Interim Remedial Measure A
Construction Completion Report
Former Liberty Brass Off-Site
NYSDEC Site No. 241178A

43-25 38th Street
Long Island City, Queens, New York

March 2021

Chazen Project No. 42005.00

Chazen
A LaBella Company

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CERTIFICATIONS

I, Roger Keating P.E., certify that I am currently a NYS registered professional engineer, I had primary direct responsibility for the implementation of the subject construction program, and I certify that the Interim Remedial Measure Work Plan (IRMWP) was implemented and that all construction activities were completed in substantial conformance with the DER-approved IRMWP. The data submitted to DER demonstrates that the remediation requirements set forth in the IRMWP and all applicable statutes and regulations have been or will be achieved in accordance with the time frames, if any, established in the IRMWP.

EXECUTIVE SUMMARY

The Chazen Companies (Chazen) has prepared this Interim Remedial Measure A (IRM - A) Construction Completion Report (IRM-A CCR) on behalf of Liberty Brass / Ideal Trading Co to mitigate the potential for soil vapor intrusion at 43-25 38th Street (Site), hereinafter referred to as the Werwaiss Warehouse, or Warehouse. This Off-Site property (hereinafter "Site") is being investigated and mitigated for soil vapor intrusion as part of the Former Liberty Brass Off-Site #C241178A Consent Order Index #R2-20170515-184 obligations. Additional properties may be investigated and / or remediated as part of this project. The work presented herein represents the Construction Completion Report for Interim Remedial Measure A which was performed consistent with a June 2020 Interim Remedial Measure Work Plan (IRMWP). The objective of this Report is to document the Interim Remedial Measures that were performed in order to confirm, control, and mitigate the potential intrusion of vapors remaining under the Werwaiss site into indoor air.

The results of a previous investigation indicates the presence of trichloroethylene (TCE) in sub-slab soil vapor and indoor air at concentrations that require additional action. This IRM CCR documents the work performed to mitigate the potential for soil vapor intrusion at the Werwaiss Warehouse. The objectives of the IRMWP were to (1) eliminate the pathway for vapor migration from the sub-surface to indoor air, (2) install suction pits / venting wells and perform communications testing to support the design of a sub-slab depressurization system, if required, (3) perform confirmation sub-slab and soil vapor sampling to confirm whether a soil vapor condition continues to exist, (3) evaluate the potential contribution from ambient outdoor and / or other potential sources in the immediate vicinity of the Site, and (5) protect human health and the environment at the Site in connection with potential for soil vapor intrusion from the Former Liberty Brass Site by mitigating the exposure pathway.

The conceptual site model for the Site indicates that vapors containing TCE levels, are present in sub-slab soil vapor at concentrations that may present a risk for vapor intrusion according to a comparison of the matrices in the October 2006 (Updated May 2017) New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York ("NYSDOH Guidance.") Even though New York State does not have soil vapor cleanup standards, when the levels of both indoor air and sub-slab samples for one of the eight substances contained in the Guidance matrices exceed the recommended levels for mitigation, then mitigation is recommended by NYSDOH. These vapors appear to have accumulated and become trapped beneath the slab despite ongoing soil vapor extraction. The exact source of the vapors is not known with certainty, since there are also volatile organic sources (VOC) sources migrating onto the Liberty Brass site from upgradient sources. However, the conditional Track 1 remediation performed at the Former Liberty Brass Site has treated, contained, and / or removed the TCE-contaminated soil on that BCP site. The remedial action for the Former Liberty Brass Site also included the installation of a soil vapor extraction (SVE) system to remove residual volatile organic

compounds (VOCs) from the vadose zone in the onsite remaining contamination area and mitigate the potential for vapor intrusion throughout the site. This SVE system is removing residual vapors from the sub-surface thereby preventing the off-site migration of vapors and mitigating the potential for soil vapor intrusion at the Werwaiss Warehouse.

Vapors that formerly accumulated beneath the slab may be substantially reduced by both the removal and replacement of portions of the slab, which will allow trapped vapors to freely escape, sealing of cracks, which will prevent the migration of sub-slab vapors into the warehouse, and actively removing trapped vapors from the sub-surface through testing and venting of the suction pits vent wells. Field observations indicated that damaged concrete and linear cracks in the southern portion of the Werwaiss Warehouse may represent a potential pathway for the migration of sub-slab soil vapor to migrate into the Werwaiss Warehouse.

The phased remedial approach presented in the IRMWP was to mitigate the potential for sub-surface vapors to enter the building through:

(1) Removal and replacement of the damaged concrete slab near the loading area in the southwest portion of the warehouse,

(2) Sealing cracks in the slab in the southeast portion of the warehouse to the degree practicable using a non-Volatile Organic Compound (VOC) caulk and/or foam in slab cracks followed by the application of an epoxy layer or equivalent, and

(3) Installation of suction pits and / vent wells to confirm the design of a sub-slab depressurization system (SSDS), if necessary, and performing communications testing which will have the added benefit of removing vapors that have accumulated beneath the slab.

This IRM Construction Completion Report (CCR) provides the documentation that the remedial work required has been completed and has been performed in compliance with the NYSDEC-approved IRMWP and in conformance with DER-10. This IRM CCR provides a comprehensive account of the locations and characteristics of all material removed from the Site.

1.0 INTRODUCTION

The results of a previous investigation indicates the presence of trichloroethylene (TCE) in sub-slab soil vapor and indoor air at concentrations that require additional action. This IRM CCR documents the work performed to mitigate the potential for soil vapor intrusion at the Werwaiss Warehouse. The objectives of the IRMWP were to (1) eliminate the pathway for vapor migration from the sub-surface to indoor air, (2) install suction pits / venting wells and perform communications testing to support the design of a sub-slab depressurization system, if

required, (3) perform confirmation sub-slab and soil vapor sampling to confirm whether a soil vapor condition continues to exist, (3) evaluate the potential contribution from ambient outdoor and / or other potential sources in the immediate vicinity of the Site, and (5) protect human health and the environment at the Site in connection with potential for soil vapor intrusion from the Former Liberty Brass Site by mitigating the exposure pathway.

Vapors that formerly accumulated beneath the slab may be substantially reduced by both the removal and replacement of portions of the slab, which will allow trapped vapors to freely escape, sealing of cracks, which will prevent the migration of sub-slab vapors into the warehouse, and actively removing trapped vapors from the sub-surface through testing and venting of the suction pits vent wells. Field observations indicated that damaged concrete and linear cracks in the southern portion of the Werwaiss Warehouse may represent a potential pathway for the migration of sub-slab soil vapor to migrate into the Werwaiss Warehouse. The phased remedial approach presented in the IRMWP was to mitigate the potential for sub-surface vapors to enter the building.

This IRM does not address the potential for vapor intrusion from any potential on-site sources, which are not the responsibility of Liberty Brass / Ideal Trading Co. Should the presence of PCE, which was not a remedy driver for the Former Liberty Brass Site, persist in soil vapor following the evacuation of TCE vapors, additional investigation should be performed to evaluate the potential for on-Site source of PCE to exist in soils at the Werwaiss Warehouse Property.

This IRM Construction Completion Report (CCR) provides the documentation that the remedial work required has been completed and has been performed in compliance with the NYSDEC-approved IRMWP and in conformance with DER-10. This IRM CCR provides a comprehensive account of the locations and characteristics of all material removed from the Site.

2.0 SITE BACKGROUND

The Werwaiss Warehouse is an approximately 6,000 square foot (sf) warehouse located to the north of, and adjacent to, the Former Liberty Brass Site, located at 38-01 Queens Blvd. The Former Liberty Brass Site has been remediated by a third party under the New York State Brownfield Cleanup Program (BCP) to Conditional Track 1 levels. An April 2019 Off-Site Soil Vapor Investigation Report prepared by P.W. Grosser Consulting (PWGC) presents the results of the January 2019 soil vapor sampling work performed consistent with a New York State Department of Environmental Conservation (NYSDEC)-approved Work Plan dated January 2018. The results of the January 2019 Off-Site Soil Vapor Investigation indicated that the concentration of TCE in sub-slab soil vapor was 97 $\mu g/m^3$ and the indoor air concentration was 6 $\mu g/m^3$. According to the (NYSDOH) Guidance, these results indicated that mitigation was recommended for the Werwaiss Warehouse at that time. On May 13, 2019,

sampling results along with recommendations for next steps were provided to the owner of the Werwaiss Warehouse, W B Werwaiss Realty LLC c/o Werwaiss & Co., Inc., (Werwaiss), as required by NYSDEC.

As part of the Conditional Track 1 remediation performed at the Former Liberty Brass Site, all TCE-contaminated soil on that site has been treated, contained, and / or removed. A soil vapor extraction (SVE) system installed at the Former Liberty Brass Site is removing residual vapors from the sub-surface thereby preventing the off-site migration of vapors and mitigating the potential for soil vapor intrusion at the Werwaiss Warehouse. Therefore, conditions may have changed in the last year and several months since the time the first and only samples were taken at the Site.

2.1 Site Location, Current Usage, and Description of Surrounding Properties

The Site is located at 43-25 38th Street immediately north-adjacent to the Former Liberty Brass BCP Site, which soil has been remediated by a third party under the New York State Brownfield Cleanup Program (BCP) to Track 1 levels, but which groundwater and soil vapor is continuing to be remediated pursuant to an SVE system.

The on-Site tenant operations at the Werwaiss Warehouse include storing and building crates, packing artworks, furniture, and other specialty items, receiving, and releasing crates. The Warehouse is almost entirely filled with packed crate storage with many permanent storage racks along the walls throughout the Warehouse. There are three offices located in the northwest portion of the building, the northernmost of which overlies a small utility cellar. The tenant has five employees each of which spend approximately 3 out of 5 days each week in the building, either in the Warehouse or the offices. The warehouse loading gate is typically kept open except in the winter months when it is open intermittently. This practice frequently introduces outdoor air into the warehouse, which mitigates the potential for exposure.

In addition, it is important to note that the NYSDOH Guidance matrices have been primarily developed for residential exposure scenarios which assume exposure for 24 hours per day, seven days per week. In contrast, the Site is a commercial warehouse with large loading dock doors that open and close frequently and / or are often kept open for extended periods with limited on-Site personnel.

Based upon the long history of industrial usage in the surrounding area, other regional upgradient sources of dissolved-phase chlorinated aliphatic hydrocarbons (CAHs) in groundwater have potentially migrated beneath the Former Liberty Brass Site as well as the adjacent properties. In addition, there are numerous commercial and industrial properties in the immediate vicinity of the Site, with the potential to have used and / or released chlorinated solvents to the sub-surface and which may represent an additional potential source of TCE in the subsurface at the Site. The source(s) of the vapors detected in samples collected at the Adjacent Properties has not been conclusively identified.

The Site location is presented in **Figure 1**.

There are presently no plans to redevelop the property to a different use.

2.2 Site Geology/Hydrogeology

The Site 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 is found at the surface in nearly all of Kings and Queens Counties.

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 46 feet below ground surface (bgs.) The lithologic description of the sediments from soil borings installed during previous investigations at the Former Liberty Brass Site identifies the contaminated fill material from zero to approximately twelve feet bgs underlain by layers of fine to medium silty sands and silt.

Regional groundwater flow direction is southeast to northwest. Municipal water supply is provided by the New York City Department of Environmental Protection (NYCDEP.)

2.3 Historical Uses and Surrounding Properties

A review of historical documentation indicates that the property at 43-25 38th Street was developed sometime prior to 1936 and has been utilized as a manufacturing facility in 1936 and as a garage from approximately 1947 to 1950 prior to being utilized as a warehouse. The property is owned by WB Werwaiss Realty LLC. The property contains two separate warehouse units, with the southern unit being investigated having been occupied by CFL Art Services, which stores, transports, and installs art, since at least 2005.

A number of additional properties with the potential to have utilized and / or released TCE to the sub-surface exist within the immediate vicinity of the Site including but not limited to, a former electro-plating facility, multiple former manufacturing facilities, multiple former auto repair facilities, the former manufacturing and garage use at this Site, and the Former Liberty Brass Site. Surrounding land uses are presented in **Figure 2**.

2.4 Environmental Setting

This section provides information on the Site geology, soils, hydrogeology, surface water resources, and land uses in the site vicinity.

2.4.1 Geology

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.

2.4.2 Hydrogeology

The Site 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 is found at the surface in nearly all of Kings and Queens Counties.

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 46 ft bgs. The lithologic description of the sediments from soil borings installed during previous investigations at the Former Liberty Brass Site identifies the contaminated fill material from zero to approximately 12 ft bgs underlain by layers of fine to medium silty sands and silt.

Regional groundwater flow direction is southeast to northwest. Municipal water supply is provided by the New York City Department of Environmental Protection (NYCDEP). The Site elevation is approximately 65 feet above mean sea level and is generally level.

2.5 Existing Conditions

Throughout the majority of the Warehouse the concrete slab appeared to be intact with the exception of the southernmost 20 feet where the concrete was damaged and / or cracked and which is adjacent to the Former Liberty Brass BCP Site. The damaged concrete in the loading area was limited to the southernmost 15 to 20 ft of

the building and extends from the entrance of the loading gate on the western side of the building to approximately 45 ft to the east. There were also several linear cracks in the southernmost 15-20 ft of the building that extend further east for another approximately 40 ft.

2.6 Summary of Previous Investigations

An Off-Site Soil Vapor Investigation was performed in January 2019 by former consulting firm PWGC consistent with a New York State Department of Environmental Conservation (NYSDEC)-approved Work Plan. The scope of work consisted of a geophysical survey, site inspection, and collection of co-located sub-slab and indoor air samples. The purpose was to determine if an off-site vapor intrusion condition existed at the Site as the result of migration of soil vapor from the Former Liberty Brass Site located at 38-01 Queens Boulevard in Long Island City, Queens, New York. Data gaps remain regarding the potential contribution from ambient outdoor sources and / or other potential sources in the immediate vicinity of the Site.

On January 17, 2019, PWGC collected one sub-slab vapor sample under the concrete slab and one indoor air sample above the floor from a central location within the Warehouse. The samples were analyzed for VOCs according to EPA method TO-15. The work was performed consistent with the approved Off-Site Soil Vapor Investigation Work Plan. The results of the Off-Site Soil Vapor Investigation at the Warehouse indicated that the concentration of TCE in sub-slab soil vapor was 97 µg/$m^3$and the indoor air concentration was 6 µg/m^3. The concentration of tetrachloroethylene (PCE) in sub-slab soil vapor was 19 µg/m^3 and the indoor air concentration was 5 µg/m^3. According to the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York, the TCE results indicate that mitigation is recommended for the Warehouse. According to NYSDOH guidance these results do not require immediate action.

Figure 3 presents the layout of the Werwaiss Warehouse.

3.0 CONCEPTUAL SITE MODEL

The conceptual site model for the Site indicates that vapors containing TCE levels, are present in sub-slab soil vapor at concentrations that may present a risk for vapor intrusion according to a comparison of the matrices in the October 2006 (Updated May 2017) New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York ("NYSDOH Guidance.") Even though New York State does not have soil vapor cleanup standards, when the levels of both indoor air and sub-slab samples for one of the eight substances contained in the Guidance matrices exceed the recommended levels for mitigation, then mitigation is recommended by NYSDOH. These vapors appear to have accumulated and become trapped beneath the slab despite ongoing soil vapor extraction. The exact source of the vapors is not known with certainty, since there are also volatile organic sources (VOC) sources migrating onto the Liberty Brass site from upgradient sources.

However, the conditional Track 1 remediation performed at the Former Liberty Brass Site has treated, contained, and / or removed the TCE-contaminated soil on that BCP site. The remedial action for the Former Liberty Brass Site also included the installation of a soil vapor extraction (SVE) system to remove residual volatile organic compounds (VOCs) from the vadose zone in the onsite remaining contamination area and mitigate the potential for vapor intrusion throughout the site. This SVE system is removing residual vapors from the sub-surface thereby preventing the off-site migration of vapors and mitigating the potential for soil vapor intrusion at the Werwaiss Warehouse.

Vapors that formerly accumulated beneath the slab may be substantially reduced by both the removal and replacement of portions of the slab, which will allow trapped vapors to freely escape, sealing of cracks, which will prevent the migration of sub-slab vapors into the warehouse, and actively removing trapped vapors from the sub-surface through testing and venting of the suction pits vent wells. Field observations indicated that damaged concrete and linear cracks in the southern portion of the Werwaiss Warehouse may represent a potential pathway for the migration of sub-slab soil vapor to migrate into the Werwaiss Warehouse.

The phased remedial approach presented in the IRMWP was to mitigate the potential for sub-surface vapors that have migrated from the Former Liberty Brass Site and which have accumulated beneath the slab to enter the Werwaiss Warehouse building through:

(1) Removal and replacement of the damaged concrete slab near the loading area in the southwest portion of the warehouse,

(2) Sealing cracks in the slab in the southeast portion of the warehouse to the degree practicable using a non-Volatile Organic Compound (VOC) caulk and/or foam in slab cracks followed by the application of an epoxy layer or equivalent, and

(3) Installation of suction pits and / vent wells to confirm the design of a sub-slab depressurization system (SSDS), if necessary, and performing communications testing which will have the added benefit of removing vapors that have accumulated beneath the slab.

This IRM does not address the potential for vapor intrusion from any potential on-site sources, which are not the responsibility of Liberty Brass / Ideal Trading Co. Should the presence of PCE, which was not a remedy driver for the Former Liberty Brass Site, persist in soil vapor following the evacuation of TCE vapors, additional investigation should be performed to evaluate the potential for on-Site source of PCE to exist in soils at the Werwaiss Warehouse Property.

4.0 INTERIM REMEDIAL MEASURE

4.1 Interim Remedial Measure Objectives

Field observations indicated that damaged concrete and linear cracks in the southern portion of the Werwaiss Warehouse may represent a potential pathway for the migration of sub-slab soil vapor to migrate into the Werwaiss Warehouse. The phased remedial approach presented in the IRMWP was to mitigate the potential for sub-surface vapors to enter the building through:

(1) Removal and replacement of the damaged concrete slab near the loading area in the southwest portion of the warehouse,

(2) Sealing cracks in the slab in the southeast portion of the warehouse to the degree practicable using a non-Volatile Organic Compound (VOC) caulk and/or foam in slab cracks followed by the application of an epoxy layer or equivalent, and

(3) Installation of suction pits and / vent wells to confirm the design of a sub-slab depressurization system (SSDS), if necessary, and performing communications testing which will have the added benefit of removing vapors that have accumulated beneath the slab.

In addition, the IRMWP required that supplemental soil vapor intrusion evaluation sampling be performed during the heating season to confirm whether the IRM constitutes a completed remedial action that is protective of human health and the environment.

4.2 Interim Remedial Measure Activities

4.2.1 Concrete Slab Removal

The removal and replacement of the damaged concrete slab near the loading area in the southwest portion of the Warehouse was performed July 27, 2020 through July 31, 2020 by Nova Concrete Contractors, Inc. (Nova), under Chazen oversight. Chazen personnel observed the concrete removal and screened excavated soil / fill for indications of contamination by visual means, odor, and monitoring with a PID. The slab removed using a mini-excavator and was determined to be approximately 4.5 - 5 inches thick. Approximately 33 yards of concrete was removed. Beneath the slab was historic fill containing soil, brick, glass, asphalt, cobbles, and gravel. No odors, staining, or other evidence of release of hazardous material was observed during remedial activities.

Upon removal of the concrete, PID measurements indicated the presence of volatile organic compound (VOC) vapors. At approximately 10:00 AM on July 27, 2020, PID readings at the soil surface were up to 1.8 ppm in the western portion of the area from which the slab was removed and up to 1.2 ppm in the eastern portion. Ambient air concentrations within the warehouse to the north of the slab removal area ranged from 0.9 to 1.1 ppm at this

time. By 10:50 AM the vapor concentrations on the soil surface has decreased significantly to approximately 0.2 ppm at both locations. Ambient air concentrations within the warehouse to the north and east of the slab removal area ranged from 0.5 to 0.7 ppm at this time. No complaints were reported. The presence of vapors inside the Werwaiss Warehouse had subsided by the next day with readings of 0.0 ppm recorded throughout the warehouse at the soil surface.

4.2.2 Vent Well / Suction Pipe Installation and Slab Replacement

On July 28, 2020, Laurel Environmental Geosciences, DPC began soil removal and trenching activities under Chazen oversight. Approximately four inches of surficial soil was removed and loaded into a roll-off to allow for pouring of a new eight-inch thick lab. Excavated soil was temporarily stockpiled inside the building prior to being loaded into a roll-off for off-site disposal. PID readings did not indicate the presence of any VOCs in the warehouse or soil surface at any point throughout the day. No odors, staining, or other evidence of release of hazardous material was observed during remedial activities.

Two trenches, one approximately 50 ft long, 2 ft wide, and 2 ft deep and another approximately 15 ft long, 2 ft wide, and 2 ft deep were excavated to accommodate horizontal vent well installation beneath the new slab to be poured in the loading area. Additional details are provided in Section 5.2.5. The soil that was removed from the trench, at depths of 8 to 24 inches below grade, was placed into a second roll-off.

Soil moving, trenching, placement of horizontal vent well piping, and imported gravel placement activities were completed on July 29, 2020. On July 30, 2020, imported gravel placement, trench backfilling, soil grading, and rebar placement was competed in preparation for concrete pouring. In addition, although not required, a 20 ml vapor barrier was installed by Laurel Environmental Geosciences, DPC, under Chazen oversight before the new slab was poured as an additional protective measure. PID readings did not indicate the presence of any VOCs in the warehouse or soil surface at any point throughout the day. No odors, staining, or other evidence of release of hazardous material was observed during remedial activities. No complaints were reported. The new concrete slab was poured on July 31, 2020 by Nova, under Chazen oversight.

On August 7, 2020, two additional suction pits and four vacuum monitoring points (VMPs) were installed in the warehouse by Laurel Environmental Geosciences, DPC, under Chazen oversight.

4.2.3 Waste Management

Waste characterization sampling was performed for off-site disposal in a manner suitable to the receiving facility and in conformance with applicable permits. A waste characterization sample collected from the material below the slab was submitted to the laboratory for analysis on July 30, 2020. This soil samples was analyzed for were analyzed for Total VOCs, Total SVOCs, Total Petroleum Hydrocarbons (both diesel and gasoline range,) PCBs, RCRA

metals, TCLP RCRA Metals, Reactivity – Cyanide and Sulfide, moisture, paint filter, corrosivity (pH) and ignitability. Results indicated the material may be hazardous for lead. Subsequently, waste characterization samples were collected from the first roll-off containing materials from the top four inches below the slab and well as from the second roll-off containing material from the trenches at depths of 8 to 24 inches below grade and submitted to the laboratory for analysis. These samples were analyzed for the same criteria as indicated above. The material in the first roll-off was confirmed to be hazardous or lead. The material in the second roll-off was determined to be non-hazardous for lead as confirmed by a Contained-In Determination provided by NYSDEC.

Approximately 32 tons of non-hazardous soil was transported by Innovative Recycling and properly disposed at Clean Earth of Carteret on September 15, 2020. Approximately 19 tons of hazardous soil (lead) was transported by Innovative Recycling and properly disposed at Clean Earth of New Jersey on September 15, 2020. Approximately 33 cubic yards of concrete was transported by Freehold Cartage, Inc. and properly disposed at Allocco Recycling, Ltd. on July 27, 2020. Transport of materials was performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364.

Attachment A contains waste disposal documentation.

4.2.4 Crack Sealing

Visible cracks located in the remainder of the southern portion of the warehouse outside of the new concrete slab were sealed on August 11, 2020 with Retro-Coat caulk followed by the application of an epoxy layer.

4.2.5 Suction Pit and Vent Well Installation

Suction pit and vent well locations were confirmed during the design process, in consultation with the owner and tenants, to accommodate existing facility equipment and operations, minimize potential impact on current and future facility operations, and allow for future access, if necessary.

Two trenches, one approximately 50 ft long, 2 ft wide, and 2 ft deep and another approximately 15 ft long, 2 ft wide, and 2 ft deep were excavated to accommodate horizontal vent well installation beneath the new slab to be poured in the loading area. The horizontal vent well installed beneath the newly poured in the southern portion of the Warehouse extending approximately 45 ft to the east from the entrance of the loading area. The horizontal vent well was constructed of three independent 15 ft sections of screened 4-inch PVC pipe each piped individually back to a common manhole located along southern boundary of the Warehouse.

Two additional suction pits were installed in the warehouse including one located to the north of the horizontal vent wells near the office and another located to the east of the horizontal vent wells toward the rear of the building. In addition, four VMPs were installed through the building concrete floor system for monitoring of sub-

slab vacuum influence of the suction pits and vent wells as part of communication testing activities. The VMPs were designed to also be used as sub-slab vapor sampling points during future vapor sampling events.

Attachment C presents suction pit and vent well As-Built Drawings.

4.2.6 Communications Testing and Air Sampling

Communications testing and venting was performed between August 20, 2020 and August 21, 2020 to help determine and evaluate the permeability of the existing sub-surface soils under the concrete slab in order to confirm the design of an SSDS, if necessary. Vacuum and pressure gauges were installed at each suction pit and vent well on the piping. A vacuum was placed upon the section pits and horizontal vent wells using a 1.5 hp regenerative blower which was connected to the suction pits and vent wells using temporary PVC piping. Communications testing was performed on each suction pit and vent well individually and combined at varying flow rates. Pressure was monitored at four VMPs located throughout the warehouse using a hand-held manometer. The installation of suction pits and vents wells and the communications testing was performed by Laurel Environmental Geosciences, DPC, under Chazen oversight, in accordance with applicable city, state , and local laws and codes for the City of New York.

The communications testing confirmed that the horizontal vent wells and suction pits provided the necessary influence should the SSDS need to be activated in the future.

Table 1 presents a summary of the observed vacuum readings collected from the suction pits, vent wells, and blower. **Table 2** presents the manometer readings for the sub-slab VMPs.

4.2.7 Post-Installation Vapor Sampling

On September 24, 2020, Chazen collected five sub-slab vapor samples (SV-1 through SV-5) under the concrete slab and two indoor air samples (IA1-1 and IA1-2) within the Warehouse and offices. The samples were analyzed for VOCs according to EPA method TO-15. The results indicated that the presence of TCE in four out of the five sampling locations and both indoor air samples with concentrations of up to 290 µg/m^3 in sub-slab soil vapor and up to 0.32 µg/m^3 in indoor air. PCE was present in one out of the five sampling locations and one indoor air sample with a concentration of 250 µg/m^3 in sub-slab soil vapor and up to 3.5 µg/m^3 in indoor air.

The source of PCE in soil vapor at the Werwaiss Warehouse is unclear. PCE was not a remedy driver for the Former Liberty Brass Site. The presence of PCE in soil vapor at the Werwaiss Warehouse may indicate the potential for another off-site source or the presence of on-site source of PCE to be present in soils at the Werwaiss Warehouse.

A comparison of results at each sampling location according to the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York indicate the following actions are recommended that mitigation:

- SV-1 / IA1-2: Monitoring recommended for TCE; No further action recommended for PCE.
- SV-2 / IA1-1: Mitigation recommended for TCE; No further action recommended for PCE.
- SV-3 / IA1-1: No further action recommended for TCE; No further action recommended for PCE.
- SV-4 / IA1-1: Monitoring recommended for TCE; No further action recommended for PCE.
- SV-5 / IA1-1: Monitoring recommended for TCE; No further action recommended for PCE.

These results indicate that mitigation is recommended for the Warehouse.

Table 3 and **Figure 4** present the post-installation soil vapor and indoor air sampling locations and laboratory analytical results.

4.2.8 Reporting

Daily and monthly reports were submitted to NYSDEC during IRM activities.

4.2.9 Deviations for the IRMWP

Deviations from the IRMWP were promptly reported to NYSDEC for approval and fully explained herein.

A VMP planned for the office space could not be installed because of the presence of an elevated wood floor. The area of influence of the suction pit and horizontal vent wells have been extrapolated from the monitoring data for four VMPs in the warehouse to confirm influence beneath the office space.

Supplemental soil vapor intrusion evaluation sampling was performed to confirm whether the IRM constitutes a completed remedial action that is protective of human health and the environment. However, the sampling was performed during the non-heating season and data validation was not performed. These sampling results indicated that mitigation is recommended for the Warehouse. As a result, NYSDEC required that the system piping be competed above grade and that the system be activated for approximately one year. The system construction will be performed in Spring 2021. As per NYSDEC, supplemental soil vapor intrusion evaluation sampling will be performed during the next heating season (2021 – 2022) to confirm that the SSDS is protective of human health and the environment. The results will be evaluated as per the Operation and Maintenance Plan (O&M) to determine whether the system may be terminated at that time.

4.2.10 Interim Remedial Measure - Governing Documents

4.2.10.1 Site Specific Health & Safety Plan

All remedial work performed under this IRM was conducted in accordance with the Site Specific Health and Safety Plan (HASP) and the IRMWP approved by the NYSDEC on June 30, 2020. The Health and Safety Plan is included as **Attachment B.**

4.3 Document Repository

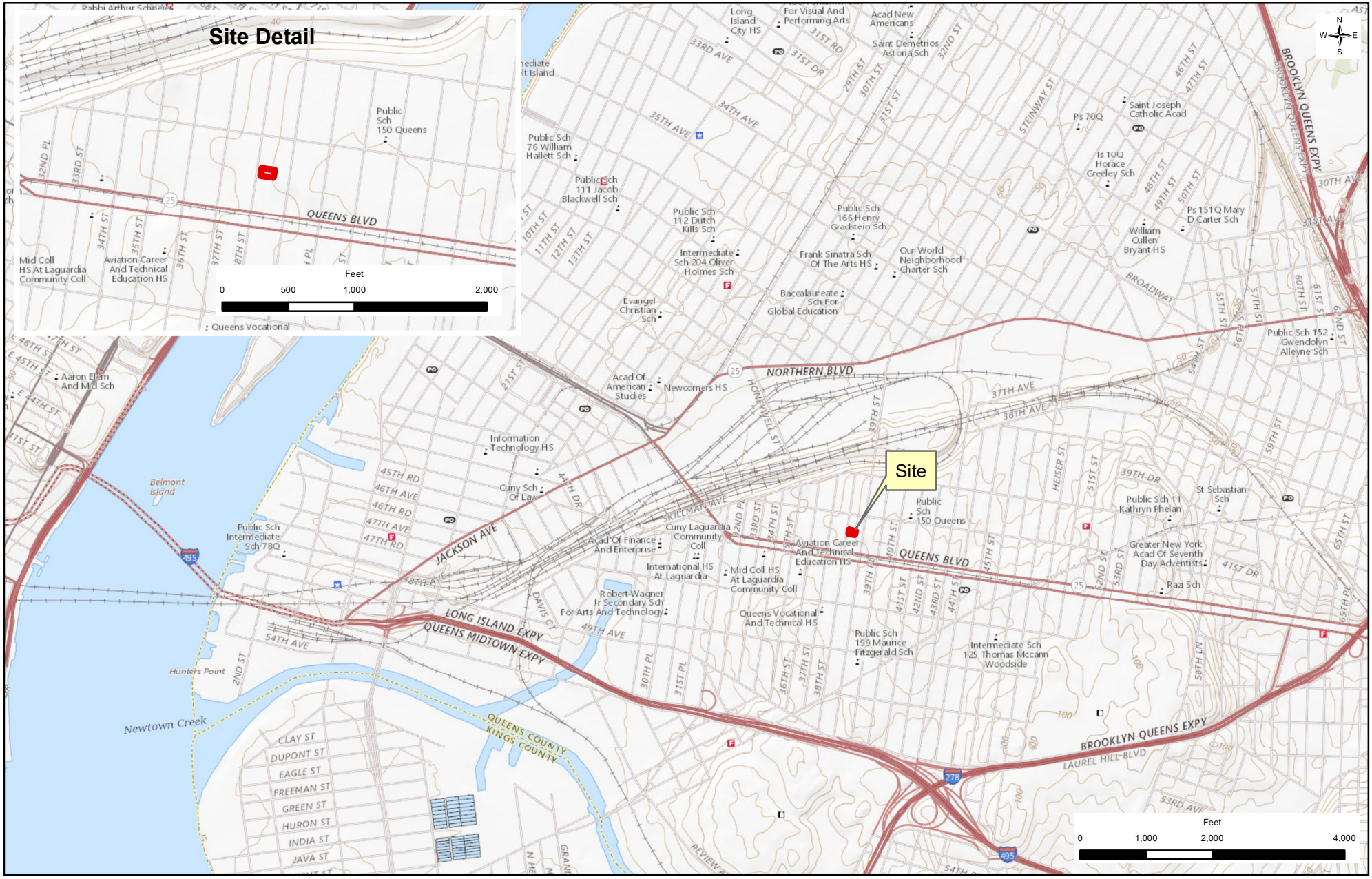
Document repositories have been established at the following location which contains applicable project documents:

Queens Sunnyside Library
Attn: Joseph Schiavone
43-06 Greenpoint Avenue
Long Island City, NY 11104
phone: 718-784-3033

5.0 REFERENCES

1. NYSDEC, DER, December 2006, 6 NYCRR Part 375 Subpart 6, Remedial Program Soil Cleanup Objectives.
2. NYSDEC, DER, May 2010, DER-10 - Technical Guidance for Site Investigation and Remediation.
3. NYSDOH, October 2006, Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (updated May 2017.)

FIGURES



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Werwaiss Warehouse

Figure 1 - Site Location Map

43-25 38th Street
Long Island City, Queens, New York

Source: US Topo 2018 - USGSTopo (MapServer) Layer: USGS TNM Topo Base Map. Accessed 13 April 2020

Drawn:	MO/STF
Date:	3/25/20
Scale:	1 inch equals 2,000 feet
Project:	42005.00
Figure:	1

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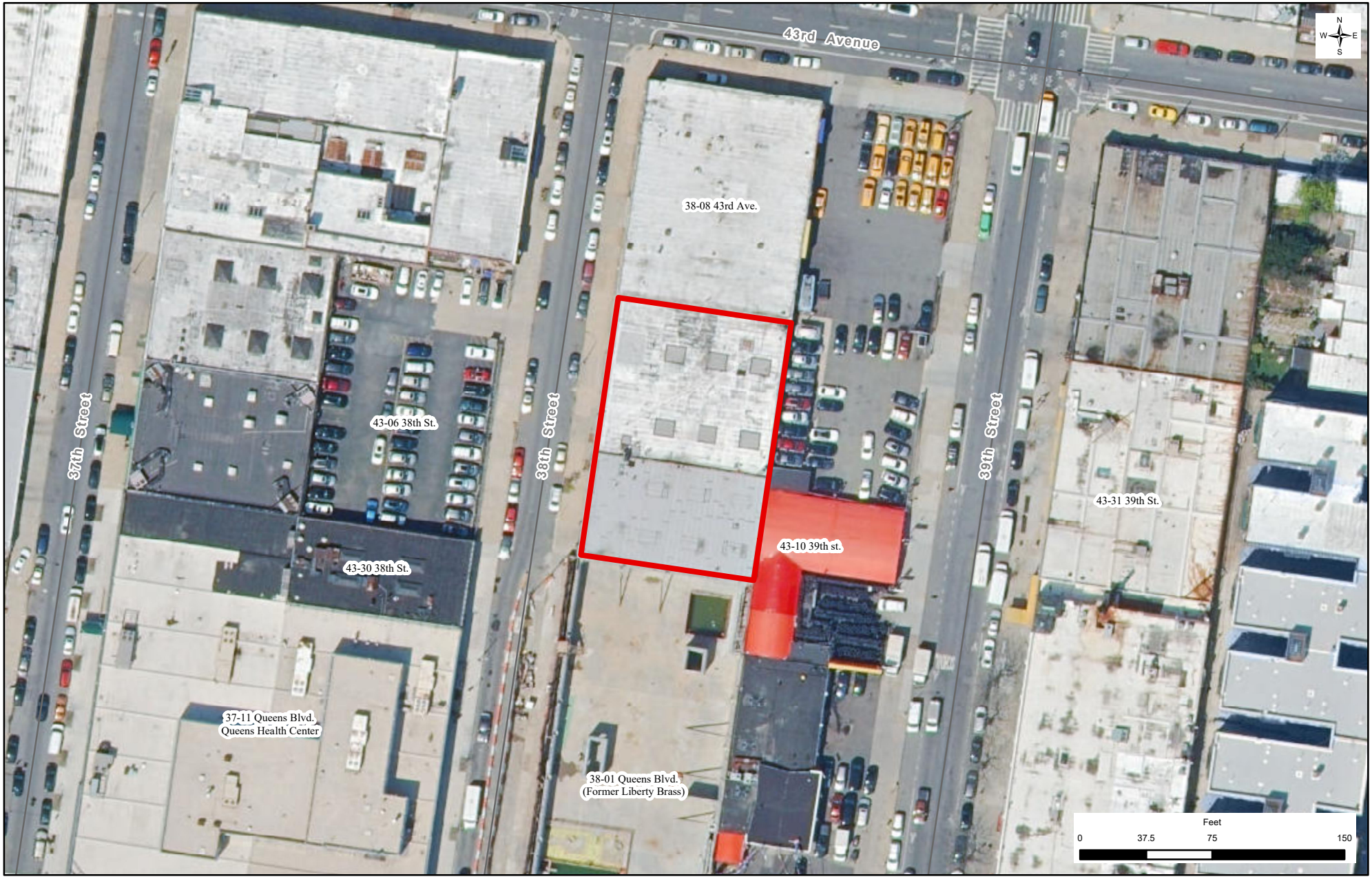

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Werwaiss Warehouse

Figure 2 - Site Plan

43-25 38th Street
Long Island City, Queens, New York

Source: NYS Office of Technology 2016 orthophoto imagery;
NYS Department of Transportation 2008 Roads Dataset

Drawn:	MO
Date:	3/12/2020
Scale:	1 inch equals 75 feet
Project:	42004.00
Figure:	2

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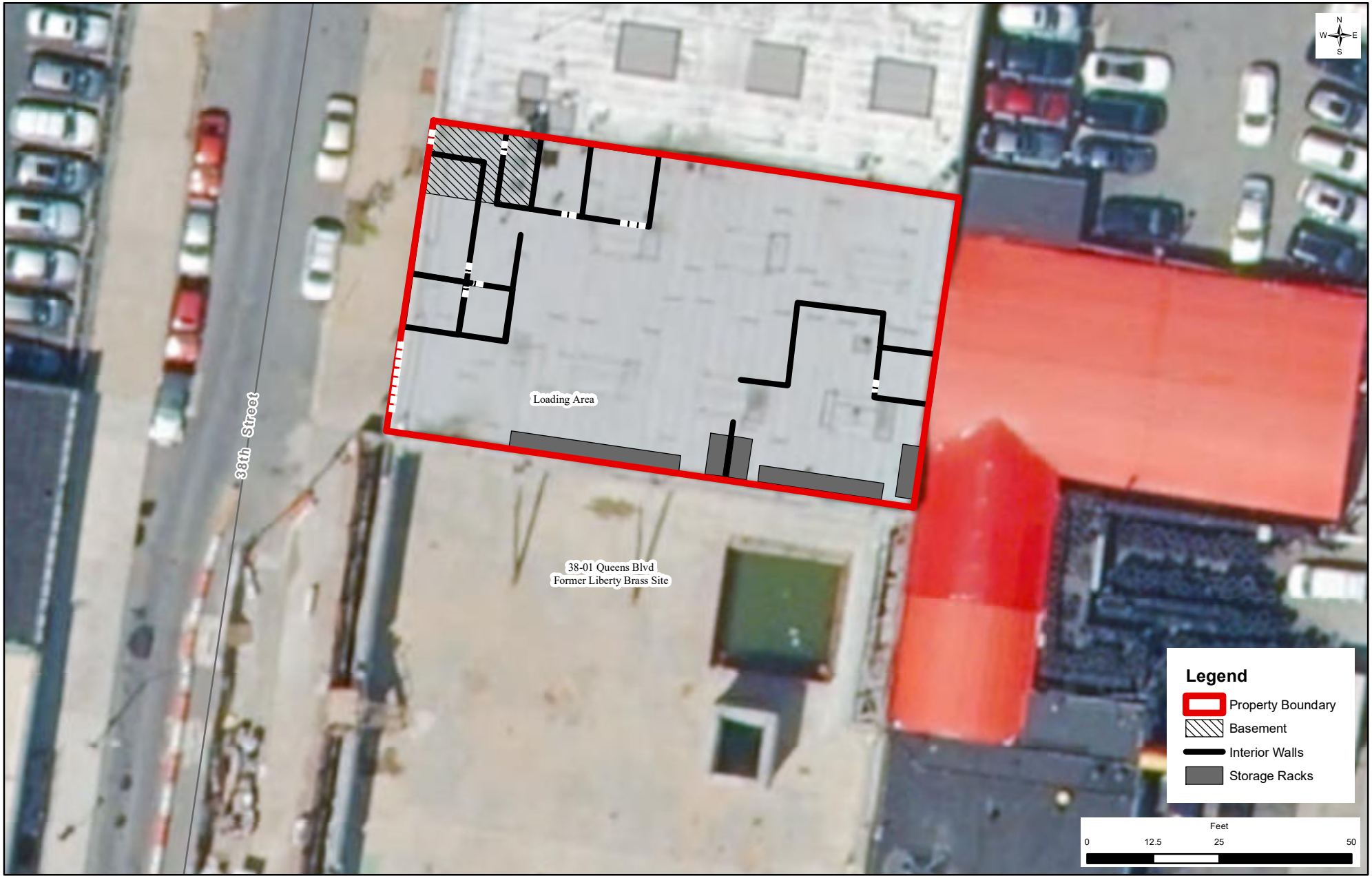

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Werwaiss Warehouse

Figure 3 - Site Detail

43-25 Queens Boulevard
Long Island City, Queens, New York

Source: NYS Office of Technology 2016 orthophoto imagery;
NYS Department of Transportation 2008 Roads Dataset

Drawn:	MO/STF
Date:	3/25/20
Scale:	1 inch equals 25 feet
Project:	42005.00
Figure:	3

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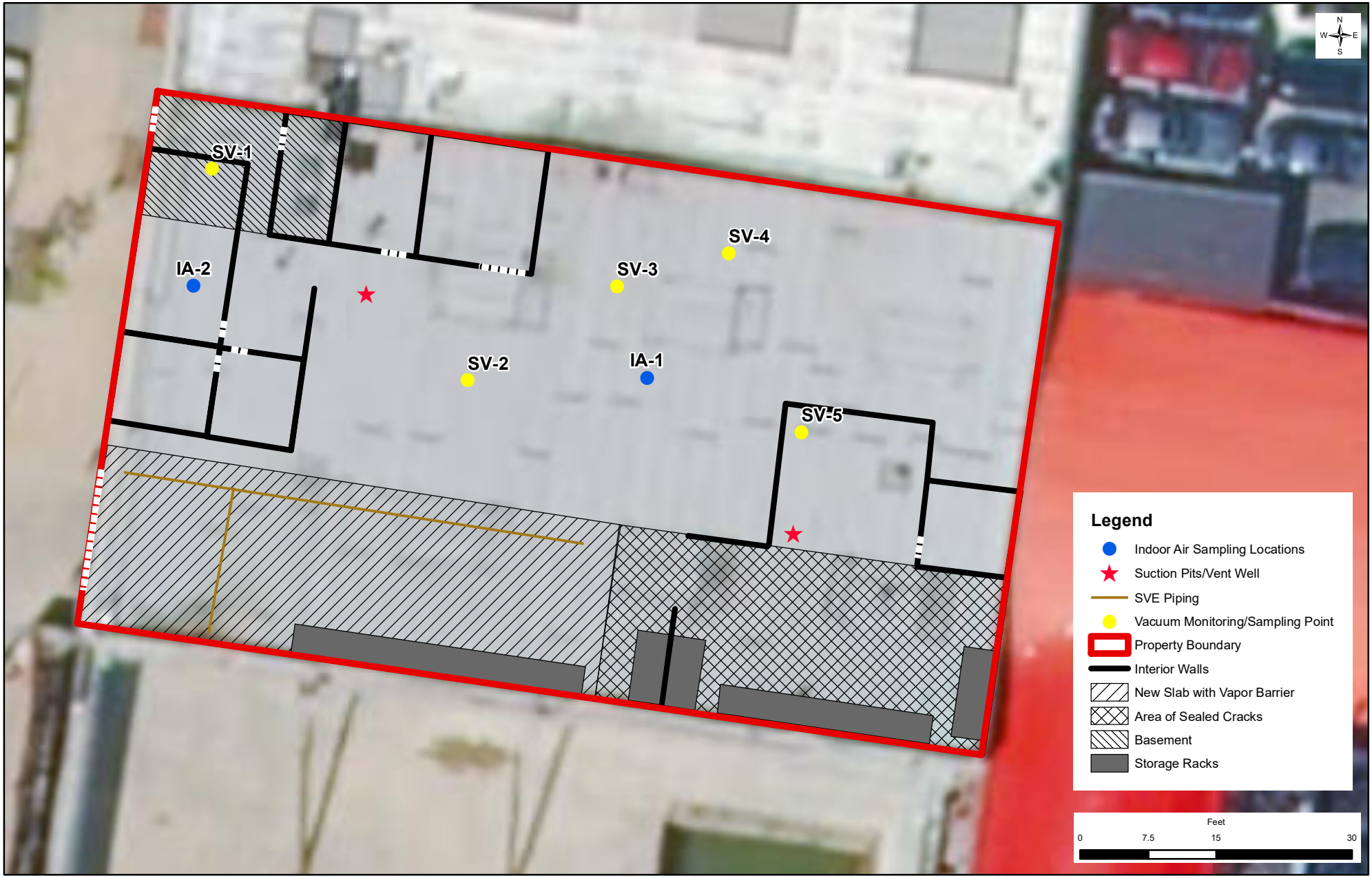

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Werwaiss Warehouse

Figure 4 - Vacuum Monitoring and Vapor Sampling Locations

43-25 Queens Boulevard
Long Island City, Queens, New York

Source: NYS Office of Technology 2016 orthophoto imagery;
NYS Department of Transportation 2008 Roads Dataset

Drawn:	MO/STF
Date:	03/10/2021
Scale:	1 inch equals 15 feet
Project:	42005.00
Figure:	4

Document Path: Z:\projects\42000-42099\42005.00_Ideal Trading-Werwaiss Warehouse\GIS\Figure4-V3_SoilVapor.mxd

TABLES

Table 1

Vacuum Monitoring at Suction Pits /Vent Wells

Werwaiss Warehouse - 42005.00

Test: Suction Pit One (SP-1)						In	Out
Time: 14:15 Pipe Size: 2" Diameter					Flow rate (cfm) =	20	20
	ft/min	Vacuum in (-) inches of H20					PPM
	Hot Wire	SP-1	VMP-1	VMP-2	VMP-3	VMP-4	PID
start							
5 minutes	2421	9.80	0.069	0.005	0.002	0.010	0.0
10 minutes	1817	13.6	0.071	0.005	0.002	0.015	0.0
15 minutes	1975	13.4	0.070	0.011	0.000	0.010	0.0
20 minutes	2737	12.5	N/A	N/A	N/A	N/A	N/A
30 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Note: Unable to increase flow rate to 30 cfm due to tight soil.							

Test: Suction Pit Two (SP-2)						In	Out
Time: 15:25 Pipe Size: 2" Diameter					Flow rate (cfm) =	20	20
	ft/min	Vacuum in(-) inches of H20					PPM
	Hot Wire	SP-2	VMP-1	VMP-2	VMP-3	VMP-4	PID
start							
5 minutes	817	1.70	0.001	0.000	0.001	0.085	0.0
10 minutes	960	1.30	0.000	0.000	0.000	0.081	0.0
15 minutes	782	1.70	0.000	0.000	0.000	0.079	0.0
20 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Test: Suction Pit Two (SP-2)						In	Out
Time: 15:45 Pipe Size: 2" Diameter					Flow rate (cfm) =	35	N/A
	ft/min	Vacuum in(-) inches of H20					PPM
	Hot Wire	SP-2	VMP-1	VMP-2	VMP-3	VMP-4	PID
start							
5 minutes	1005	3.10	0.000	0.000	0.001	0.141	0.0
10 minutes	1105	3.10	0.001	0.000	0.001	0.146	0.0
15 minutes	2211	13.1	0.001	0.000	0.001	0.146	0.0
20 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Test: Suction Pit Two (SP-2)						In	Out
Time: 16:05 Pipe Size: 2" Diameter					Flow rate (cfm) =	45	N/A
	ft/min	Vacuum in(-) inches of H20					PPM
	Hot Wire	SP-2	VMP-1	VMP-2	VMP-3	VMP-4	PID
start							
5 minutes	1658	4.60	0.003	0.005	0.002	0.195	0.0
10 minutes	2283	4.50	0.001	0.000	0.001	0.195	0.0
15 minutes	3170	4.60	0.000	0.003	0.001	0.195	0.0
20 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 1

Vacuum Monitoring at Suction Pits /Vent Wells

Werwaiss Warehouse - 42005.00

Test: Suction Pit One (SP-1) and Suction Pit Two (SP-2)								In	Out
Time: 9:20 Pipe Size: 2" Diameter							Flow rate (cfm) at blower =	20	N/A
	ft/min		Vacuum in(-) inches of H20						PPM
	SP-1 Hot Wire	SP-2 Hot Wire	SP-1	SP-2	VMP-1	VMP-2	VMP-3	VMP-4	PID
start									
5 minutes	304	205	0.180	0.190	0.003	0.000	0.004	0.034	N/A
10 minutes	263	218	0.170	0.187	0.004	0.012	0.001	0.030	N/A
15 minutes	268	213	0.180	0.187	0.007	0.000	0.000	0.020	N/A
20 minutes	324	248	0.197	0.201	0.005	0.000	0.001	0.033	N/A
30 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Test: Suction Pit One (SP-1) and Suction Pit Two (SP-2)								In	Out
Time: 10:00 Pipe Size: 2" Diameter							Flow rate (cfm) at blower =	35	N/A
	ft/min		Vacuum in(-) inches of H20						PPM
	SP-1 Hot Wire	SP-2 Hot Wire	SP-1	SP-2	VMP-1	VMP-2	VMP-3	VMP-4	PID
start									
5 minutes	286	348	0.347	0.375	0.004	0.003	0.000	0.060	N/A
10 minutes	338	410	0.351	0.342	0.002	0.000	0.001	0.080	N/A
15 minutes	268	318	0.345	0.341	0.006	0.000	0.001	0.054	N/A
20 minutes	225	289	0.348	0.335	0.005	0.000	0.001	0.063	N/A
30 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Test: Suction Pit One (SP-1) and Suction Pit Two (SP-2)								In	Out
Time: 10:30 Pipe Size: 2" Diameter							Flow rate (cfm) at blower =	50	N/A
	ft/min		Vacuum in(-) inches of H20						PPM
	SP-1 Hot Wire	SP-2 Hot Wire	SP-1	SP-2	VMP-1	VMP-2	VMP-3	VMP-4	PID
start									
5 minutes	247	446	0.515	0.515	0.007	0.000	0.003	0.105	N/A
10 minutes	224	511	0.515	0.478	0.004	0.000	0.001	0.106	N/A
15 minutes	422	448	0.520	0.498	0.004	0.000	0.003	0.092	N/A
20 minutes	222	376	0.511	0.470	0.004	0.000	0.002	0.094	N/A
30 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes: PPM = Parts Per Million; cfm = Cubic Feet per Minute; PID = Photoionization Detector; VMP = Vapor Monitoring Point; SP = Suction Pit; ft/min = Feet per Minute; N/A = not applicable

Table 2

Pressure Monitoring at Vapor Monitoring Points

Werwaiss Warehouse - 42005.00

Test: Eastern Leg (HVW-1)						In	Out
Time: 11:15 Pipe Size: 2" Diameter					Flow rate (cfm) =	20	20
	ft/min	Vacuum in (-) inches of H20					PPM
	Hot Wire	HVW-1	VMP-1	VMP-2	VMP-3	VMP-4	PID
start		0.40	0.000	0.001	0.001	0.030	0.0
5 minutes	N/A	0.50	0.000	0.001	0.001	0.037	0.0
10 minutes	812	0.40	0.000	0.001	0.001	0.027	0.0
15 minutes	1134	0.60	0.001	0.001	0.002	0.031	0.0
20 minutes	918	0.60	0.001	0.000	0.000	0.028	0.0
30 minutes	875	N/A	0.001	0.002	0.001	0.030	0.0

Test: Eastern Leg (HVW-1)						In	Out
Time: 12:15 Pipe Size: 2" Diameter					Flow rate (cfm) =	35	N/A
	ft/min	Vacuum in (-) inches of H20					PPM
	Hot Wire	HVW-1	VMP-1	VMP-2	VMP-3	VMP-4	PID
start							
5 minutes	1460	1.30	0.002	0.003	0.001	0.057	0.0
10 minutes	1365	1.20	0.001	0.003	0.002	0.052	0.0
15 minutes	1594	1.30	0.001	0.003	0.002	0.055	0.0
20 minutes	1375	1.20	0.001	0.002	0.001	0.060	0.0
30 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Test: Eastern Leg (HVW-1)						In	Out
Time: 12:40 Pipe Size: 2" Diameter					Flow rate (cfm) =	50	N/A
	ft/min	Vacuum in (-) inches of H20					PPM
	Hot Wire	HVW-1	VMP-1	VMP-2	VMP-3	VMP-4	PID
start							
5 minutes	2246	1.9	0.001	0.000	0.001	0.078	0.0
10 minutes	2171	1.9	0.001	0.001	0.001	0.075	0.0
15 minutes	2003	2.2	0.001	0.004	0.002	0.085	0.0
20 minutes	2379	2.1	0.001	0.001	0.002	0.081	0.0
30 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Test: HVW-1, HVW-2 & HVW-3 Time: 13:05 Pipe Size: 2" Diameter

	Hot Wire (feet/minute)		
	HVW-1	HVW-2	HVW-3
5 minutes	446	278	279
10 minutes	516	260	201
15 minutes	202	279	200
20 minutes	N/A	N/A	N/A
30 minutes (if nec)	N/A	N/A	N/A

	In	Out
Flow rate (cfm) =	20	N/A
	20	N/A
	20	N/A

	Vacuum in (-) inches of H20							PPM
	HVW-1	HVW-2	HVW-3	VMP-1	VMP-2	VMP-3	VMP-4	PID
start	0.3	0.3	0.3	0.000	0.000	0.000	0.032	0.0
5 minutes	0.3	0.3	0.3	0.000	0.000	0.000	0.033	0.0
10 minutes	0.3	0.3	0.3	0.001	0.000	0.000	0.032	0.0
15 minutes	0.3	0.3	0.3	0.001	0.000	0.000	0.032	0.0
20 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30 minutes (if nec)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 2

Pressure Monitoring at Vapor Monitoring Points

Werwaiss Warehouse - 42005.00

Test: HVW-1, HVW-2 & HVW-3 Time: 13:25 Pipe Size: 2" Diameter

	Hot Wire (feet/minute)		
	HVW-1	HVW-2	HVW-3
5 minutes	492	228	362
10 minutes	565	302	208
15 minutes	717	401	213
20 minutes	659	250	369
30 minutes (if nec)	N/A	N/A	N/A

Flow rate (cfm) =	In	Out
	35	N/A
	35	N/A
	35	N/A
	35	N/A

	Vacuum in (-) inches of H20							PPM
	HVW-1	HVW-2	HVW-3	VMP-1	VMP-2	VMP-3	VMP-4	PID
start								
5 minutes	0.5	0.5	0.5	0.001	0.001	0.001	0.058	0.0
10 minutes	0.5	0.5	0.5	0.001	0.000	0.000	0.056	0.0
15 minutes	0.5	0.5	0.5	0.001	0.001	0.001	0.060	0.0
20 minutes	0.5	0.5	0.5	0.003	0.001	0.001	0.058	0.0
30 minutes (if nec)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Test: HVW-1, HVW-2 & HVW-3 Time: 13:50 Pipe Size: 2" Diameter

	Hot Wire (feet/minute)		
	HVW-1	HVW-2	HVW-3
5 minutes	643	560	457
10 minutes	925	642	474
15 minutes	898	458	207
20 minutes	475	470	209
30 minutes (if nec)	N/A	N/A	N/A

Flow rate (cfm) =	In	Out
	50	N/A
	50	N/A
	50	N/A
	50	N/A

	Vacuum in (-) inches of H20							PPM
	HVW-1	HVW-2	HVW-3	VMP-1	VMP-2	VMP-3	VMP-4	PID
start								
5 minutes	0.9	1.0	1.0	0.001	0.000	0.002	0.089	N/A
10 minutes	1.0	1.0	1.0	0.002	0.001	0.002	0.092	N/A
15 minutes	1.0	1.0	1.0	0.004	0.000	0.002	0.096	N/A
20 minutes	1.0	1.0	1.0	N/A	N/A	N/A	N/A	N/A
30 minutes (if nec)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Test: All Points Time: 09:20 Pipe Size: 2" Diameter

	Hot Wire (feet/minute)		
	HVW-1	HVW-2	HVW-3
5 minutes	463	324	215
10 minutes	448	330	257
15 minutes	548	373	246
20 minutes	603	286	200
30 minutes (if nec)	N/A	N/A	N/A

Flow rate (cfm) =	In	Out
	20	N/A
	20	N/A
	20	N/A
	20	N/A

	Vacuum in (-) inches of H20							PPM
	HVW-1	HVW-2	HVW-3	VMP-1	VMP-2	VMP-3	VMP-4	PID
start								
5 minutes	0.180	0.180	0.180	0.003	0.000	0.004	0.034	N/A
10 minutes	0.253	0.215	0.214	0.004	0.012	0.001	0.030	N/A
15 minutes	0.240	0.218	0.201	0.007	0.000	0.000	0.020	N/A
20 minutes	0.259	0.238	0.207	0.005	0.000	0.001	0.033	N/A
30 minutes (if nec)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 2

Pressure Monitoring at Vapor Monitoring Points

Werwaiss Warehouse - 42005.00

Test: All Points | Time: 10:00 | Pipe Size: 2" Diameter

	Hot Wire (feet/minute)		
	HVW-1	HVW-2	HVW-3
5 minutes	779	495	205
10 minutes	649	618	217
15 minutes	660	562	275
20 minutes	644	452	402
30 minutes (if nec)	N/A	N/A	N/A

	In	Out
Flow rate (cfm) =	35	N/A
	35	N/A
	35	N/A
	35	N/A

	Vacuum in (-) inches of H20							PPM
	HVW-1	HVW-2	HVW-3	VMP-1	VMP-2	VMP-3	VMP-4	PID
start								
5 minutes	0.472	0.420	0.380	0.004	0.003	0.000	0.060	N/A
10 minutes	0.507	0.442	0.415	0.002	0.000	0.001	0.080	N/A
15 minutes	0.502	0.427	0.407	0.006	0.000	0.001	0.054	N/A
20 minutes	0.505	0.425	0.398	0.005	0.000	0.001	0.063	N/A
30 minutes (if nec)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Test: All Points | Time: 10:30 | Pipe Size: 2" Diameter

	Hot Wire (feet/minute)		
	HVW-1	HVW-2	HVW-3
5 minutes	946	765	360
10 minutes	888	708	300
15 minutes	895	705	409
20 minutes	884	811	421
30 minutes (if nec)	N/A	N/A	N/A

	In	Out
Flow rate (cfm) =	50	N/A
	50	N/A
	50	N/A
	50	N/A

	Vacuum in (-) inches of H20							PPM
	HVW-1	HVW-2	HVW-3	VMP-1	VMP-2	VMP-3	VMP-4	PID
start								
5 minutes	0.795	0.680	0.598	0.007	0.000	0.003	0.105	N/A
10 minutes	0.801	0.669	0.625	0.004	0.000	0.001	0.106	N/A
15 minutes	0.813	0.692	0.635	0.004	0.000	0.003	0.092	N/A
20 minutes	0.818	0.711	0.644	0.004	0.000	0.002	0.094	N/A
30 minutes (if nec)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes: PPM = Parts Per Million; cfm = Cubic Feet per Minute; PID = Photoionization Detector; VMP = Vapor Monitoring Point; HVW-1 = Eastern Leg; HVW-2 = Central Leg; HVW-3 = Eastern Leg; ft/min = Feet per Minute; N/A = not applicable

Table 3

Post-Installation Sampling Analytical Results

Werweiss Warehouse - 42005.00

Sample ID	NYSDOH Guidance for Evaluating Soil Vapor Intrusion	SV-1		SV-2		SV-3		SV-4		SV-5		IA1-1		IA1-2	
Sample Location		Cellar Sub-Slab		Center Warehouse Sub-Slab		North Sub-Slab		Northeat Sub-Slab		East Warehouse Sub-Slab		Warehouse Indoor Air		Office Indoor Air	
York ID		2011135-01		2011135-02		2011135-03		2011135-04		2011135-05		2011135-06		2011135-07	
Sampling Date/Time	Matrix A	9/24/2020 16:50		9/24/2020 16:50		9/24/2020 17:08		9/24/2020 17:15		9/24/2020 17:00		9/24/2020 17:05		9/24/2020 17:05	
Sample Matrix	Matrix B	Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Indoor Ambient Air		Indoor Ambient Air	
Compound	Matrix C	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Volatile Organics, EPA TO15 Full List		ug/m3		ug/m3		ug/m3		ug/m3		ug/m3		ug/m3		ug/m3	
Dilution Factor		2.918		4.67		8.152		9.34		9.34		1.006		1.337	
1,1,1-Trichloroethane	<100 SS; <3 IA	ND		ND		ND		ND		ND		ND		ND	
1,1-Dichloroethylene	<6 SS; <0.2 IA	ND		ND		ND		ND		ND		ND		ND	
Carbon tetrachloride	<6 SS; 0.2 to <1 IA	ND		14		ND		ND		ND		0.51		0.5	
cis-1,2-Dichloroethylene	<6 SS; <0.2 IA	1.4		ND		ND		ND		ND		ND		ND	
Methylene chloride	<100 SS; <3 IA	ND		ND		ND		ND		ND		2.6		7.6	
Tetrachloroethylene	<100 SS; <3 IA	2.0		6.0		ND		93		250		1.8		3.5	
Trichloroethylene	<6 SS; <0.2 IA	14		290		2.6		24		45		0.32		0.29	
Vinyl Chloride	<6 SS; <0.2 IA	ND		ND		ND		ND		ND		ND		ND	

NOTES:

Analyte names are shaded to reflect the applicable NYSDOH Soil Vapor/Indoor Air Matrix (A, B, and C.) There are three tiers of indoor air and sub-slab concentrations resulting in a nine point matrix indicating that either no further action, monitoring , or mitigation are required. Exceedences of the lowest tier are highlighted in yellow. See attached Decision Matrix for each sample.

ND=analyte not detected at or above the Reported To level

ATTACHMENT A
WASTE DISPOSAL DOCUMENTATION

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Materials Management, Bureau of Hazardous Waste and Radiation Management
625 Broadway, 9th Floor, Albany, New York 12233-7256
P: (518) 402-8651 | F: (518) 402-9024
www.dec.ny.gov

September 8, 2020

Mr. Richard T. Kampf, PG, LEP
Director, NYC Office
The Chazen Companies
21 Fox St.
Poughkeepsie, NY 12601

Re: Former Liberty Brass Off-Site, Long Island City, Queens, New York
NYSDEC BCP No. C241178A
Non-Hazardous Waste Contained-In Determination Request – Off-Site Material

Dear Mr. Kampf:

The New York State Department of Environmental Conservation has reviewed the analytical soil data (Lab Sample ID: 20G1195-02) submitted with your e-mail request dated August 13,2020 for a "contained-in" determination for contaminated soils as part of an Interim Remedial measure of the above project.

Concentrations detected for individual VOCs, SVOCs, metals and PCBs were all significantly less than their current "contained-in" soil action levels, and Land Disposal Restriction concentrations. No hazardous constituents exhibited a hazardous waste characteristic by exceeding their TCLP regulatory level.

Concentration for trichloroethene (TCE) was detected was significantly less than its current "contained-in" soil action levels and Land Disposal Restriction concentrations. Based on our review, the roll-off (Lab Sample ID: 20G1195-02), which contained approximately 10 yards of soil from the trench, does not have to be managed as hazardous waste and can be transported off-site to Clean Earth of Carteret, located in New Jersey, for proper treatment as non-hazardous waste.

Should you have any questions regarding the content of this letter, please do not hesitate to contact me at (518) 402-9611 or email me at henry.wilkie@dec.ny.gov.

Sincerely,

Henry Wilkie
Assistant Environmental Engineer
RCRA Permitting Section

ec: S. Ahmed, DER

CLEANEARTH

Manifest # 507439

GLOBAL JOB NUMBER: 100110 FACILITY APPROVAL NUMBER: 203071482

Please Check One:

- [x] Clean Earth of Carteret, 24 Middlesex Avenue, Carteret, NJ 07008, Ph: 732-541-8909
- [ ] Clean Earth of Maryland, 1469 Oak Ridge Place, Hagerstown, MD 21740, Ph: 301-791-6220
- [ ] Clean Earth of New Castle, 94 Pyles Lane, New Castle, DE 19720, Ph: 302-427-6633
- [ ] Other
- [ ] Clean Earth of Philadelphia, 3201 S. 61st Street, Philadelphia, PA 19153, Ph: 215-724-5520
- [ ] Clean Earth of North Jersey, 115 Jacobus Avenue, Kearny, NJ 07032, Ph: 973-344-4004
- [ ] Clean Earth of Southeast Pennsylvania, 7 Steel Road East, Morrisville, PA 19067, Ph: 215-428-1700

Non-Hazardous Material Manifest

(Type or Print Clearly)

GENERATOR'S NAME & SITE ADDRESS: Ideal Trading Co., Inc. ~~WB WERWAISS REALTY LLC~~	GROSS WEIGHT: ☐ Tons ☒ Yards	64,760
43-25 38th STREET LONG ISLAND CITY, NY 11101	TARE WEIGHT: ☐ Tons ☐ Yards	
GENERATOR'S PHONE: (212) 983-0044	NET WEIGHT: ☐ Tons ☐ Yards	

DESCRIPTION OF MATERIAL/SAMPLE ID AND LOCATION

NON-HAZARDOUS SOIL

GENERATOR'S CERTIFICATION – Incomplete and/or unsigned manifests will cause the load to be delayed and/or rejected.

I hereby certify that the above named material does not contain free liquid as defined by 40 CFR Part 260.10 or any applicable state law, is not a hazardous waste as defined by 40 CFR Part 261 or any applicable state law, is not a DOT hazardous substance as defined by 49 CFR Part 172 or any applicable state law, has been fully and accurately described above, classified, packaged and is in proper condition for transportation according to all applicable state and federal regulations.

Name: X Peter Zuckerville Title: X

Signature: X [signature] Date and Time: 9/15/20 ~0700

TRANSPORTER

Company: FREEHOLD CARTAGE, INC. Phone Number: (800) 346-2035

Address: 825 HIGHWAY 33 EAST, FREEHOLD, NJ 07728 Truck # and License Plate: 3015 / AU128V

Driver: Alan Schultz SW Haulers Permit #: 08581

(Type or Print Clearly) (applicable state permit #)

I hereby certify that the above named material was picked up at the site listed above.

Driver Signature: [signature] Date and Time: 9/15/20 - 0700

DESTINATION

I hereby certify that the above named material was delivered without incident to the facility noted above.

Driver Signature: [signature] Date and Time: 9/15/20 - 900

I hereby certify that the above named material has been accepted at the above referenced facility.

Authorized Signature: [signature] Date and Time: 9.15.20

FACILITY

Clean Earth of Carteret
24 Middlesex Ave
Carteret, NJ 07008
Ph: Fax:

Ticket: 2326603

	Date	Time	Scale
In:	09/15/2020	09:43:53	Manual
Out:	09/15/2020	09:43:53	Manual

	Lbs.	Tns
Gross:	64,760	32.38
Tare:	33,160	16.58
Net:	31,600	15.80

Manifest: 507439
Vehicle: 07FCI3015
Decal:

Customer: INNOVATIVE RECYCLING
Generator: ~~WB Werwaiss-43-25 38th~~ (68) Ideal Trading Co., Inc.
Address: Street-Innovative Recycling
43-25 38th Street
Long Island City, NY 11101

Carrier:
Profile #: 203071482

Job: WB Werwaiss Realty LLC
Address: 43-25 38th Street
Long Island City, NY 11101

Material

Recyclable soil/rock/material

Comment:

Driver

Facility Clean Earth of Carteret
Barry Gibson

3192541

Please print or type. Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
NYR000247189	1	(267) 406-0083	020732362 JJK

GENERATOR

5. Generator's Name and Mailing Address
~~WB Werwaiss Realty LLC~~ Attn: GretchenWerwaiss
~~43-25 38th Street~~
~~Long Island City NY 11101~~
Ideal Trading Co. Inc
200 Shames Drive
Westbury, NJ 11590
Generator's Phone: 212 983-0044

Generator's Site Address (if different than mailing address)
WB Werwaiss Realty
43-25 38th St
Long Island, NJ 11101

6. Transporter 1 Company Name: Freehold Cartage, Inc. — U.S. EPA ID Number: NJD054126164

7. Transporter 2 Company Name — U.S. EPA ID Number:

8. Designated Facility Name and Site Address
Clean Earth of North Jersey
105 Jacobus Avenue
South Kearny NJ 07032
Facility's Phone: 973 344-4004
U.S. EPA ID Number: NJD991291105

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. NA3077, Hazardous waste, solid, n.o.s. 9, PGIII,(D008)(Lead) ERG#171	001	CM	00010	Y	D008	T	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
9B.1) Approval: 20308928

BOX# 0727 DECAL 405627

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Peter Zuckerwise — Signature: [signature] — Month 09 Day 15 Year 20

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: FRED BARTH — Signature: [signature] — Month 09 Day 15 Year 20

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☑ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Lead: 98100 lb

Manifest Reference Number:

18b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

Received Pending Manifest Review/Quality Control Date

18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H110			

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name: Brian Smith — Signature: [signature] — Month 9 Day 15 Year 20

EPA Form 8700-22 (Rev. 12-17) Previous editions are obsolete. DESIGNATED FACILITY TO EPA's e-MANIFEST SYSTEM

COX PRINTERS • (908) 928-1010 • REORDER # 8910

CLEAN

Faster, smarter, greener solutions...

Ideal Trading Co, Inc.

GENERATOR ~~W.B. Werwood~~

MAN. NO. 020135236 2FBS

TRANSPORTER PCR

VEHICLE ID. 0727

DRIVER ON OFF

REMARKS: 30 yd.

IN

10:42 AM 9/15/2020

69220 lb G

OUT

01:04 PM 9/15/2020

31120 lb G

38100

WEIGHER

WEIGH-TRONIX®

FREEHOLD CARTAGE INC.

P.O. BOX 5010 • FREEHOLD, NJ 07728-5010
(732) 462-1001 • FAX (732) 308-0924

BILL OF LADING

FCI EPA ID NO. NJD0541261

S 683629

350 Pigeon Point Road
New Castle, DE 19720
Phone: (302) 658-2005
Fax: (302) 658-6229

520 Beechcraft Street
Bartow, FL 33830
Phone: (863) 533-4599
Fax: (863) 533-1613

5533 Dunham Road
Maple Heights, OH 44137
Phone: (330) 835-3473
Fax: (330) 835-3732

108 Monahan Avenue
Dunmore, PA 18512
Phone: (570) 342-7232
Fax: (570) 342-7367

132 Myrtle Beach Hwy.
Sumter, SC 29153
Phone: (803) 773-2611
Fax: (803) 773-2942

SHIPPER NAME/ADDRESS	PHONE (AREA CODE)		
	TRACTOR	TRAILER	APPOINTMENT TIME :

FCI REP. LOADING (PRINT)	PROCEDURE	EQUIP. SPOTTED	EQUIP. REMOVED	TIME AT SHIPPER (MILITARY TIME ONLY)
				: ARRIVAL TIME : DEPARTURE TIME

COMMENTS OR DELAYS AT SHIPPER	EQUIPMENT USED

BROKER:

PO#: WO#:

MANIFEST/DOCUMENT NO.

(X) HM		PROPER U.S. D.O.T. SHIPPING NAME	U.S. D.O.T. HAZARDOUS CLASS	NA/UN/NO.	PACKING GROUP	NO. CONT.	CONT. TYPE	NET QUANTITY	UNIT MEASURE	WASTE NO.	FORM
	1										
	2										
	3										

SPECIAL HANDLING INSTRUCTIONS INCLUDING CONTAINER EXEMPTION NUMBER.

SHIPPER'S CERTIFICATION: This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation, U.S. EPA and the State. The materials described above were consigned to the *Transporter* named. The consignee can and will accept the shipment and has a valid permit to do so if required. I certify that the foregoing is true and correct to the best of my knowledge.

Payment to the contractor for waste removal does not constitute payment to the carrier and if the contractor does not pay the carrier, the shipper is obligated to pay the agreed rate offered to the contractor.

PLEASE PRINT NAME/TITLE	SHIPPER'S SIGNATURE	DATE LOADED
	X _____ I HAVE READ THE ABOVE AND UNDERSTAND AND AGREE TO ALL OF ITS CONTENT	/ / MO. DAY YR.

CONSIGNEE NAME/ADDRESS	PHONE (AREA CODE)		
	TRACTOR	TRAILER	APPOINTMENT TIME :

FCI REP. UNLOADING (PRINT)	PROCEDURE	EQUIP. SPOTTED	EQUIP. REMOVED	TIME AT CONSIGNEE (MILITARY TIME ONLY)
				: ARRIVAL TIME : DEPARTURE TIME

COMMENTS OR DELAYS AT CONSIGNEE	EQUIPMENT USED

PLEASE PRINT NAME/TITLE	CONSIGNEE SIGNATURE	DATE UNLOADED
	X _____	/ / MO. DAY YR.

AR H-0257	MD HWH-167	MO H-1490	OH UPW-0190713-OH	TX 40705
CT CT-HW-307	2001-OPV-2335	ND WH-429	OK UPW-0190713-OH	WI 11602
DE DE-HW-203	ME ME-HWT-47	NH TNH-0047	ONTARIO, CANADA A 840943	WV UPW-0190713-OH
DE-SW-203	ME-WOT-47	NJ S-2265	PA PA-AH-0067	
IL UPW-0190713-OH	MI UPW-0190713-OH	15939	QUEBEC, CANADA QC-6ML-047	
MA MA-294	MN UPW-0190713-OH	NY NJ-113	RI RI-535	

White - FCI Original
Yellow - FCI Billing
Blue - FCI Office/Customer
Green - Retained by TSDF
Gold - Retained by Generator

S 683629

FREEHOLD CARTAGE INC.

FCI

P.O. BOX 5010 • FREEHOLD, NJ 07728-5010
(732) 462-1001 • FAX (732) 308-0924

BILL OF LADING

FCI EPA ID NO. NJD054126164

M 315080

350 Pigeon Point Road
New Castle, DE 19720
Phone: (302) 658-2005
Fax: (302) 658-6229

520 Beechcraft St.
Bartow, FL 33830
Phone: (863) 533-4599
Fax: (863) 533-1613

5533 Dunham Road
Maple Heights, OH 44137
Phone: (330) 835-3473
Fax: (330) 835-3732

108 Monahan Avenue
Dunmore, PA 18512
Phone: (570) 342-7232
Fax: (570) 342-7367

132 Myrtle Beach Hwy.
Sumter, SC 29153
Phone: (803) 773-2611
Fax: (803) 773-2942

SHIPPER NAME/ADDRESS FREEHOLD CARTAGE INC 825 HIGHWAY 33 EAST FREEHOLD, NJ 07728	PHONE (AREA CODE) 800-326-9238		
	TRACTOR 985	TRAILER	APPOINTMENT TIME 10 : 16
FCI REP. LOADING (PRINT) REEVES JR.KENNETH	PROCEDURE	EQUIP. SPOTTED 0727	EQUIP. REMOVED
			TIME AT SHIPPER (MILITARY TIME ONLY) ARRIVAL TIME : DEPARTURE TIME :
COMMENTS OR DELAYS AT SHIPPER			EQUIPMENT USED

BROKER: INNLIN - INNOVATIVE RECYCLING INC	**MANIFEST / DOCUMENT NO.**
PO#: WO#: 115030	

(X) HM		PROPER U.S. D.O.T. SHIPPING NAME	U.S. D.O.T. HAZARDOUS CLASS	NA/UN/NO.	PACKING GROUP	NO. CONT.	CONT. TYPE	NET QUANTITY	UNIT MEASURE	WASTE NO.	FORM
	1	Empty				1		30	Y		
	2										
	3										

SPECIAL HANDLING INSTRUCTIONS INCLUDING CONTAINER EXEMPTION NUMBER.

SHIPPER'S CERTIFICATION: This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation, U.S. EPA and the State. The materials described above were consigned to the Transporter named. The consignee can and will accept the shipment and has a valid permit to do so if required. I certify that the foregoing is true and correct to the best of my knowledge.

Payment to the contractor for waste removal does not constitute payment to the carrier and if the contractor does not pay the carrier, the shipper is obligated to pay the agreed rate offered to the contractor.

PLEASE PRINT NAME/TITLE	SHIPPER'S SIGNATURE X ______ I HAVE READ THE ABOVE AND UNDERSTAND AND AGREE TO ALL OF ITS CONTENT.	DATE LOADED 07 / 27 / 20 MO. DAY YR.

CONSIGNEE NAME/ADDRESS LIBERTY BRASS Queens Blvd. & 38th st. LONG ISLAND CITY, NY 11101	PHONE (AREA CODE)		
	TRACTOR 985	TRAILER	APPOINTMENT TIME 11 : 20
FCI REP. UNLOADING (PRINT) REEVES JR.KENNETH	PROCEDURE	EQUIP. SPOTTED	EQUIP. REMOVED
			TIME AT CONSIGNEE (MILITARY TIME ONLY) ARRIVAL TIME : DEPARTURE TIME :
COMMENTS OR DELAYS AT CONSIGNEE			EQUIPMENT USED

PLEASE PRINT NAME/TITLE	CONSIGNEE SIGNATURE X ______	DATE UNLOADED 07 / 27 / 20 MO. DAY YR.

AR H-0257
CT CT-HW-307
DE DE-HW-203
DE-SW-203
IL UPW-0190713-OH
MA MA-294

MD HWH-167
2001-OPV-2335
ME ME-HWT-47
ME-WOT-47
MI UPW-0190713-OH
MN UPW-0190713-OH

MO H-1490
ND WH-429
NH TNH-0047
NJ S-2265
15939
NY NJ-113

OH UPW-0190713-OH
OK UPW-0190713-OH
ONTARIO, CANADA A 840943
PA PA-AH-0067
QUEBEC, CANADA QC-6ML-047
RI RI-535

TX 40705
WI 11602
WV UPW-0190713-OH

White - FCI Original
Yellow - FCI Billing
Blue - FCI Office/Customer
Green - Retained by TSDF
Gold - Retained by Generator

M 315080

Invoice

ALLOCCO RECYCLING LTD.
540 KINGSLAND AVENUE, BROOKLYN, NY 11222 P.718.349.3094 F.718.349.3097

www.alloccorecycling.com

PAID 07/27/2020

Date	Invoice #
7/28/2020	5223389

Bill To

NOVA CONCRETE CONTRACTORS
99 JEFERSON AVE.
BAYSHORE, NY 11706

Terms	Due Date
	7/28/2020

Item	Date	Description	Quantity	Rate	Amount
DUMP	7/27/2020	Mixed Debris Ticket Number: 776650	18	55.00	990.00
DUMP	7/27/2020	Mixed Debris Ticket Number: 776696	15	55.00	825.00

Copies of all tickets may be obtained at: WWW.ALLOCCOWEBPORTAL.COM

If you need assistance, please contact us at 718-349-3094.

Invoice Total $1,815.00

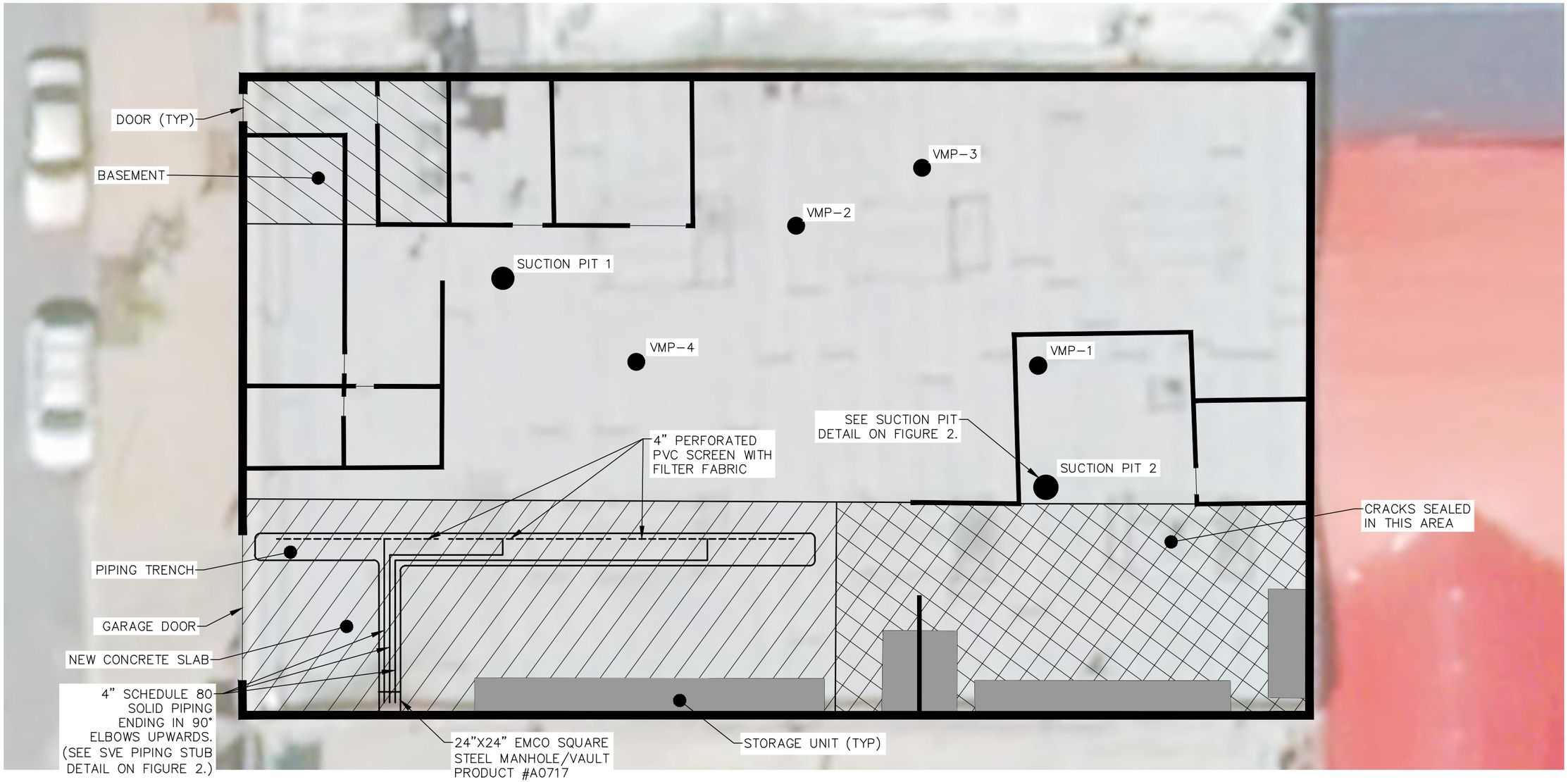
Mail To:

NOVA CONCRETE CONTRACTORS
99 JEFERSON AVE.
BAYSHORE, NY 11706

Invoice Balance Due $0.00

Total Account Balance $0.00

ATTACHMENT B
AS-BUILT DRAWINGS



NOTES:
AS-BUILT DRAWING NOT PREPARED FROM A FIELD SURVEY.
AS-BUILT IS A COMPILATION OF THE FOLLOWING MAP REFERENCES:

1. "FIGURE 1.0 SITE SKETCH" PREPARED BY LAUREL ENVIRONMENTAL GEOSCIENCES D.P.C., DATED 2/19/21
2. SKETCH PROVIDED BY LAUREL ENVIRONMENTAL GEOSCIENCES D.P.C., DATED 2/24/21
3. "SOIL VENTING PLANS" PREPARED BY THE CHAZEN COMPANIES, DATED 9/24/20

CHAZEN ENGINEERING, LAND SURVEYING & LANDSCAPE ARCHITECTURE CO., D.P.C.

Office Locations:

☐ Hudson Valley Office:
21 Fox Street
Poughkeepsie, New York 12601
Phone: (845) 454-3980

☐ North Country Office:
20 Elm Street (Suite 110)
Glens Falls, New York 12801
Phone: (518) 812-0513

☒ Capital District Office:
547 River Street
Troy, New York 12180
Phone: (518) 273-0055

☐ Westchester NY Office:
1 North Broadway, Suite 803
White Plains, New York 10601
Phone: (914) 997-8510

Nashville Tennessee Office:
2416 21st Ave S. (Suite 103)
Nashville, Tennessee 37212
Phone: (615) 380-1359

Chattanooga Tennessee Office:
1426 Williams St. (Suite 12)
Chattanooga, Tennessee 37408
Phone: (423) 241-6575

WERWAISS WAREHOUSE

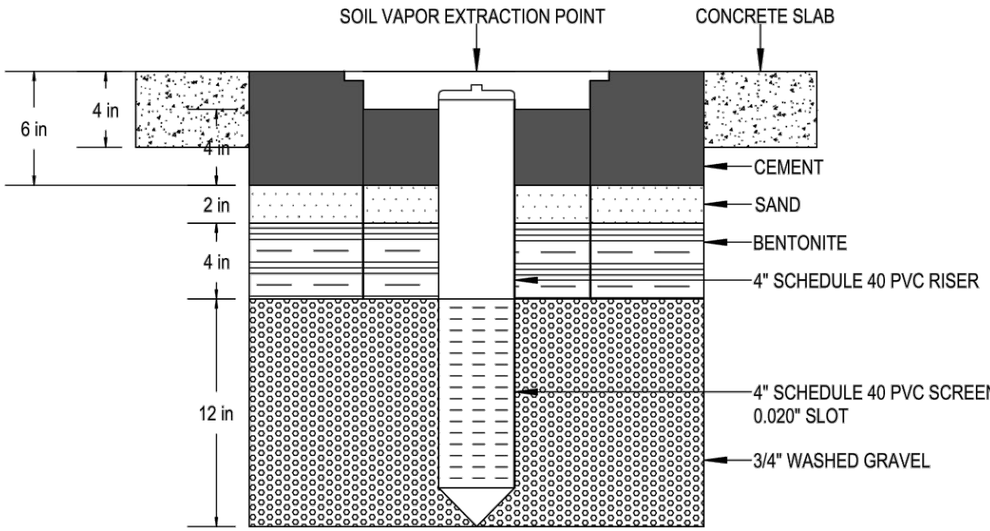
SSDS UNDERGROUND PIPING AS-BUILT

LONG ISLAND CITY, QUEENS, NEW YORK

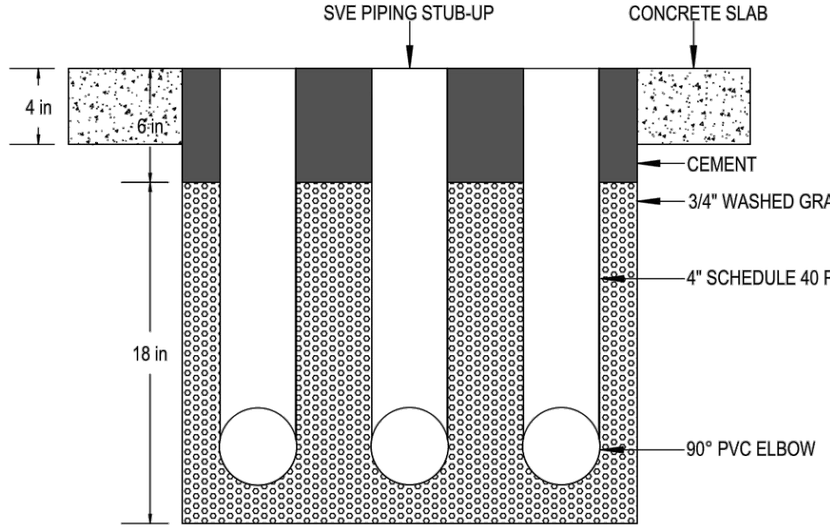
designed	checked
CAR	REK
date	scale
3/2/21	N.T.S.
project no.	
42005.00	
sheet no.	
FIG 1	

Drawing Name: \\chazencompanies.com\chazen\projects\42000-42099\42005.00_Ideal Trading-Werwaiss Warehouse\DWG\01_42005-00_SSDS_AS-BUILT.dwg Date Printed: Mar 10, 2021, 9:30am

SUCTION PIT DETAIL



SVE PIPING STUB-UP DETAIL



NOTES:

AS-BUILT DRAWING NOT PREPARED FROM A FIELD SURVEY.

MAP REFERENCE:

1. "FIGURE 2.0 PIPING DETAILS" PREPARED BY LAUREL ENVIRONMENTAL GEOSCIENCES D.P.C., DATED 2/19/21

CHAZEN ENGINEERING, LAND SURVEYING & LANDSCAPE ARCHITECTURE CO., D.P.C.

Office Locations:

☐ Hudson Valley Office:
21 Fox Street
Poughkeepsie, New York 12601
Phone: (845) 454-3980

☒ Capital District Office:
547 River Street
Troy, New York 12180
Phone: (518) 273-0055

Nashville Tennessee Office:
2416 21st Ave S. (Suite 103)
Nashville, Tennessee 37212
Phone: (615) 380-1359

☐ North Country Office:
20 Elm Street (Suite 110)
Glens Falls, New York 12801
Phone: (518) 812-0513

☐ Westchester NY Office:
1 North Broadway, Suite 803
White Plains, New York 10601
Phone: (914) 997-8510

Chattanooga Tennessee Office:
1426 Williams St. (Suite 12)
Chattanooga, Tennessee 37408
Phone: (423) 241-6575

WERWAISS WAREHOUSE

SSDS UNDERGROUND PIPING AS-BUILT DETAILS

LONG ISLAND CITY, QUEENS, NEW YORK

designed	checked
CAR	REK
date	scale
3/2/21	N.T.S.

project no. 42005.00

sheet no. **FIG 2**

ATTACHMENT C
HEALTH AND SAFETY PLAN

ATTACHMENT A
HEALTH AND SAFETY PLAN

Health and Safety Plan
Former Liberty Brass Off-Site
NYSDEC Site No. 241178A

43-25 Queens Boulevard
Long Island City, Queens, New York
Werwaiss Warehouse

April 2020

Chazen Project No. 42005.00

THE Chazen COMPANIES®
Engineers
Environmental Professionals
Land Surveyors
Landscape Architects
Planners

Prepared for:

Liberty Brass / Ideal Trading Co.
c/o Linda R. Shaw
Knauf Shaw LLP
1400 Crossroads Building
2 State Street

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

Prepared by:

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I certify that this 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 (DER10).

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QEP: Richard T. Kampf, PG, LEP

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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 an Off-Site Soil Vapor Investigation being performed at 43-06 38th Street, Long Island City, Queens, New York. Chazen Engineering, Land Surveying & Landscape Architecture Co., DPC (Chazen'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 (PPE), and the following activity specific safety protocols contained in this HASP. Chazen 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 the Off-Site Remedial Action and Soil Vapor Investigation activities taking place at the off-site area affiliated with the 43-25 38th Street Long Island City, Queens, New York property.

The HASP takes into account the specific hazards inherent to the site and presents the minimum requirements which are to be met by Chazen, its subcontractors, and other on-site personnel in order to avoid and, if necessary, protect against health and/or safety hazards. Chazen 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 Chazen.

Activities performed under this HASP will comply with applicable parts of Occupational Safety and Health Administration (OSHA) Regulations, primarily 29 Code of Federal Regulations (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 Chazen 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 RAWP activities. The primary investigation activities may include the following:

- Site mobilization/demobilization;
- Concrete removal and replacement;
- Sealing Cracks;
- Drilling, and;
- Sub-slab 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; and
- 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:

- Chazen 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 / Site Health and Safety Officer (SHSO)

- Ensures that the HASP is implemented in conjunction with the HSM;
- Ensures that field work is scheduled with adequate equipment to complete the job safely;
- Enforces site health and safety rules;
- Ensures that proper PPE 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.

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 HASP has been prepared by Chazen, on behalf of Liberty Brass / Ideal Trading. Previous investigations have identified semi-volatile organic compounds (SVOCs) and metals above standards in soil, volatile organic compounds (VOCs), SVOCs and metals above standards and/or guidance levels in groundwater and VOCs above guidance values in soil vapor at the site.

4.2 Site Description

The Site is defined as the 43-25 38th Street property that is currently occupied by a warehouse hereinafter referred to as the Werwaiss Warehouse. The adjacent Former Liberty Brass Site has been remediated by a third party under the New York State Brownfield Cleanup Program (BCP).

4.3 Site History

The available information indicates that the property at 43-25 38th Street was developed sometime prior to 1936 and has been utilized as a manufacturing facility in 1936 and as a garage from approximately 1947 to 1950 prior to being utilized as a warehouse.

4.4 Site Features

The Site elevation is approximately 65 feet above mean sea level and is generally level with a very slight slope to the west.

4.5 Current and Future Site Use

The property is owned by WB Werwaiss Realty LLC. The property contains two separate warehouse units, with the southern unit being investigated having been occupied by CFL Art Services, which stores, transports, and installs art, since at least 2005. The on-Site tenant operations at the Werwaiss Warehouse include storing and building crates, packing artworks, furniture, and other specialty items, receiving and releasing crates. The Warehouse is almost entirely filled with packed crate storage with many permanent storage racks along the walls throughout the Warehouse. There are three offices located in the northwest portion of the building, the northernmost of which overlies a small utility cellar. The tenant has five employees each of which spend approximately 3 out of 5 days each week in the building, either in the Warehouse or the offices. The warehouse loading gate is typically kept open except in the winter months when it is open intermittently. This practice frequently introduces outdoor air into the warehouse, which mitigates the potential for exposure.

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 (AHA).

5.1 Chemical Hazards

Review of historical information indicates that the soil, soil vapor and groundwater at the Site may be contaminated with the constituents listed in Table 5-1. These compounds may present an occupational exposure hazard during site operations. Specific information on the primary chemicals that may be present at the can be found in Table 5-1 and specific information on each chemical that may be present 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
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 acrid odor
Arsenic	7440-38-2	TWA 0.01 mg/m^3	Inhalation Ingestion	Cough, sore throat, shortness of breath, weakness, abdominal pain, diarrhea, nausea, vomiting	Liver, bone marrow, peripheral nervous system	Grey metallic-looking crystals
Benzene	71-43-2	TWA 0.5 mg/m^3	Inhalation Ingestion Skin/Eye	Confusion, cough, dizziness, drowsiness, headache, sore throat, vomiting, redness, dry skin, pain.	Skin, lungs, central nervous system, eyes, respiratory tract	Colorless liquid, with characteristic odor
Benzo(a) anthracene	56-55-3	None	Inhalation Ingestion Skin/Eye	None	None	Flakes or Powder
Benzo(a) Pyrene	50-32-8	None	Inhalation Ingestion Skin/Eye	None	None	Crystals
Cadmium	7440-43-9	TWA 0.002 mg/m^3	Inhalation Ingestion	Cough, sore throat, redness, pain, abdominal pain, diarrhea, headache, nausea, vomiting	Kidneys	Soft Blue-White Metal Lumps or Grey powder
Chromium	7440-47-3	TWA 0.5 mg/m^3	Inhalation Eye	Cough Redness	None	BP-2642°C
Copper	7440-50-8	TWA 0.2 mg/m^3	Inhalation Ingestion	Cough, headache, shortness of breath, sore throat, redness, pain, abdominal pain, nausea, vomiting	None	Red powder
Isopropylbenzene	98-82-8	TWA 50 mg/m^3	Inhalation Ingestion Skin/Eye	Dizziness, skin and eye irritation	Skin, liver, kidney, lungs	Colorless liquid, with characteristic odor
Lead	7439-92-1	TWA 0.05 mg/m^3	Inhalation Ingestion	None	Blood, bone marrow, central nervous system, kidneys	Bluish-White or Silvery-Grey Solid

Magnesium	7439-95-4	None	Inhalation Ingestion	None	None	Silver or grey Rod

COMPOUND	CAS#	OSHA PEL	ROUTES OF EXPOSURE	SYMPTOMS OF EXPOSURE	TARGET ORGANS	PHYSICAL DATA
Mercury	7439-97-6	TWA 0.025 mg/m^3	Inhalation Ingestion Skin/Eye	Abdominal pain, cough, diarrhea, shortness of breath, vomiting, fever	Central nervous system, kidneys	Silvery liquid metal
n-Propylbenzene	103-65-1	None	Inhalation Ingestion Skin/Eye	Lung, skin, eye irritation	Lungs, eyes, kidneys	Colorless liquid
Naphthalene	91-20-3	TWA 10 ppm	Inhalation Ingestion Skin	Headache, weakness, nausea, vomiting, sweating, confusion, jaundice, dark urine	Blood, eyes	White solid in various forms, with characteristic odor
m+p-xylene	179601-23-1	TWA 100 mg/m^3	Inhalation Ingestion Skin/Eye	Dizziness, drowsiness, headache, nausea, dry skin, redness, pain	Skin, central nervous system, ears	Colorless liquid, with characteristic odor
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
Zinc	7440-66-6	None	Inhalation Ingestion	Metallic taste, dry skin, abdominal pain, nausea, vomiting	None	Odorless Grey to Blue Powder

Abbreviations

C = Ceiling limit, not to be exceeded

CNS = Central Nervous System

PEL=Permissible Exposure Limit

TWA = Time-weighted average (8 hours)

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 AHAs 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, 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.

5.2.3 Plants

The property is developed. No exposure to plant life is expected with the possible exception of tree pits allocated in the right-of-way.

5.2.4 COVID-19

During such time as the COVID-19 pandemic is recognized by either the NYS or City of New York, measures to comply with associated employee health and safety will be followed. These will adhere to the NYS Governor's worker protection directives, including maximum allowable site staffing, social distancing, and applicable PPE.

5.3 Physical Hazards

Most safety hazards are discussed in the AHAs 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

<u>Heat Stress</u>

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.

<u>Cold Stress</u>

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.

Chazen'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 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 workplace 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

A drill rig will be used to install borings 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 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 Chazen for the following phases of work:

- Site mobilization/demobilization;
- Concrete removal and replacement;
- Sealing Cracks;
- Drilling, and;
- Sub-slab and soil-vapor sampling.

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

7.0 PERSONAL PROTECTIVE EQUIPMENT

The 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** - AHA. 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

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

FOOT PROTECTION

Neo = Neoprene

OB = Overboot

Poly = polyethylene coated boot

Rub = rubber slush boots

STB = Leather work boots with steel toe

HAND PROTECTION

Cot = cotton

But = Butyl

LWG = Leather Work Gloves

Neo = Neoprene

Nit = Nitrile

Sur = Surgical

BODY PROTECTION

WC = work clothes

Cot Cov = Cotton Coveralls

Poly = Polyethylene coated Tyvek® coveralls

Saran = Saranex coated coveralls

Tyvek® = Uncoated Tyvek® coveralls

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;
- Characteristics, capabilities and limitations of PPE and any hazard that the PPE presents or magnifies; and
- The potential that COVID-19 employee protection measures stipulated by either the NYSDOH or the City of New York remain in place at the time this work is scheduled.

A review of the analytical data from previous sampling events indicates that VOCs and metals identified in **Table 5-1** and the potential for COVID-19 exposure identified in **Section 5.2** re the primary contaminants of concern.

The exposure routes for the listed 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. Similar gloves will limit contact with viruses found on surfaces and cloth or enhanced dust masks will limit respiratory transmission. Anyone testing positive for COVID-19 must be removed from the work team. 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
Mobilization/ Demobilization	HH	SG	STB	WG	WC	None
Drilling Activities	HH	SG	STB	WG	WC	EM or EP
Environmental sampling	HH	SG	STB	WG, Nit & Sur as needed	WC, Tyvek® as needed	None
Decontamination	HH	SG	STB	Nit + Sur	WC, Tyvek® as needed	None

7.3 Respirator Cartridge Change-Out Schedule

For chemical exposure, 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:

- 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
- 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 AHA;
- All of the chemicals have boiling points greater than 70^{o}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 (e.g., 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.
- For cloth or silica masks work for COVID-19 protection, the most current Governor's Executive Orders do not require wearing of masks but indicates they must be made available should an employee wish to wear one. They should be used whenever you feel the need. They must be used whenever someone will inadvertently get closer than 6 feet. Do NOT be shy about telling someone to keep their distance, be watchful of persons seeming to be headed into your "space".
- When handling the mask, don't touch the face of the mask where any contamination has been pulled to that surface by breathing through it. Use the ear straps to remove. Wash hands thoroughly after handling the mask.
- If you have been using gloves for any of your work or safety: they must be taken off by grasping one glove at the base of your palm with the other glove, pull this glove inside-out and ball up in the palm of the still gloved hand, then insert a finger from the uncovered hand into the gauntlet of the other glove pulling this down your hand and inside-out over the balled up glove. Dispose of immediately and Wash your hands immediately.
- If you are wearing a reusable mask, it should be washed frequently.

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 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

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 or properly disposed. 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, if necessary. 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 SZ 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.

11.5 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 form stepping or falling into the hole.
- Terminate drilling operations during an electrical storm and move the entire crew away from the drill rig.

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 (FOL/HSO)

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

Chazen 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

Chazen 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	Mount Sinai Hospital Queens	(718) 932-1000
Ambulance		911
Project Manager/Health and Safety Manager	Richard T. Kampf, PG, Chazen	(917) 280-6364
Health & Safety Officer	Branson Fields, Chazen	(720) 626-6362
NYSDEC Site Contact	Sadique Ahemd	(518) 402-9656
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:

HSM;

PM; and

The employer of any injured worker who is not a Chazen 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 Chazen 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 Chazen 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.

14.2.1 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.

14.3 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.

14.4 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.

14.5 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 logbook and as appropriate, the HSM and/or PM will be notified. Daily tailgate meetings will be documented in the H&S logbook 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.

15.0 FIELD PERSONNEL REVIEW

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

I have read, or have been informed of, the HASP and understand the information presented. I will comply with the provisions contained therein.

Name (Print and Sign)	***Date***

Appendix A
Material Safety Data Sheets

ARSENIC

0013
October 1999

CAS No: 7440-38-2
RTECS No: CG0525000
UN No: 1558
EC No: 033-001-00-X

Grey arsenic
As
Atomic mass: 74.9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with strong oxidizers. NO contact with hot surfaces.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Risk of fire and explosion is slight when exposed to hot surfaces or flames in the form of fine powder or dust.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		**PREVENT DISPERSION OF DUST! AVOID ALL CONTACT! AVOID EXPOSURE OF (PREGNANT) WOMEN!**	**IN ALL CASES CONSULT A DOCTOR!**
Inhalation	Cough. Sore throat. Shortness of breath. Weakness. See Ingestion.	Closed system and ventilation.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
Skin	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
Eyes	Redness.	Face shield or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. Diarrhoea. Nausea. Vomiting. Burning sensation in the throat and chest. Shock or collapse. Unconsciousness.	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING	
Evacuate danger area! Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place. Chemical protection suit including self-contained breathing apparatus. Do NOT let this chemical enter the environment.	T Symbol N Symbol R: 23/25-50/53 S: (1/2-)20/21-28-45-60-61 UN Hazard Class: 6.1 UN Pack Group: II	Do not transport with food and feedstuffs. Marine pollutant.

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-61GT5-II	Separated from strong oxidants, acids, halogens, food and feedstuffs. Well closed.

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

IMPORTANT DATA

Physical State; Appearance
ODOURLESS, BRITTLE, GREY, METALLIC-LOOKING CRYSTALS.

Chemical dangers
Upon heating, toxic fumes are formed. Reacts violently with strong oxidants and halogens, causing fire and explosion hazard. Reacts with acids to produce toxic arsine gas (see: ICSC 0222).

Occupational exposure limits
TLV: 0.01 mg/m^3 as TWA; A1 (confirmed human carcinogen); BEI issued; (ACGIH 2004).
MAK: Carcinogen category: 1; Germ cell mutagen group: 3A; (DFG 2004).

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

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

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 gastrointestinal tract, cardiovascular system, central nervous system and kidneys, resulting in severe gastroenteritis, loss of fluid, and electrolytes, cardiac disorders, shock, convulsions and kidney impairment. Exposure above the OEL may result in death. The effects may be delayed. Medical observation is indicated.

Effects of long-term or repeated exposure
Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the mucous membranes, skin, peripheral nervous system, liver and bone marrow, resulting in pigmentation disorders, hyperkeratosis, perforation of nasal septum, neuropathy, liver impairment, anaemia. This substance is carcinogenic to humans. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Sublimation point: 613/C
Density: 5.7 g/cm^3
Solubility in water: none

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms. It is strongly advised that this substance does not enter the environment.

NOTES

The substance is combustible but no flash point is available in literature.
Depending on the degree of exposure, periodic medical examination is suggested.
Do NOT take working clothes home.
Refer also to cards for specific arsenic compounds, e.g., Arsenic pentoxide (ICSC 0377), Arsenic trichloride (ICSC 0221), Arsenic trioxide (ICSC 0378), Arsine (ICSC 0222).
Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.
Card has been partly updated in October 2005 in section Effects of long-term or repeated exposure.

ADDITIONAL INFORMATION

BENZENE	ICSC: 0015

Date of Peer Review: May 2003

Cyclohexatriene
Benzol

CAS #	71-43-2	C_6H_6
RTECS #	CY1400000	Molecular mass: 78.1
UN #	1114	
EC #	601-020-00-8	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive. Risk of fire and explosion: see Chemical Dangers.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling. Use non-sparking handtools. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**AVOID ALL CONTACT!**	
Inhalation	Dizziness. Drowsiness. Headache. Nausea. Shortness of breath. Convulsions. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	MAY BE ABSORBED! Dry skin. Redness. Pain. (Further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
Eyes	Redness. Pain.	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	Abdominal pain. Sore throat. Vomiting. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	**PACKAGING & LABELLING**
Remove all ignition sources. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Personal protection: complete protective clothing including self-contained breathing apparatus.	Do not transport with food and feedstuffs. **EU Classification** Symbol: F, T R: 45-46-11-36/38-48/23/24/25-65 S: 53-45 Note: [E] **UN Classification** UN Hazard Class: 3 UN Pack Group: II
EMERGENCY RESPONSE	**SAFE STORAGE**
Transport Emergency Card: TEC (R)-30S1114 / 30GF1-II NFPA Code: H2; F3; R0	Fireproof. Separated from food and feedstuffs oxidants and halogens.

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SEE IMPORTANT INFORMATION ON BACK

BENZENE ICSC: 0015

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The vapour is heavier than air and may travel along the ground; distant ignition possible. As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
Reacts violently with oxidants, nitric acid, sulfuric acid and halogens causing fire and explosion hazard. Attacks plastic and rubber.

OCCUPATIONAL EXPOSURE LIMITS:

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 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes, the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous

TLV: 0.5 ppm as TWA; 2.5 ppm as STEL; (skin); A1; BEI issued; (ACGIH 2004). MAK: H; Carcinogen category: 1; Germ cell mutagen group: 3A; (DFG 2004).	system, resulting in lowering of consciousness. Exposure far above the occupational exposure limit value may result in unconsciousness and death. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** The liquid defats the skin. The substance may have effects on the bone marrow and immune system, resulting in a decrease of blood cells. This substance is carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 80°C Melting point: 6°C Relative density (water = 1): 0.88 Solubility in water, g/100 ml at 25°C: 0.18 Vapour pressure, kPa at 20°C: 10 Relative vapour density (air = 1): 2.7	Relative density of the vapour/air-mixture at 20°C (air = 1): 1.2 Flash point: -11°C c.c. Auto-ignition temperature: 498°C Explosive limits, vol% in air: 1.2-8.0 Octanol/water partition coefficient as log Pow: 2.13

ENVIRONMENTAL DATA

The substance is very toxic to aquatic organisms.

NOTES

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

ADDITIONAL INFORMATION

BENZ(a)ANTHRACENE

0385
October 1995

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

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

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

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

EMERGENCY RESPONSE	SAFE STORAGE
	Well closed.

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SEE IMPORTANT INFORMATION ON THE BACK.

IMPORTANT DATA

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

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

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

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

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

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

PHYSICAL PROPERTIES

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

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

ENVIRONMENTAL DATA

Bioaccumulation of this chemical may occur in seafood.

NOTES

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

ADDITIONAL INFORMATION

BENZO(a)PYRENE

0104
October 2005

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

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

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

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

EMERGENCY RESPONSE	SAFE STORAGE
	Separated from strong oxidants.

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IMPORTANT DATA

Physical State; Appearance
PALE-YELLOW CRYSTALS

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

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

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

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

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

PHYSICAL PROPERTIES

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

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

ENVIRONMENTAL DATA

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

NOTES

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

ADDITIONAL INFORMATION

CADMIUM

0020
April 2005

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

Cd
Atomic mass: 112.4

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

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

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

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

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IMPORTANT DATA

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

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

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

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

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

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

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

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

PHYSICAL PROPERTIES

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

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

ENVIRONMENTAL DATA

NOTES

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

ADDITIONAL INFORMATION

CHROMIUM

0029
October 2004

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

Chrome
(powder)
Cr
Atomic mass: 52.0

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

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

EMERGENCY RESPONSE	SAFE STORAGE

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IMPORTANT DATA

Physical State; Appearance
GREY POWDER

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

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

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

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

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

PHYSICAL PROPERTIES

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

ENVIRONMENTAL DATA

NOTES

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

ADDITIONAL INFORMATION

COPPER

0240

September 1993

CAS No: 7440-50-8
RTECS No: GL5325000
UN No:
EC No:

Cu
Atomic mass: 63.5

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Special powder, dry sand, NO other agents.
EXPLOSION			

EXPOSURE		**PREVENT DISPERSION OF DUST!**	
Inhalation	Cough. Headache. Shortness of breath. Sore throat.	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.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. Nausea. Vomiting.	Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	**PACKAGING & LABELLING**
Sweep spilled substance into containers. Carefully collect remainder. Then remove to safe place (extra personal protection: P2 filter respirator for harmful particles).	Symbol R: S:

EMERGENCY RESPONSE	**STORAGE**
	Separated from: see Chemical Dangers.

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IMPORTANT DATA

Physical State; Appearance
RED POWDER, TURNS GREEN ON EXPOSURE TO MOIST AIR.

Chemical Dangers
Shock-sensitive compounds are formed with acetylenic compounds, ethylene oxides and azides. Reacts with strong oxidants like chlorates, bromates and iodates, causing explosion hazard.

Occupational Exposure Limits
TLV: ppm; 0.2 mg/m^3 fume (ACGIH 1992-1993).
TLV (as Cu, dusts & mists): ppm; 1 mg/m3 (ACGIH 1992-1993).

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 fever (see Notes).

Effects of Long-term or Repeated Exposure
Repeated or prolonged contact may cause skin sensitization.

PHYSICAL PROPERTIES

Boiling point: 2595 C
Melting point: 1083 C
Relative density (water = 1): 8.9
Solubility in water: none

ENVIRONMENTAL DATA

NOTES

The symptoms of metal fume fever do not become manifest until several hours.

ADDITIONAL INFORMATION

LEAD

0052
October 2002

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

Lead metal
Plumbum
(powder)
Pb
Atomic mass: 207.2

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

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

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

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IMPORTANT DATA

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

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

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

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

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

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

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

PHYSICAL PROPERTIES

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

ENVIRONMENTAL DATA

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

NOTES

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

ADDITIONAL INFORMATION

Safety data for magnesium

Click here for data on magnesium in student-friendly format, from the HSci project

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: magnesium ribbon, magnesium wire, magnesium powder
Molecular formula: Mg
CAS No: 7439-95-4
EC No: 231-104-6

Physical data

Appearance: silver or grey rod, turnings or ribbon
Melting point: 650 C
Boiling point: 1107 C
Vapour density:
Vapour pressure: 1 mm at 621 C
Specific gravity: 1.73
Flash point: 634 C (closed cup)

Explosion limits:
Autoignition temperature: 510 C

Stability

Stable. Reacts violently with halogens, chlorinated solvents, chloromethane. Air and moisture sensitive. Incompatible with acids, acid chlorides, strong oxidizing agents. Highly flammable.

Toxicology

Harmful if swallowed or inhaled. Severe irritant. Vesicant.

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R11 R20 R22.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
Hazard class 4.1 Packing group III

Personal protection

Safety glasses.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S16 S26 S33 S36 S37 S39.

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

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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.

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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/m^3 as TWA; (skin); A4; BEI issued; (ACGIH 2004).
MAK: 0.1 mg/m^3; 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

NAPHTHALENE

0667
April 2005

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

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

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

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

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

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IMPORTANT DATA

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

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

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

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

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

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

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

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

PHYSICAL PROPERTIES

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

ENVIRONMENTAL DATA

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

NOTES

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

ADDITIONAL INFORMATION

m-XYLENE

0085
August 2002

CAS No: 108-38-3
RTECS No: ZE2275000
UN No: 1307
EC No: 601-022-00-9

meta-Xylene
1,3-Dimethylbenzene
m-Xylol
$C_6H_4(CH_3)_2$ / C_8H_{10}
Molecular mass: 106.2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 27/C explosive vapour/air mixtures may be formed.	Above 27/C use a closed system, ventilation, and explosion-proof electrical equipment. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**STRICT HYGIENE!**	
Inhalation	Dizziness. Drowsiness. Headache. Nausea.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Burning sensation. Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Ventilation. Remove all ignition sources. 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. (Extra personal protection: filter respirator for organic gases and vapours.)	**EU classification** Xn Symbol R: 10-20/21-38 S: (2-)25 Note: C **UN classification** UN Hazard Class: 3 UN Pack Group: III

EMERGENCY RESPONSE	SAFE STORAGE
NFPA Code: H 2; F 3; R 0; Transport Emergency Card: TEC (R)-30S1307-III	Fireproof. Separated from strong oxidants and strong acids.

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IMPORTANT DATA

Physical State; Appearance
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

Physical dangers
As a result of flow, agitation, etc., electrostatic charges can be generated.

Chemical dangers
Reacts with strong acids and strong oxidants.

Occupational exposure limits
TLV: 100 ppm as TWA; 150 ppm as STEL A4 (ACGIH 2001). BEI specified by (ACGIH 2001).
MAK: 100 ppm, 440 mg/m^3. Peak limitation category: II(2) skin absorption (H); Pregnancy risk group: D (DFG 2005).
EU OEL: 50 ppm as TWA; 100 ppm as STEL (skin) (EU 2000).

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

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

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

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

PHYSICAL PROPERTIES

Boiling point: 139/C
Melting point: -48/C
Relative density (water = 1): 0.86
Solubility in water: none
Vapour pressure, kPa at 20/C: 0.8
Relative vapour density (air = 1): 3.7
Relative density of the vapour/air-mixture at 20/C (air = 1): 1.02
Flash point: 27/C c.c.
Auto-ignition temperature: 527/C
Explosive limits, vol% in air: 1.1-7.0
Octanol/water partition coefficient as log Pow: 3.20

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated.
The recommendations on this Card also apply to technical xylene.
See ICSC 0084 o-Xylene and 0086 p-Xylene.

ADDITIONAL INFORMATION

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
C_2Cl_4 / $Cl_2C=CCl_2$
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.

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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

TRICHLOROETHYLENE

0081
October 2000

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 / $ClCH=CCl_2$
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.

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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

ZINC POWDER

1205
October 1994

CAS No: 7440-66-6
RTECS No: ZG8600000
UN No: 1436 (zinc powder or dust)
EC No: 030-001-00-1

Blue powder
Merrillite
(powder)
Zn
Atomic mass: 65.4

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 open flames, NO sparks, and NO smoking. NO contact with acid(s), base(s) and incompatible substances (see Chemical Dangers).	Special powder, dry sand, NO other agents. NO water.
EXPLOSION	Risk of fire and explosion on contact with acid(s), base(s), water and incompatible substances.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding). Prevent deposition of dust.	In case of fire: cool drums, etc., by spraying with water but avoid contact of the substance with water.
EXPOSURE		**PREVENT DISPERSION OF DUST! STRICT HYGIENE!**	
Inhalation	Metallic taste and metal fume fever. Symptoms may be delayed (see Notes).	Local exhaust.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin.	Protective gloves.	Rinse and then wash skin with water and soap.
Eyes		Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. Nausea. Vomiting.	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Extinguish or remove all ignition sources. Do NOT wash away into sewer. Sweep spilled substance into containers. then remove to safe place. Personal protection: self-contained breathing apparatus.	F Symbol N Symbol R: 15-17-50/53 S: (2-)7/8-43-46-60-61 UN Hazard Class: 4.3 UN Subsidiary Risks: 4.2 Airtight.

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-43GWS-II+III NFPA Code: H0; F1; R1	Fireproof. Separated from acids, bases oxidants. Dry.

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IMPORTANT DATA

Physical State; Appearance
ODOURLESS GREY TO BLUE POWDER.

Physical dangers
Dust explosion possible if in powder or granular form, mixed with air. If dry, it can be charged electrostatically by swirling, pneumatic transport, pouring, etc.

Chemical dangers
Upon heating, toxic fumes are formed. The substance is a strong reducing agent and reacts violently with oxidants. Reacts with water and reacts violently with acids and bases forming flammable/explosive gas (hydrogen - see ICSC0001). Reacts violently with sulfur, halogenated hydrocarbons and many other substances causing fire and explosion hazard.

Occupational exposure limits
TLV not established.

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 fumes may cause metal fume fever. The effects may be delayed.

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

PHYSICAL PROPERTIES

Boiling point: 907/C
Melting point: 419/C
Relative density (water = 1): 7.14
Solubility in water: reaction
Vapour pressure, kPa at 487/C: 0.1
Auto-ignition temperature: 460/C

ENVIRONMENTAL DATA

NOTES

Zinc may contain trace amounts of arsenic, when forming hydrogen, may also form toxic gas arsine (see ICSC0001 and ICSC0222).
Reacts violently with fire extinguishing agents such as water, halons, foam and carbon dioxide.
The symptoms of metal fume fever do not become manifest until several hours later.
Rinse contaminated clothes (fire hazard) with plenty of water.
Card has been partly updated in April 2005. See sections EU classification, Emergency Response.

ADDITIONAL INFORMATION

Appendix B
Activity Hazard Analyses

Project Identification 43-25 38th Street	**Location** Various	**Estimated Dates** TBD
Phase of Work Mobilization/ Demobilization	**Page 1 of 5**	**Analysis Approved by** Richard Kampf, PM/HSM
TASKS	**HAZARDS**	**CONTROL MEASURES**
1. Mobilization and demobilization of equipment site tools, personnel	Slips/trips/falls	• Maintain alertness to slip/trip/fall hazards; ain 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	• 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	• 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	• Spotters will be used when backing up trucks and heavy equipment • and when moving equipment.
	Noise	• Ear plugs or ear muffs shall be worn for operations that exceed 85 • decibels.
	Electrocution	• 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	• 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 43-25 38th Street	**Location** Various	**Estimated Dates** TBD
Phase of Work Drilling	**Page 2 of 5**	**Analysis Approved by** Richard Kampf, PM/HSM
TASKS	**HAZARDS**	**CONTROL MEASURES**
Drilling	Noise	• Hearing protection mandatory at or above 85 dBA. • Instruct personnel how to properly wear heating protective devices. • Disposable ear plugs or other hearing protection required when working near noisy equipment.
	Steam/Heat/Splashing	• 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	• Follow 29 CFR 1926 Subpart P.
	Overhead hazards	• 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	• 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 37-11 Queens Blvd	**Location** Various	**Estimated Dates** TBD
Phase of Work Environmental Sampling	**Page 3 of 5**	**Analysis Approved by** Richard Kampf, PM/HSM
TASKS	**HAZARDS**	**CONTROL MEASURES**
Soil/sub-slab vapor/soil vapor/indoor air sampling	Chemical hazards	• 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	• 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	• 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	• 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.

Project Identification 37-11 Queens Blvd	**Location** Various	**Estimated Dates** TBD
Phase of Work Decontamination	**Page 4 of 5**	**Analysis Approved by** Richard Kampf, PM/HSM
TASKS	**HAZARDS**	**CONTROL MEASURES**
Decontaminate equipment	Chemical hazards	• 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	• 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	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.
	Electrocution	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 43-25 38th Street	**Location** Various	**Estimated Dates** TBD
Phase of Work Concrete Repair	**Page 5 of 5**	**Analysis Approved by** Richard Kampf, PM/HSM
TASKS	**HAZARDS**	**CONTROL MEASURES**
Slab removal and Replacement Sealing Cracks	Noise	• Hearing protection mandatory at or above 85 dBA. • Instruct personnel how to properly wear heating protective devices. • Disposable ear plugs or other hearing protection required when working near noisy equipment.
	Steam/Heat/Splashing	• 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	• Follow 29 CFR 1926 Subpart P.
	Overhead hazards	• 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	• 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.

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.

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.

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.

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.

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.

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.

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.

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.

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;

- Temperature elevated 1-2^{o}
- 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^{o} 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) 100.6°F	Shorten next work period by 33% Prohibit work in impermeable clothing
Body weight	Before workday begins (a.m.) 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:

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.

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.

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

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

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.

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

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.

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.

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.

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^{o}F to 106^{o}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.

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	^{o}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.

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)											
	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

Site personnel must attend each day's Daily Briefing and sign the attendance sheet.

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.

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.

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.

Personnel must follow proper decontamination procedures and shower as soon as possible upon completion of work shift.

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).

Lighters, matches, cigarettes and other forms of tobacco are prohibited in the Exclusion Zone.

Signs and demarcations shall be followed. Such signs and demarcation shall not be removed, except as authorized by the FTL/HSO.

No one shall enter a permit-required confined space without a permit and appropriate training. Confined space entry permits shall be implemented as issued.

Personnel must follow Hot Work Permits as issued.

Personnel must use the Buddy System in the Exclusion Zone.

Personnel must follow the work-rest regimens and other practices required by the heat stress program.

Personnel must follow lockout/tagout procedures when working on equipment involving moving parts or hazardous energy sources.

No person shall operate equipment unless trained and authorized.

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.

Ladders and scaffolds shall be solidly constructed, in good working condition, and inspected prior to use. No one may use defective ladders or scaffolds.

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.

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.

Hand and portable power tools must be inspected prior to use. Defective tools and equipment shall not be used.

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.

Improper use, mishandling, or tampering with health and safety equipment and samples is prohibited.

Horseplay of any kind is prohibited.

Possession or use of alcoholic beverages, controlled substances, or firearms on any site is forbidden.

Incidents, no matter how minor, must be reported immediately to the Supervisor.

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, Chazen Supervisors, and the FTL/HSO.

Appendix F
Hospital Route Map and Directions

HOSPITAL ROUTE

43-25 38th Street
Queens, NY

0 ¼ ½ ¾ 1 Miles

Document Path: W:\Projects\S-

Appendix G
Incident Report Form / Investigation Form

INCIDENT / NEAR MISS REPORT AND INVESTIGATION - PAGE 1 OF 2

TYPE OF INCIDENT - CHECK ALL THAT APPLY

☐ INJURY/ILLNESS ☐ VEHICLE DAMAGE ☐ PROPERTY DAMAGE ☐ FIRE

☐ SPILL/RELEASE ☐ PERMIT EXCEEDENCE ☐ NEAR MISS ☐ OTHER

GENERAL INFORMATION

PROJECT NAME: DATE OF REPORT: REPORT NO.:

DATE OF INCIDENT: TIME: DAY OF WEEK:

LOCATION OF INCIDENT:

WEATHER CONDITIONS: ADEQUATE LIGHTING AT SCENE? ☐ YES ☐ NO ☐ N/A

DESCRIBE WHAT HAPPENED (STEP BY STEP - USE ADDITIONAL PAGES IF NECESSARY)

AFFECTED EMPLOYEE INFORMATION

NAME: EMPLOYEE: ☐ YES ☐ NO

HOME ADDRESS:

SOCIAL SECURITY NO.: HOME PHONE NO.:

JOB CLASSIFICATION: YEARS IN JOB CLASSIFICATION:

HOURS WORKED ON SHIFT PRIOR TO INCIDENT: AGE:

DID INCIDENT RELATE TO ROUTINE TASK FOR JOB CLASSIFICATION? ☐ YES ☐ NO

INJURY/ILLNESS INFORMATION

NATURE OF INJURY OR ILLNESS:

OBJECT/EQUIPMENT/SUBSTANCE CAUSING HARM:

FIRST AID PROVIDED? ☐ YES ☐ NO

IF YES, WHERE WAS IT GIVEN: ☐ ON-SITE ☐ OFF-SITE

IF YES, WHO PROVIDED FIRST AID:

WILL THE INJURY/ILLNESS RESULT IN: ☐ RESTRICTED DUTY ☐ LOST TIME ☐ UNKNOWN

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

INVESTIGATIVE REPORT

DATE OF INCIDENT: DATE OF REPORT: REPORT NUMBER:

INCIDENT COST: ESTIMATED: $_____ ACTUAL: $_____

OSHA RECORDABLE(S): ☐ YES ☐ NO # RESTRICTED DAYS_____# DAYS AWAY FROM WORK _____

CAUSE ANALYSIS

IMMEDIATE CAUSES - WHAT ACTIONS AND CONDITIONS CONTRIBUTED TO THIS EVENT?

BASIC CAUSES - WHAT SPECIFIC PERSONAL OR JOB FACTORS CONTRIBUTED TO THIS EVENT?

ACTION PLAN

REMEDIAL ACTIONS - WHAT HAS AND OR SHOULD BE DONE TO CONTROL EACH OF THE CAUSES LISTED?

ACTION	PERSON RESPONSIBLE	TARGET DATE	COMPLETION DATE

PERSONS PERFORMING INVESTIGATION

INVESTIGATOR'S NAME: (PRINT) SIGN: DATE:

INVESTIGATOR'S NAME: (PRINT) SIGN: DATE:

INVESTIGATOR'S NAME: (PRINT) SIGN: DATE:

MANAGEMENT REVIEW

PROJECT MANAGER: (PRINT) SIGN: DATE:

COMMENTS:

H&S MANAGER: (PRINT) SIGN: DATE:

COMMENTS:

EXAMPLES OF IMMEDIATE CAUSES

Substandard Actions

- Operating equipment without authority
- Failure to warn
- Failure to secure
- Operating at improper speed
- Making safety devices inoperable
- Removing safety devices
- Using defective equipment
- Failure to use PPE properly
- Improper loading
- Improper placement
- Improper lifting
- Improper position for task
- Servicing equipment in operation
- Under influence of alcohol/drugs
- Horseplay

Substandard Conditions

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

EXAMPLES OF BASIC CAUSES

Personal Factors

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

Job Factors

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

MANAGEMENT PROGRAMS FOR CONTROL OF INCIDENTS

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

Appendix 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.
9.	29.
10.	30.
11.	31.
12.	32.
13.	33.
14.	34.
15.	35.
16.	36.
17.	37.
18.	38.
19.	39.
20.	40.

ATTACHMENT B
QUALITY ASSURANCE PROJECT PLAN

ATTACHMENT B

QUALITY ASSURANCE PROJECT PLAN

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

1.0 PROJECT ORGANIZATION

The investigative efforts defined in this RIWP will be coordinated by Chazen. The following identifies the responsibilities of various organizations supporting the Remedial Investigation (RI) component of this RAWP:

- NYSDEC Project Manager (Sadique Ahmed) will be responsible for reviewing and approving this work plan, coordinating approval of requested modifications, and providing guidance on regulatory requirements.
- Chazen Project Director (Richard T. Kampf, PG, LEP) will provide technical expertise for review of the project plans, reports and ongoing field activities. The Project Director will act as the Project Manager and Quality Assurance Manager.
- Chazen Project Manager 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).
- Chazen Field Team Leader (Branson Fields, Eric Orlowski, Will Olsen, and / or Scott Schmidt) 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 ELAP certified laboratory will be contracted to perform required analyses and reporting, including ASP Category B Deliverables, which will allow for data validation.
- Subcontractors will perform surveying, drilling, data validation, and/or sampling at the direction of the Field Team Leader in accordance with this work plan.

2.0 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.

2.1 Field/Laboratory Data Control Requirements

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 equipment blanks, trip blanks, and field duplicates.

2.2 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. An example of a sample ID is shown below:

- SV001 @ 5': indicates a soil vapor sample collected at location No. 1 set at 5 feet bgs.

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

2.3 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 COC 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 COC as long as it is enclosed in the shipping container and evidence tape (custody seal) remains in place on the shipping container.

2.4 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.

2.4.1 Data Usability and Validation Requirements

Data usability and validation are performed on analytical data sets, primarily to confirm that sampling and COC 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.

2.4.2 Data Usability and Validation Methods

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

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

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.

2.5 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.

2.5.1 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 8.9. 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).

2.5.2 Drilling Equipment

Drilling equipment shall be decontaminated prior to performance of the first soil vapor implant and between all soil vapor implants. This shall include hand tools, casing, augers, drill rods, and other related tools and equipment. Water used during drilling and/or steam cleaning operations shall be from a potable source.

2.5.3 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

2.5.4 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)

2.6 Management of Investigation Derived Waste

Waste materials generated from the field operations may consist of soil cuttings and miscellaneous solid materials such as (PPE) and supplies. Investigative derived waste (IDW) generated during field operations will be disposed of in accordance with applicable regulations. Soil cuttings generated from soil vapor implant 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. 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.

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.

2.7 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 Chazen 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.