-890-891-892-893-894-895-896-897-898-899-900-901-902-903-904-905-906-907-908-909-910-911-912-913-914-915-916-917-918-919-920-921-922-923-924-925-926-927-928-929-930-931-932-933-934-935-936-937-938-939-940-941-942-943-944-945-946-947-948-949-950-951-952-953-954-955-956-957-958-959-960-961-962-963-964-965-966-967-968-969-970-971-972-973-974-975-976-977-978-979-980-981-982-983-984-985-986-987-988-989-990-991-992-993-994-995-996-997-998-999-1000-1001-1002-1003-1004-1005-1006-1007-1008-1009-1010-1011-1012-1013-1014-1015-1016-1017-1018-1019-1020-1021-1022-1023-1024-1025-1026-1027-1028-1029-1030-1031-1032-1033-1034-1035-1036-1037-1038-1039-1040-1041-1042-1043-1044-1045-1046-1047-1048-1049-1050-1051-1052-1053-1054-1055-1056-1057-1058-1059-1060-1061-1062-1063-1064-1065-1066-1067-1068-1069-1070-1071-1072-1073-1074-1075-1076-1077-1078-1079-1080-1081-1082-1083-1084-1085-1086-1087-1088-1089-1090-1091-1092-1093-1094-1095-1096-1097-1098-1099-1100-1101-1102-1103-1104-1105-1106-1107-1108-1109-1110-1111-1112-1113-1114-1115-1116-1117-1118-1119-1120-1121-1122-1123-1124-1125-1126-1127-1128-1129-1130-1131-1132-1133-1134-1135-1136-1137-1138-1139-1140-1141-1142-1143-1144-1145-1146-1147-1148-1149-1150-1151-1152-1153-1154-1155-1156-1157-1158-1159-1160-1161-1162-1163-1164-1165-1166-1167-1168-1169-1170-1171-1172-1173-1174-1175-1176-1177-1178-1179-1180-1181-1182-1183-1184-1185-1186-1187-1188-1189-1190-1191-1192-1193-1194-1195-1196-1197-1198-1199-1200-1201-1202-1203-1204-1205-1206-1207-1208-1209-1210-1211-1212-1213-1214-1215-1216-1217-1218-1219-1220-1221-1222-1223-1224-1225-1226-1227-1228-1229-1230-1231-1232-1233-1234-1235-1236-1237-1238-1239-1240-1241-1242-1243-1244-1245-1246-1247-1248-1249-1250-1251-1252-1253-1254-1255-1256-1257-1258-1259-1260-1261-1262-1263-1264-1265-1266-1267-1268-1269-1270-1271-1272-1273-1274-1275-1276-1277-1278-1279-1280-1281-1282-1283-1284-1285-1286-1287-1288-1289-1290-1291-1292-1293-1294-1295-1296-1297-1298-1299-1300-1301-1302-1303-1304-1305-1306-1307-1308-1309-1310-1311-1312-1313-1314-1315-1316-1317-1318-1319-1320-1321-1322-1323-1324-1325-1326-1327-1328-1329-1330-1331-1332-1333-1334-1335-1336-1337-1338-1339-1340-1341-1342-1343-1344-1345-1346-1347-1348-1349-1350-1351-1352-1353-1354-1355-1356-1357-1358-1359-1360-1361-1362-1363-1364-1365-1366-1367-1368-1369-1370-1371-1372-1373-1374-1375-1376-1377-1378-1379-1380-1381-1382-1383-1384-1385-1386-1387-1388-1389-1390-1391-1392-1393-1394-1395-1396-1397-1398-1399-1400-1401-1402-1403-1404-1405-1406-1407-1408-1409-1410-1411-1412-1413-1414-1415-1416-1417-1418-1419-1420-1421-1422-1423-1424-1425-1426-1427-1428-1429-1430-1431-1432-1433-1434-1435-1436-1437-1438-1439-1440-1441-1442-1443-1444-1445-1446-1447-1448-1449-1450-1451-1452-1453-1454-1455-1456-1457-1458-1459-1460-1461-1462-1463-1464-1465-1466-1467-1468-1469-1470-1471-1472-1473-1474-1475-1476-1477-1478-1479-1480-1481-1482-1483-1484-1485-1486-1487-1488-1489-1490-1491-1492-1493-1494-1495-1496-1497-1498-1499-1500-1501-1502-1503-1504-1505-1506-1507-1508-1509-1510-1511-1512-1513-1514-1515-1516-1517-1518-1519-1520-1521-1522-1523-1524-1525-1526-1527-1528-1529-1530-1531-1532-1533-1534-1535-1536-1537-1538-1539-1540-1541-1542-1543-1544-1545-1546-1547-1548-1549-1550-1551-1552-1553-1554-1555-1556-1557-1558-1559-1560-1561-1562-1563-1564-1565-1566-1567-1568-1569-1570-1571-1572-1573-1574-1575-1576-1577-1578-1579-1580-1581-1582-1583-1584-1585-1586-1587-1588-1589-1590-1591-1592-1593-1594-1595-1596-1597-1598-1599-1600-1601-1602-1603-1604-1605-1606-1607-1608-1609-1610-1611-1612-1613-1614-1615-1616-1617-1618-1619-1620-1621-1622-1623-1624-1625-1626-1627-1628-1629-1630-1631-1632-1633-1634-1635-1636-1637-1638-1639-1640-1641-1642-1643-1644-1645-1646-1647-1648-1649-1650-1651-1652-1653-1654-1655-1656-1657-1658-1659-1660-1661-1662-1663-1664-1665-1666-1667-1668-1669-1670-1671-1672-1673-1674-1675-1676-1677-1678-1679-1680-1681-1682-1683-1684-1685-1686-1687-1688-1689-1690-1691-1692-1693-1694-1695-1696-1697-1698-1699-1700-1701-1702-1703-1704-1705-1706-1707-1708-1709-1710-1711-1712-1713-1714-1715-1716-1717-1718-1719-1720-1721-1722-1723-1724-1725-1726-1727-1728-1729-1730-1731-1732-1733-1734-1735-1736-1737-1738-1739-1740-1741-1742-1743-1744-1745-1746-1747-1748-1749-1750-1751-1752-1753-1754-1755-1756-1757-1758-1759-1760-1761-1762-1763-1764-1765-1766-1767-1768-1769-1770-1771-1772-1773-1774-1775-1776-1777-1778-1779-1780-1781-1782-1783-1784-1785-1786-1787-1788-1789-1790-1791-1792-1793-1794-1795-1796-1797-1798-1799-1800-1801-1802-1803-1804-1805-1806-1807-1808-1809-1810-1811-1812-1813-1814-1815-1816-1817-1818-1819-1820-1821-1822-1823-1824-1825-1826-1827-1828-1829-1830-1831-1832-1833-1834-1835-1836-1837-1838-1839-1840-1841-1842-1843-1844-1845-1846-1847-1848-1849-1850-1851-1852-1853-1854-1855-1856-1857-1858-1859-1860-1861-1862-1863-1864-1865-1866-1867-1868-1869-1870-1871-1872-1873-1874-1875-1876-1877-1878-1879-1880-1881-1882-1883-1884-1885-1886-1887-1888-1889-1890-1891-1892-1893-1894-1895-1896-1897-1898-1899-1900-1901-1902-1903-1904-1905-1906-1907-1908-1909-1910-1911-1912-1913-1914-1915-1916-1917-1918-1919-1920-1921-1922-1923-1924-1925-1926-1927-1928-1929-1930-1931-1932-1933-1934-1935-1936-1937-1938-1939-1940-1941-1942-1943-1944-1945-1946-1947-1948-1949-1950-1951-1952-1953-1954-1955-1956-1957-1958-1959-1960-1961-1962-1963-1964-1965-1966-1967-1968-1969-1970-1971-1972-1973-1974-1975-1976-1977-1978-1979-1980-1981-1982-1983-1984-1985-1986-1987-1988-1989-1990-1991-1992-1993-1994-1995-1996-1997-1998-1999-2000-2001-2002-2003-2004-2005-2006-2007-2008-2009-2010-2011-2012-2013-2014-2015-2016-2017-2018-2019-2020-2021-2022-2023-2024-2025-2026-2027-2028-2029-2030-2031-2032-2033-2034-2035-2036-2037-2038-2039-2040-2041-2042-2043-2044-2045-2046-2047-2048-2049-2050-2051-2052-2053-2054-2055-2056-2057-2058-2059-2060-2061-2062-2063-2064-2065-2066-2067-2068-2069-2070-2071-2072-2073-2074-2075-2076-2077-2078-2079-2080-2081-2082-2083-2084-2085-2086-2087-2088-2089-2090-2091-2092-2093-2094-2095-2096-2097-2098-2099-2100-2101-2102-2103-2104-2105-2106-2107-2108-2109-2110-2111-2112-2113-2114-2115-2116-2117-2118-2119-2120-2121-2122-2123-2124-2125-2126-2127-2128-2129-2130-2131-2132-2133-2134-2135-2136-2137-2138-2139-2140-2141-2142-2143-2144-2145-2146-2147-2148-2149-2150-2151-2152-2153-2154-2155-2156-2157-2158-2159-2160-2161-2162-2163-2164-2165-2166-2167-2168-2169-2170-2171-2172-2173-2174-2175-2176-2177-2178-2179-2180-2181-2182-2183-2184-2185-2186-2187-2188-2189-2190-2191-2192-2193-2194-2195-2196-2197-2198-2199-2200-2201-2202-2203-2204-2205-2206-2207-2208-2209-2210-2211-2212-2213-2214-2215-2216-2217-2218-2219-2220-2221-2222-2223-2224-2225-2226-2227-2228-2229-2230-2231-2232-2233-2234-2235-2236-2237-2238-2239-2240-2241-2242-2243-2244-2245-2246-2247-2248-2249-2250-2251-2252-2253-2254-2255-2256-2257-2258-2259-2260-2261-2262-2263-2264-2265-2266-2267-2268-2269-2270-2271-2272-2273-2274-2275-2276-2277-2278-2279-2280-2281-2282-2283-2284-2285-2286-2287-2288-2289-2290-2291-2292-2293-2294-2295-2296-2297-2298-2299-2300-2301-2302-2303-2304-2305-2306-2307-2308-2309-2310-2311-2312-2313-2314-2315-2316-2317-2318-2319-2320-2321-2322-2323-2324-2325-2326-2327-2328-2329-2330-2331-2332-2333-2334-2335-2336-2337-2338-2339-2340-2341-2342-2343-2344-2345-2346-2347-2348-2349-2350-2351-2352-2353-2354-2355-2356-2357-2358-2359-2360-2361-2362-2363-2364-2365-2366-2367-2368-2369-2370-2371-2372-2373-2374-2375-2376-2377-2378-2379-2380-2381-2382-2383-2384-2385-2386-2387-2388-2389-2390-2391-2392-2393-2394-2395-2396-2397-2398-2399-2400-2401-2402-2403-2404-2405-2406-2407-2408-2409-2410-2411-2412-2413-2414-2415-2416-2417-2418-2419-2420-2421-2422-2423-2424-2425-2426-2427-2428-2429-2430-2431-2432-2433-2434-2435-2436-2437-2438-2439-2440-2441-2442-2443-2444-2445-2446-2447-2448-2449-2450-2451-2452-2453-2454-2455-2456-2457-2458-2459-2460-2461-2462-2463-2464-2465-2466-2467-2

Appendix G

Incident Report Form / Investigation Form

INCIDENT / NEAR MISS REPORT AND INVESTIGATION - PAGE 1 OF 2			
TYPE OF INCIDENT - CHECK ALL THAT APPLY			
<input type="checkbox"/> INJURY/ILLNESS	<input type="checkbox"/> VEHICLE DAMAGE	<input type="checkbox"/> PROPERTY DAMAGE	<input type="checkbox"/> FIRE
<input type="checkbox"/> SPILL/RELEASE	<input type="checkbox"/> PERMIT EXCEEDENCE	<input type="checkbox"/> NEAR MISS	<input type="checkbox"/> 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? <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A		
DESCRIBE WHAT HAPPENED (STEP BY STEP - USE ADDITIONAL PAGES IF NECESSARY)			
AFFECTED EMPLOYEE INFORMATION			
NAME:	EMPLOYEE: <input type="checkbox"/> YES <input type="checkbox"/> 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? <input type="checkbox"/> YES <input type="checkbox"/> NO			
INJURY/ILLNESS INFORMATION			
NATURE OF INJURY OR ILLNESS:			
OBJECT/EQUIPMENT/SUBSTANCE CAUSING HARM:			
FIRST AID PROVIDED? <input type="checkbox"/> YES <input type="checkbox"/> NO			
IF YES, WHERE WAS IT GIVEN: <input type="checkbox"/> ON-SITE <input type="checkbox"/> OFF-SITE			
IF YES, WHO PROVIDED FIRST AID:			
WILL THE INJURY/ILLNESS RESULT IN: <input type="checkbox"/> RESTRICTED DUTY <input type="checkbox"/> LOST TIME <input type="checkbox"/> UNKNOWN			

INCIDENT / NEAR MISS REPORT AND INVESTIGATION - PAGE 2 OF 2		REPORT NO.
MEDICAL TREATMENT INFORMATION		
WAS MEDICAL TREATMENT PROVIDED? <input type="checkbox"/> YES <input type="checkbox"/> NO		
IF YES, WAS MEDICAL TREATMENT PROVIDED: <input type="checkbox"/> ON-SITE <input type="checkbox"/> DR.'S OFFICE <input type="checkbox"/> 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? <input type="checkbox"/> YES <input type="checkbox"/> NO		
REPORTABLE TO AGENCY? <input type="checkbox"/> YES <input type="checkbox"/> NO SPECIFY:		
WRITTEN REPORT: <input type="checkbox"/> YES <input type="checkbox"/> 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? <input type="checkbox"/> YES <input type="checkbox"/> NO SPECIFY:		
WRITTEN REPORT: <input type="checkbox"/> YES <input type="checkbox"/> 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:	

INVESTIGATIVE REPORT			
DATE OF INCIDENT:		DATE OF REPORT:	REPORT NUMBER:
INCIDENT COST: ESTIMATED: \$ _____		ACTUAL: \$ _____	
OSHA RECORDABLE(S): <input type="checkbox"/> YES <input type="checkbox"/> 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

- | | |
|---|---|
| <ol style="list-style-type: none"> 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 | <ol style="list-style-type: none"> 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 H

Daily Briefing Sign-In Sheet

DAILY BRIEFING SIGN-IN SHEET

Date: _____ Project Name/Location: _____

Person Conducting Briefing: _____

1. AWARENESS (topics discussed, special safety concerns, recent incidents, etc.)

2. OTHER ISSUES (HASP/EAP changes, attendee comments, etc.)

3. ATTENDEES (Print Name):

1.	21.
2.	22.
3.	23.
4.	24.
5.	25.
6.	26.
7.	27.
8.	28.
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20.	40.

491 WORTMAN AVENUE
BROOKLYN, NEW YORK

COMMUNITY AIR MONITORING PLAN

SUBMITTED TO:

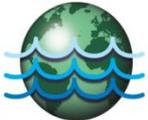


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APRIL 2013

491 WORTMAN AVENUE
BROOKLYN, NEW YORK

APRIL 2013

**COMMUNITY AIR MONITORING PLAN
491 WORTMAN AVENUE
BROOKLYN, NEW YORK**

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1.0 INTRODUCTION

This Community Air Monitoring Plan (CAMP) provides measures for protection for on-site workers and the downwind community (i.e., off-site receptors including residences, businesses, and on-site workers not directly involved in the remedial investigation) from potential airborne contaminant releases resulting from Supplemental Remedial Investigation (SRI) at 491 Wortman Avenue, 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 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.
- NYSDER-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:

- PhotoionizationDetector (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 MiniRam Model PDM-3 aerosol monitor or equivalent. Air will be monitored for VOCs with a portable Photovac MicroTip 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	25-100 ppm, non-transient	Don APR	Based on potential exposure to VOCs
PID	Breathing Zone	>100 ppm, non-transient	Don ASR or SCBA, Institute vapor/odor suppression measures, Notify HSM.	Increased exposure to site contaminants, potential for vapor release to public areas.
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 but < 150 $\mu\text{g}/\text{m}^3$ for 15 minutes	Institute dust suppression measures, Notify HSM.	Work to continue if particulate concentrations remain below 150 $\mu\text{g}/\text{m}^3$
Aerosol Monitor	Work Area Perimeter	>150 $\mu\text{g}/\text{m}^3$	Don ASR or SCBA, 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 operations 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 FOL/SHSO will interpret all monitoring data based on Table 1-2 and his/her professional judgment. The FOL/HSO shall review the data with the HSM 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 HSM.

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.