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Final Site Characterization Work Plan

Former Dangman Park Manufactured Gas Plant
Site
Brooklyn, New York
Site No. 224047
Index # A2-0552-0606

April 7, 2009

ARCADIS

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Executive Summary

On behalf of National Grid USA (NGRID, formerly KeySpan Corporation [KeySpan]), ARCADIS has prepared this Site Characterization (SC) Work Plan for the former Dangman Park Manufactured Gas Plant (MGP) site (Site) located at 486 Neptune Avenue, Brooklyn, New York. The Site was operated by the Brooklyn Borough Gas Company, which was a predecessor company to NGRID. The Brooklyn Borough Gas Company was acquired by the Brooklyn Union Gas Company (BUG), which ultimately became KeySpan. The MGP operated from prior to 1895 until sometime between 1906 and 1930. The MGP structures were dismantled sometime between 1906 and 1930, and the Site was subsequently sold to and redeveloped by third parties.

The investigation activities outlined in this SC Work Plan will provide data to:

1. Determine if MGP-related and/or non-MGP-related chemical constituents are present in soil, groundwater, sub-slab soil vapor, and/or indoor air at the Site;

2. Identify the potential presence of MGP-related and/or non-MGP-related by-product residuals (e.g., coal tar, non-aqueous phase liquid [NAPL], purifier wastes, petroleum, solvents) in soil and/or groundwater at the Site;

3. Assess the potential for soil vapor intrusion (VI);

4. Evaluate, to the extent practicable, whether there are complete exposure pathways of soil vapor to indoor air (i.e., determine if vapors from MGP-related constituents are migrating through various pathways into on-site buildings at concentrations that may result in an unacceptable human health risk);

5. Preliminarily evaluate whether groundwater flow may be a pathway for off-site migration of identified chemical constituents (if present);

6. Determine compliance with applicable New York State standards, criteria, and guidance (SCGs); and,

7. Provide sufficient data to evaluate the necessity for further action.

Environmental setting and historical information (i.e., Sanborn fire insurance maps and aerial photographs) were reviewed and Site visits conducted to evaluate the nature of environmental conditions in the Site vicinity, current and historical use of the Site and adjacent properties, and potential environmental issues associated with these current and historical activities. The Site is located in the Coney Island community district of Brooklyn on approximately 4 acres of land, and is bounded by Neptune Avenue to the north, W. 5th Street to the east, a residential parcel to the south, and a commercial parcel to the west. Currently, the Site is developed with a strip mall and a parking lot for a high-rise apartment building.

The 1895 Sanborn map shows two gas holders, a retort house, two oil tanks, a tar tank, an engine room, a purifying house, and a shed. By 1906, the MGP Site was operated by the Brooklyn Borough Gas Company; an additional gas holder, generating house and cistern had been constructed, and the retort house and tar tank were no longer present. The MGP structures were removed sometime between 1906 and 1930. By 1930, the MGP structures had been removed and the Site was occupied by a club house. By 1966, the Trump Village Shopping Center occupied the Site.

The field activities to be conducted during the SC consist of a subsurface investigation including:

1. A ground penetrating radar (GPR) investigation to evaluate the possible presence and location of the former MGP structures;

2. The completion of soil borings and subsurface soil analysis;

3. A groundwater investigation including the installation of groundwater monitoring wells, characterization of groundwater flow and quality, determining presence/absence of NAPL, and determining NAPL characteristics (if present); and

4. A VI investigation including the advancement of temporary sub-slab soil vapor points and characterization of sub-slab soil vapor and indoor air quality.

All soil and monitoring well groundwater samples will be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals and free cyanide. A groundwater sample collected from soil boring SB-2 (i.e., HydroPunch® sample) will be analyzed for VOCs

only. The sub-slab soil vapor and indoor air samples will be analyzed for the EPA Method TO-15 target analyte list provided in the QAPP (Appendix B of this SC Work Plan). If MGP impacts are observed during the SC, a qualitative human health exposure assessment (QHHEA) will be conducted. Following an evaluation of the analytical results for the samples collected during the SC field activities, an SC Report will be prepared to describe the SC field investigation activities and results. If a QHHEA is required, it will be conducted subsequent to the SC; therefore, the results of a QHHEA will be presented in a separate report to be incorporated into the previously completed SC Report.

1. Introduction

On behalf of National Grid USA (NGRID, formerly KeySpan Corporation [KeySpan]), ARCADIS has prepared this Site Characterization (SC) Work Plan for the former Dangman Park Manufactured Gas Plant (MGP) site (Site) located at 486 Neptune Avenue, Brooklyn, New York. The Site consists of two parcels located along Neptune Avenue and W. 5th Street. The Site was operated by the Brooklyn Borough Gas Company, which was a predecessor company to NGRID. The Brooklyn Borough Gas Company was acquired by the Brooklyn Union Gas Company (BUG), which ultimately became KeySpan. The MGP operated from prior to 1895 until sometime between 1906 and 1930. The MGP structures were dismantled sometime between 1906 and 1930, and the Site was subsequently sold to and redeveloped by third parties. This SC Work Plan has been prepared in accordance with the requirements of a Multi-Site Order on Consent (ACO) and Administrative Settlement (Index # A2-0552-0606) that was entered into by KeySpan and the New York State Department of Environmental Conservation (NYSDEC) in February 2007.

1.1 Objectives

The investigation activities outlined in this SC Work Plan will provide data to address the following objectives:

- Determine if MGP-related and/or non-MGP-related chemical constituents are present in soil, groundwater, sub-slab soil vapor, and/or indoor air at the Site.
- Identify the potential presence of MGP-related and/or non-MGP-related by-product residuals (e.g., coal tar, non-aqueous phase liquid [NAPL], purifier wastes, petroleum, solvents) in soil and/or groundwater at the Site.
- Assess the potential for soil vapor intrusion.
- Evaluate, to the extent practicable, whether there are complete exposure pathways of soil vapor to indoor air (i.e., determine if vapors from MGP-related constituents are migrating through various pathways into on-site buildings at concentrations that may result in an unacceptable human health risk).
- Preliminarily evaluate whether groundwater flow may be a pathway for off-site migration of identified chemical constituents (if present).

- Determine compliance with applicable New York State standards, criteria, and guidance (SCGs).

- Provide sufficient data to evaluate the necessity for further action.

1.2 Work Plan Organization

This SC Work Plan is organized into the following sections, attachments, and appendices:

- Section 2 of this SC Work Plan summarizes the Site setting and history, geology, and hydrogeology.

- Section 3 describes the SC field activities to be conducted.

- Section 4 provides an outline of the Site Characterization Report (SC Report) that will be prepared following the SC investigation activities to summarize the activities and results.

- Section 5 presents a conceptual target duration schedule for completing the field investigation activities and submitting the SC Report.

- Section 6 presents the references used to develop the SC Work Plan.

- Attachment 1 presents the Records Search letter that was prepared by GEI Consultants, Inc. (GEI).

- Attachment 2 presents historical documentation used to develop the SC Work Plan and other pertinent records.

- Attachment 3 presents a Contingency Plan that describes detailed procedures to be followed during drilling to limit the potential for remobilization and downward migration of dense non-aqueous phase liquid (DNAPL), if encountered.

- Appendix A – Field Sampling Plan (FSP) contains detailed field procedures and protocols that will be followed during the field activities.

- Appendix B – Quality Assurance Project Plan (QAPP) presents the analytical methods and procedures that will be used to analyze soil, groundwater, sub-slab soil vapor, indoor air, and ambient (outdoor) air samples collected during the field activities.

- Appendix C – Community Air Monitoring Plan (CAMP) presents air monitoring and response efforts to detect and mitigate potential airborne releases of constituents of concern (COCs) during the field activities.

- Appendix D – Health and Safety Plan (HASP) presents the project-specific procedures to protect Site workers conducting the SC field activities.

2. Site Description and History

This section presents a detailed description of the Site setting, Site history, current Site conditions based on an October 28, 2008 Site visit, and geologic and hydrogeologic conditions in the Site vicinity. Environmental setting and historical information (i.e., Sanborn fire insurance maps and aerial photographs) were reviewed and Site visits conducted to evaluate the nature of environmental conditions in the Site vicinity, current and historical use of the Site and adjacent properties, and potential environmental issues associated with these current and historical activities. A regulatory database search was conducted by GEI to evaluate the presence of potential environmental issues at the Site and the surrounding area (see Attachment 1 of this SC Work Plan). This information was compiled to develop the approach for the SC investigation activities that are presented in Section 3.

2.1 Site Setting

The Site is located at 486 Neptune Avenue in the Borough of Brooklyn, New York City, Kings County, New York and is identified by Tax Map Number: Block 7273, Lots 1 and 25. As shown on Figure 1, the Site is located approximately 1,300 feet southeast of Coney Island Creek and approximately 2,400 feet north of New York Bay. The Site is generally flat with an elevation of approximately 6 feet above mean sea level (amsl). The closest natural surface water body is Coney Island Creek, which is located approximately 0.25 miles to the northwest of the Site.

The layout of the Site and surrounding properties is presented on Figure 2. The Site is located in the Coney Island community district of Brooklyn on approximately 4 acres of land, and is bounded by Neptune Avenue to the north, W. 5th Street to the east, a

residential parcel to the south, and a commercial parcel to the west. Currently, the Site is developed with a strip mall and a parking lot for a high-rise apartment building. Land use and zoning at the Site and the other properties in the area is commercial and residential. Land use to the north is residential and commercial, land use to the east and south is residential, and land use to the west is commercial and residential (New York City Planning Commission Zoning Map, 2005).

2.2 Site History

This section discusses the historical use of the Site and adjacent properties, with emphasis on the former MGP operations. The information reviewed to produce this summary included:

- Sanborn fire insurance maps
- Aerial photographs (EDR, 2008)

An overview of the historical MGP operations and land use in the Site vicinity, and a timeline of key observations made from the review of historical information in connection with the Site are presented in Sections 2.2.1 and 2.2.2, respectively.

2.2.1 Historical Overview

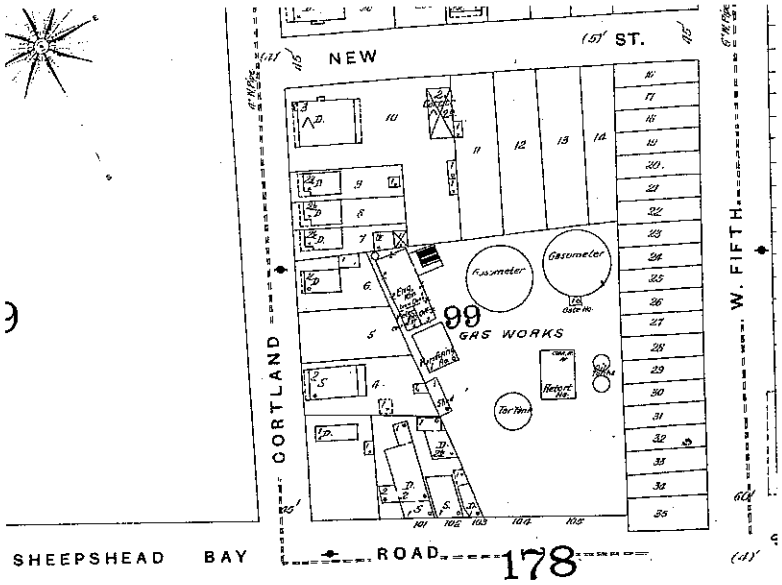
Based on a review of available historical information, the Site was used as a MGP site from prior to 1895 until sometime between 1906 and 1930. The 1895 Sanborn map shows two gas holders, a retort house, two oil tanks, a tar tank, an engine room, a purifying house, and a shed. By 1906, the MGP Site was operated by the Brooklyn Borough Gas Company; an additional gas holder, generating house and cistern had been constructed, and the retort house and tar tank were no longer present. The MGP structures were removed sometime between 1906 and 1930. By 1930, the MGP structures had been removed and the Site was occupied by a club house. By 1966, the Trump Village Shopping Center occupied the Site. The shopping center and parking lot for a high-rise apartment building currently occupy the Site. Figure 2 depicts the approximate location of the former MGP structures.

2.2.2 Historical Timeline

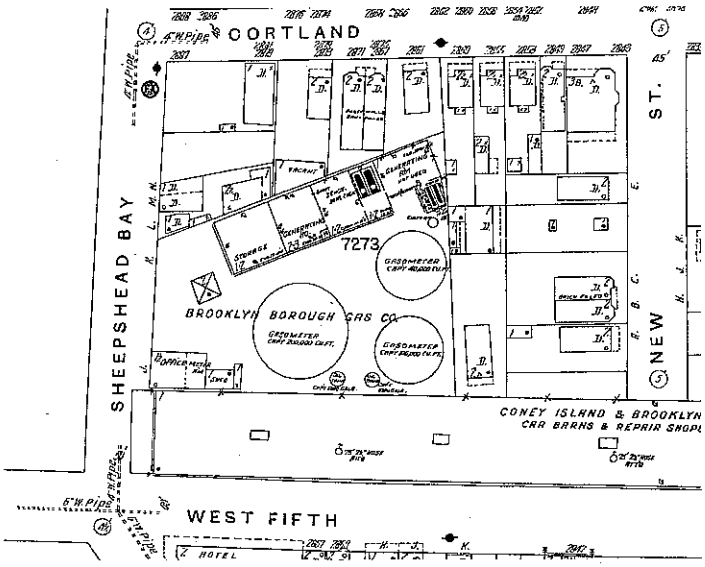
The Sanborn maps (reviewed for 1895, 1906, 1930, 1950, 1966, 1983, 1994, and 1996) provide information on the infrastructure of the Site through time. A copy of the

Sanborn maps, select aerial photographs (photographs that show relevant historical features), and other historical information are included in Attachment 2. Key observations from these maps and other historical resources are summarized in the timeline below.

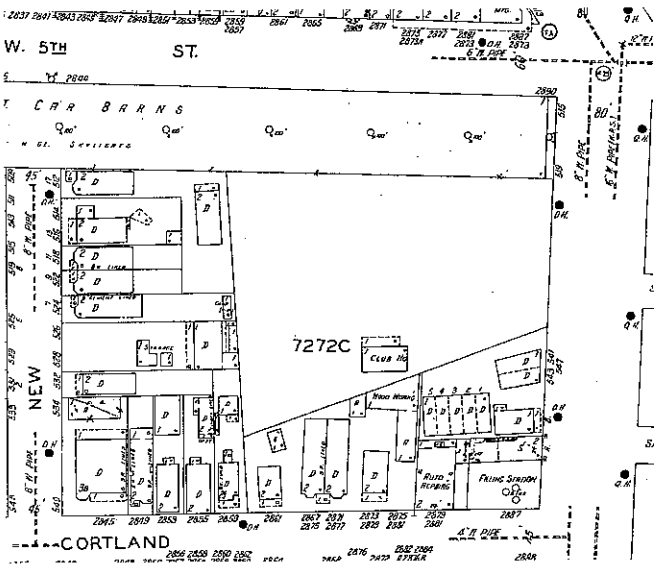
- 1895 Sanborn map (see figure below): Two gas holders, a retort house, two oil tanks, a tar tank, an engine room, a purifying house, and a shed occupied the Site.



- 1906 Sanborn map (see figure below): Brooklyn Borough Gas Company had three gas holders, two oil tanks, a cistern, a generating house, and a shed at the Site. To the east/northeast within the same city block was a parcel occupied by the Coney Island & Brooklyn Railroad (car barns and repair shops).



- 1930 Sanborn map (see figure below): The former MGP structures are no longer present and the Site was occupied by a club house. To the east/northeast within the same city block was a parcel occupied by Brooklyn-Manhattan Transit (BMT) (car barns). To the west/southwest within the same city block was a filling station with three gasoline tanks.



- 1950 Sanborn map: The Site was still occupied by a club house. To the east/northeast within the same city block was a machinery and equipment storage facility. To the west/southwest within the same city block was a filling station with three gasoline tanks.

- 1966 to 1996 Sanborn maps: The Site was occupied by the Trump Village Shopping Center. To the south was a high-rise apartment building.

- 2006 EDR aerial photograph: The Site is occupied by the shopping center and a parking lot for a high-rise apartment building to the south.

2.3 Current Conditions

ARCADIS visited the Site on October 28, 2008 to conduct an initial evaluation of the current Site conditions. ARCADIS also obtained zoning and land use information, which showed the Site's block zoned as commercial/residential, adjacent areas to the east (across W. 5th Street) and south as residential, adjacent area to the west as

commercial/residential, and adjacent area to the north (across Neptune Avenue) as commercial/residential (New York City Planning Commission Zoning Map, 2005).

The Site reconnaissance indicated the following:

- The photo below (looking southeast) shows the portion of the shopping center at the Site that is situated above the former MGP structures (i.e., eastern portion of strip mall) and high-rise apartment buildings in the background.

- An overhead utility is present at the eastern end of the Site. All other utility lines are apparently underground in the Site vicinity. Concrete sidewalks are present around the block; fire protection water lines and hydrants are present in the sidewalk.

- Current strip mall occupants that appear to be situated in the vicinity of/above the former MGP structures (i.e., eastern portion of strip mall) are as follows:

    - Radio Shack

- Karate Instruction
- West 5th Medical Supply
- Eastern Chinese Restaurant
- Kurt Cleaners
- Capital One Bank
- CVS Pharmacy

To evaluate the nature of environmental conditions at the Site and adjacent properties, GEI reviewed a regulatory database search from EDR (GEI, 2007). Related information was also requested from the NYSDEC per the Freedom of Information Law (FOIL). The NYSDEC indicated that no records could be located for the names and/or address that were provided in the FOIL request. Based on the database query, environmental records information for the Site includes:

- Two (2) No. 2 fuel oil underground storage tanks (USTs) were discovered to be leaking based on tank testing. The USTs are located at 2928 W. 5th Street, which is the address of the residential parcel to the south (Block 7273, Lot 25). The Site occupies a portion of this parcel.

- Kurt Cleaners (current strip mall occupant) was identified as a small quantity generator.

No environmental records information was identified for properties abutting the Site.

2.4 Geology

The unconsolidated geologic deposits underlying Kings County consist of clay, silt, sand, and gravel that overlie southward-dipping consolidated bedrock. The crystalline bedrock consists mainly of Precambrian age granite, gneiss, and schist. The overlying unconsolidated sediments were deposited during the Cretaceous and form, in ascending order, the Raritan and Magothy Formations. During the Pleistocene, several episodes of glaciation eroded the Cretaceous deposits (Smolensky, et al, 1989). The oldest Pleistocene deposit is the Jameco Gravel (Jameco aquifer), which overlies the Magothy Formation and Raritan confining unit and is present only in

western Long Island. The Gardiners Clay overlies the Jameco Gravel, Magothy Formation, and Raritan confining unit in western Long Island. The Upper Pleistocene deposits formed when the glacial ice and glacial meltwater deposited till and outwash material, forming what is presently known as the Upper Glacial aquifer.

The Raritan Formation consists of the Lloyd Sand and the Raritan Clay. The Lloyd aquifer (the hydrogeologic equivalent of the Lloyd Sand) consists of fine to coarse sand, gravel, commonly with a clayey matrix, and lenses and layers of silty and solid clay. The Raritan confining unit (the hydrogeologic equivalent of the Raritan Clay) is regionally continuous and consists of silty and solid clay, and lenses and layers of sand. Because of its low permeability, the Raritan Clay serves as a confining unit for the underlying Lloyd Sand.

The Magothy Formation is a deltaic deposit consisting of fine to medium sand, clayey in part, interbedded with lenses and layers of coarse sand, silt, and sandy and solid clay. Gravel is common in the basal zone of the Magothy Formation.

The Jameco aquifer (the hydrogeologic equivalent of the Jameco Gravel) is a channel filling consisting of fine to very coarse sand and gravel with few layers of clay and silt (Smolensky, et al, 1989).

The Gardiners Clay is a lagoonal/shallow-bay clay consisting of clay, silt, and few layers of sand and gravel (Smolensky, et al, 1989).

The Upper Glacial aquifer consists primarily of till and glacial outwash deposits. The till, composed of clay, sand, gravel, and boulders, forms the Harbor Hill and Ronkonkoma terminal moraines. These terminal moraines represent the farthest advance of late-Pleistocene glaciation on Long Island. South of the morainal deposits is a glacial outwash plain, which, in Kings County, extends from the Harbor Hill moraine to Jamaica Bay and New York Bay, and consists of fine to very coarse sand and pebble to boulder sized gravel.

Bedrock beneath the Site is found at an approximate elevation of 650 feet below msl. The Lloyd aquifer, which overlies bedrock, has a surface elevation of approximately 500 feet below msl. The Raritan Clay has a surface elevation of approximately 400 feet below msl. The Magothy aquifer has a surface elevation of approximately 250 feet below msl. The Jameco aquifer has a surface elevation of approximately 200 feet below msl. The Gardiners Clay has a surface elevation of approximately 150 feet

below msl. The Upper Glacial aquifer corresponds to the saturated upper part of the highly permeable Pleistocene deposits of sand and gravel.

2.5 Hydrogeology

The principal aquifers underlying the project area are the Upper Glacial aquifer, Jameco aquifer, and Magothy aquifer. The Gardiners Clay hydraulically confines the Magothy and Jameco aquifers in most of Kings County; the Jameco aquifer and Magothy aquifer hydrogeologic units are in direct hydraulic connection with each other. Groundwater in the Upper Glacial aquifer occurs under unconfined conditions at and near the Site. Within the project area, the average horizontal hydraulic conductivity of the Upper Glacial aquifer is approximately 270 feet per day (ft/d), with an anisotropy ratio of approximately 10:1 (horizontal to vertical, respectively) (McClymonds and Franke, 1972). The average horizontal hydraulic conductivity of the Jameco aquifer in the project area is approximately 200 to 300 ft/d, with an anisotropy ratio of approximately 10:1 (horizontal to vertical, respectively) (McClymonds and Franke, 1972). The average horizontal hydraulic conductivity of the Magothy aquifer in the project area is approximately 50 ft/d, with an anisotropy ratio of approximately 100:1 (horizontal to vertical, respectively) (McClymonds and Franke, 1972).

The Site is located approximately 2,400 feet north of New York Bay. Based on topography, the shallow groundwater flow direction is believed to be generally to the south. However, localized influences, such as underground utilities or other structures, seasonal fluctuations, rainfall, and local surface-water infiltration may cause groundwater flow directions to vary. Site-specific information is needed to evaluate the groundwater flow direction. The depth to groundwater at the Site is approximately 5 feet below land surface (ft bls).

3. Site Characterization Field Activities

This section of the SC Work Plan describes the field activities to be conducted during the SC. Project personnel will conduct the following work activities to evaluate the presence of potential environmental issues at the Site and surrounding area:

- Mobilize to the Site and conduct a utility mark out to verify existing Site conditions and label and/or mark the proposed sample locations.
- Plan the work in conjunction with Site occupants to minimize impacts and promote safe conditions for workers and visitors.

- Conduct a soil investigation including the completion of soil borings and subsurface soil analysis.

- Conduct a groundwater investigation including collection of a HydroPunch® groundwater sample during soil boring activities, the installation of groundwater monitoring wells, characterization of groundwater flow and quality, determine presence/absence of NAPL, and determine NAPL characteristics (if present).

- Conduct a VI investigation including the advancement of temporary sub-slab soil vapor points and characterization of sub-slab soil vapor and indoor air quality.

The VI investigation will be conducted in general accordance with the New York State Department of Health's (NYSDOH) *"Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York"*, dated October 2006, and National Grid's *"Draft Standard Operating Procedures for Soil Vapor Intrusion Evaluation at National Grid MGP Sites in New York State."* It is anticipated that the VI investigation will be conducted during the early part of the 2009-2010 winter heating season (i.e., fall 2009). In New York State, heating systems are generally expected to be operating routinely from November 15 through March 31. Therefore, the VI investigation will be conducted sometime after November 15, 2009.

If MGP impacts are observed during the SC, a qualitative human health exposure assessment (QHHEA) will be conducted. If a QHHEA is required, it will be conducted subsequent to the SC; therefore, the results of a QHHEA will be presented in a separate report to be incorporated into the previously completed SC Report.

The QHHEA will be conducted in accordance with NYSDEC, Division of Environmental Remediation, *Draft DER-10, Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2002). The purpose of the QHHEA is to determine whether Site conditions pose an unacceptable hazard to potentially exposed receptor populations. To pose an unacceptable hazard to receptor populations, the receptor must be exposed to contaminants at the Site. The QHHEA will evaluate whether complete exposure pathways exist at the Site and identify chemicals of potential concern for those receptors and media of concern where a complete exposure pathway exists (NYSDEC, 2002).

3.1 Mobilization and Utility Mark Out

Field personnel will mobilize to the Site to verify existing Site conditions and label and/or mark the proposed sample locations presented on Figure 2. Once the sample locations are marked, New York City/Long Island One Call Dig Safely will be contacted to mark underground utilities in areas where intrusive activities (i.e., drilling, split-spoon sampling, well installation) will occur. The Site property owners, adjacent property owners and/or private vendors will be contacted for assistance with mark out of utilities. Once the utilities are marked, equipment and personnel necessary to accomplish the SC activities will be mobilized to the Site. Given the numerous utilities likely present in an urban setting, the subsurface sample locations will be cleared of utilities to a depth of 5 ft bls by hand or by air knife.

3.2 Soil Investigation

The objectives for the SC soil investigation and the general procedures for obtaining and analyzing subsurface soil samples are detailed in Sections 3.2.1 through 3.2.4.

3.2.1 Soil Investigation Objectives

The objectives of the soil investigation are to:

- Determine if MGP-related and/or non-MGP-related chemical constituents are present in Site soil by collecting, visually characterizing, and analyzing subsurface soil samples.
- Identify the potential presence of MGP-related and non-MGP-related by-product residuals (e.g., coal tar, NAPL, purifier wastes, petroleum, solvents), if any, in soil.
- Obtain sufficient information to evaluate the necessity for further action.

In addition to the objectives outlined above, the subsurface information collected as part of this investigation will be used to characterize the distribution, saturated thickness, and relative permeability of subsurface soil at the Site. This information is important in understanding subsurface conditions at the Site.

3.2.2 Surface Geophysical Survey

To evaluate the possible presence and location of the former MGP structures, a ground penetrating radar (GPR) investigation of the areas immediately north and south of the shopping center building will be completed. The results of the GPR investigation will be used to determine the locations of the proposed subsurface borings SB-1, SB-2, and SB-3 (see Section 3.2.3). If the former tar tank and gas holder extending to the south of the shopping center building are not identified during the GPR investigation, then soil borings SB-1 and SB-2 will be completed at the locations shown on Figure 2 (i.e., based on the superimposition of Sanborn fire insurance maps relative to a recent aerial photograph).

3.2.3 Soil Borings

To accomplish the soil investigation objectives, subsurface borings will be completed at the target locations shown on Figure 2. A summary of the SC activities and sampling rationale is presented in Table 1. Based on observations made during the Site visit, the Site is predominantly covered by a building (i.e., strip mall). NGRID anticipates that the following seven soil borings will be drilled:

- Four soil borings (MW-1 through MW-4) will be completed around the former MGP structures. MW-1 and MW-2 will be completed just upgradient of the former MGP perimeter. MW-3 will be completed along the former MGP western perimeter and MW-4 will be completed along the former MGP eastern perimeter (adjacent to one of the former gas holders).

- One soil boring (SB-1) will be completed within the footprint of the former tar tank, one soil boring (SB-2) will be completed within the footprint of one of the former gas holders, and one soil boring (SB-3) will be completed along the former MGP northern perimeter (between MW-1 and MW-2 and adjacent to one of the former gas holders and the former cistern).

As discussed in Section 3.3.2, four of these soil borings (MW-1 through MW-4) will be completed as monitoring wells. The actual drilling locations may be adjusted based on accessibility and field conditions (e.g., utilities), and in consultation with NGRID and the NYSDEC.

Soil borings will be completed using 4.25-inch inside diameter (ID) hollow-stem augers. Continuous soil sampling will be conducted at the boring locations by advancing a 2-

foot long, 2-inch outside diameter (OD) split-spoon sampler ahead of the augers. Soil recovered from each sample interval will be visually characterized for color, texture, and moisture content as described in the FSP (Appendix A of this SC Work Plan). The presence of visible staining, NAPL (if encountered), and obvious odors will be noted. If NAPL is encountered in any of the soil borings, the DNAPL Contingency Plan provided in Attachment 3 of this SC Work Plan will be implemented to limit the potential for remobilization and downward migration of DNAPL.

Soil borings MW-1 through MW-4 will be completed to a target depth of 20 ft bls, or 10 feet below the water table, whichever is deeper. Soil borings SB-1, SB-2, and SB-3 will be advanced to the base of the structure (estimated to be 10 feet or less below land surface), or to refusal, whichever is encountered first. If evidence of MGP-related impacts is observed, the boring will continue to approximately 10 feet beyond the observed impacts for vertical delineation purposes, until refusal is encountered, until a confining layer is observed, or to a maximum depth of 50 ft bls. At each of the four perimeter soil boring locations (MW-1 through MW-4), a water table monitoring well will be installed, as described in Section 3.3.2. Air monitoring will be conducted in the worker breathing zone during implementation of the SC work activities (most notably during the drilling activities). The air will be monitored using a photoionization detector (PID) and a real-time aerosol monitor. The need for additional perimeter air monitoring at the boundary of the work area during the investigation is detailed in the CAMP (Appendix C of this SC Work Plan). Appendix D provides the health and safety procedures that will be implemented to protect Site workers conducting the SC field activities.

3.2.4 Subsurface Soil Analyses

Two to three subsurface soil samples from each boring will be analyzed for Target Compound List (TCL) VOCs, TCL SVOCs, pesticides, polychlorinated biphenyls (PCBs), target analyte list (TAL) metals, and free cyanide (extraction by EPA Method 9013A and analysis by Microdiffusion, ASTM International Method D4282-02). One sample will be collected from a 2-foot interval in the upper 5 ft of the boring and the second sample will be collected from the depth interval where the greatest apparent degree of impacts is observed. The field representative will select soil samples to meet the SC objectives presented in Section 3.2.1 based on visual observation of MGP and/or non-MGP residual staining in the soil sample interval and/or the sample interval with the highest PID reading. If no staining or PID readings are encountered at a boring location, the second soil sample will be collected immediately above the groundwater table (or for locations within a subgrade holder, just above the foundation)

for laboratory analysis. Samples of "un-impacted' soil (third soil sample) may also be collected below apparent "impacted" soil to aid in vertical delineation, if warranted. Soil sampling methods are described in the FSP (Appendix A of this SC Work Plan).

Samples will be submitted to a NYSDOH accredited laboratory certified for the selected analysis. Analytical methods, sample handling, and laboratory protocols are outlined in the QAPP (Appendix B of this SC Work Plan). Sample analyses will follow the NYSDEC Analytical Services Protocol (ASP) (most recent version) and will include quality assurance/quality control (QA/QC) samples at a frequency indicated in the QAPP. Analytical results for analysis of the soil samples will be reported using NYSDEC ASP Category B data deliverables.

Equipment decontamination will follow the procedures outlined in the FSP. In general, non-disposable equipment, including drilling tools and equipment, will be decontaminated prior to first use on Site, between each investigation location, and prior to demobilization (if dedicated equipment is not used). The integrity of the decontamination procedures will be checked periodically with equipment rinse blanks, as required by the QAPP.

Investigation-derived waste (IDW) will be containerized in appropriate waste containers and staged in an on-site area prior to off-site disposal. Soil cuttings, personal protective equipment (PPE), and spent disposable sampling materials will be segregated by waste type and placed in DOT-approved 55-gallon steel drums. Decontamination water and drilling water will be stored in polyethylene tanks or DOT-approved 55-gallon steel drums. Storage vessels will be appropriately labeled with the contents, generator, location, and date for later off-site transportation and disposal by NGRID.

3.3 Groundwater Investigation

The SC groundwater investigation objectives and general procedures for obtaining and analyzing groundwater samples are detailed in Sections 3.3.1 through 3.3.6.

3.3.1 Groundwater Investigation Objectives

The objectives of the groundwater investigation are to:

- Determine groundwater flow and hydraulic characteristics beneath the Site.

- Evaluate, to the extent practicable, whether groundwater flow may be a pathway for off-site migration of identified chemical constituents (if present).
- Gather sufficient analytical data to evaluate the necessity for further action.
- Determine if MGP-related and/or non-MGP-related chemical constituents are present in groundwater beneath the Site by collecting and analyzing groundwater samples.
- Determine the potential presence of NAPL in subsurface materials, and, if present, quantify relevant physical properties of the NAPL.

The approach that will be implemented to address these objectives is discussed below.

3.3.2 Groundwater Monitoring Well Installation

NGRID anticipates that the SC groundwater investigation will consist of installing four overburden monitoring wells (MW-1 through MW-4) at the MW-1 through MW-4 soil boring locations and the collection of a HydroPunch® groundwater sample from the soil boring SB-2 location. The final locations of the monitoring wells and soil borings may be modified in the field based on the Site reconnaissance and utility locations.

After completing soil borings MW-1 through MW-4, monitoring wells will be installed at each location using the protocols presented in the FSP. The monitoring wells will be constructed using 2-inch diameter Schedule 40 polyvinyl chloride (PVC) casing and screen and will be completed to a depth that permits the screened section of the well to straddle the water table. However, if the water table is within 2 feet of the surface, an alternate monitoring well installation protocol will be used to maintain an adequate surface seal (as described in the FSP). If MGP-related impacts are observed below the water table, an alternative depth may be selected in the field, in consultation with NGRID and the NYSDEC. The monitoring well will be completed at the surface with a locking cap and a flush-mount protective casing.

Following installation, and immediately prior to development as discussed below, each well will be gauged for the presence of NAPL using the procedures described in the FSP. Each well will then be developed by surging and bailing or pumping water from the well using the procedures outlined in the FSP. Surging and bailing or pumping will continue until the turbidity is below 50 nephelometric turbidity units (NTUs) or until pH and conductivity measurements have stabilized. Water generated by monitoring well

development and equipment decontamination will be containerized in DOT-approved 55-gallon steel drums or an on-site polyethylene storage tank for storage prior to being transported for off-site disposal by NGRID.

Subsequent to the well installation activities, a New York State licensed surveyor will field survey the soil boring and monitoring well locations and any other pertinent locations (e.g., GPR grid). A permanently surveyed benchmark will be established at the Site. For each soil boring, the surveyor will determine the location relative to the New York State Plane Coordinate System and the ground surface elevation relative to the National Geodetic Vertical Datum of 1929 (NGVD 29). For each monitoring well, the surveyor will determine the location relative to the New York State Plane Coordinate System, and the ground surface elevation and measuring point elevation (defined as the top of the inner casing) relative to NGVD 29.

3.3.3 Groundwater Flow and Hydraulic Characteristics

Concurrent with the collection of groundwater samples from each monitoring well, specific capacity tests will be conducted, where feasible, to evaluate the hydraulic conductivity of the formation surrounding the screened interval of each monitoring well. Water-level drawdown will be monitored using an electronic water-level indicator.

The groundwater flow patterns and hydraulic characteristics beneath the Site will be evaluated by collecting a comprehensive round of fluid-level measurements from the groundwater monitoring wells to determine the general groundwater flow direction at the Site. Groundwater levels will be measured to the nearest one-hundredth of a foot from a reference point at the top of the inner casing using the procedures outlined in the FSP. The fluid-level measurements will be converted to groundwater elevations based on the surveyed monitoring well measuring point elevations. The groundwater elevation information will be used in conjunction with the hydraulic conductivity test results to evaluate horizontal groundwater flow beneath the Site.

3.3.4 Groundwater Quality Characterization

To assess the potential presence of dissolved-phase MGP-related and/or non-MGP-related chemical constituents in groundwater at the Site, one complete round of groundwater sampling will be conducted. The groundwater sampling will be conducted two weeks after completion of the monitoring well installation and development activities to allow for a period of equilibration. The groundwater sampling event will consist of collecting one groundwater sample from each groundwater monitoring well.

The wells will be purged using low-flow methods as described in the FSP. Each well will be gauged for the presence of NAPL prior to purging.

Following the purging, one groundwater sample will be collected from each monitoring well using low-flow sampling techniques and a submersible pump. The groundwater samples will be submitted to the laboratory for the analysis of TCL VOCs, TCL SVOCs, pesticides, PCBs, TAL metals, and free cyanide (Microdiffusion, ASTM International Method D4282-02). Field parameters including pH, oxidation-reduction potential (ORP), turbidity, temperature, conductivity, and dissolved oxygen will be collected during groundwater sampling using the procedures outlined in the FSP.

A HydroPunch® groundwater sample will be collected from the SB-2 location at a depth 5 feet below the water table using the methods described in the FSP and submitted to the laboratory for the analysis of TCL VOCs. The intent of this groundwater sample is to assess whether tetrachloroethene (PCE) impacts are present in groundwater in the apparent downgradient direction from Kurt Cleaners. If the geophysical survey and soil boring indicate that there is a concrete foundation associated with the subgrade holder, then a groundwater sample from SB-2 may not be representative of ambient groundwater conditions outside the holder foundation. A determination will be made in the field as to whether a groundwater sample needs to be collected from an alternate or additional soil boring location.

3.3.5 Assess the Presence/Characteristics of NAPL

The existing monitoring wells will be gauged for the presence of NAPLs during the water-level measurement round. If LNAPL and/or DNAPL are observed to be present in sufficient volume at any monitoring well, the NAPL will be sampled and analyzed for fingerprint analysis, density, viscosity, and interfacial tension. Analyses will be conducted at ambient groundwater temperatures.

3.3.6 Management of Investigation-Derived Waste

As described above, IDW will be containerized and staged on site for appropriate characterization and disposal. PPE and spent disposable sampling materials will be segregated and placed in DOT-approved 55-gallon steel drums. Decontamination water and monitoring well purge water will be stored in DOT-approved 55-gallon steel drums or polyethylene tanks. Waste storage containers will be appropriately labeled with the contents, generator, location, and date for later off-site transportation and disposal by NGRID.

One representative sample will be collected from the drill cuttings and one representative sample will be collected from the decontamination water and monitoring well purge water generated by the field activities. The samples will be submitted to the laboratory for extraction using the toxicity characteristic leaching procedure (TCLP), followed by laboratory analysis of the leachate for TCLP VOCs, TCLP SVOCs, TCLP pesticides, and TCLP metals. In addition, the samples will be analyzed for total polychlorinated biphenyls (PCBs), reactivity, corrosivity, and ignitability. NGRID will use the analytical results from the waste characterization samples to profile the waste materials for disposal.

3.4 Vapor Intrusion Investigation

The SC VI investigation objectives and general procedures for obtaining and analyzing groundwater samples are detailed in Sections 3.4.1 through 3.4.3.

3.4.1 VI Investigation Objectives

The objectives of the VI investigation are to:

- Determine if MGP-related and/or non-MGP-related chemical constituents are present in Site sub-slab soil vapor and indoor air by collecting and analyzing sub-slab soil vapor and indoor air quality samples.

- Evaluate, to the extent practicable, whether there are complete exposure pathways of soil vapor to indoor air (i.e., determine if vapors from MGP-related constituents are migrating through various pathways into on-site buildings at concentrations that may result in an unacceptable human health risk).

- Obtain sufficient information to evaluate the necessity for further action.

The approach that will be implemented to address these objectives is discussed below.

3.4.2 Temporary Sub-Slab Soil Vapor Point Advancement and Sub-Slab Soil Vapor Sampling

A summary of the SC activities and sampling rationale is presented in Table 1. NGRID anticipates that the SC VI investigation will consist of advancing temporary sub-slab soil vapor points in select tenant spaces in the strip mall that overlie the former MGP structures. The number of proposed temporary sub-slab soil vapor points and their locations will be provided in a SC Work Plan Addendum following the completion of the

soil and groundwater investigation. Data collected during the soil and groundwater investigation will be used to refine the number and locations of sub-slab soil vapor points. The final locations of the temporary sub-slab soil vapor points may be modified in the field based on Site constraints within the tenant spaces.

The temporary sub-slab soil vapor point boreholes will be drilled using a core drill or rotary hammer drill and a manual slide hammer. Temporary sub-slab soil vapor sampling points consisting of 1.25-inch diameter steel drive rods will be advanced to a depth of approximately 2 to 3 inches below the bottom of the floor slab following the methods described in the FSP (Appendix A of this SC Work Plan). The temporary sub-slab soil vapor point samples are intended to serve as screening-level samples that will be collected from a temporary point; therefore, temporal repeat sampling of temporary sub-slab soil vapor point sample intervals will not be performed.

The sub-slab soil vapor samples will be collected from the temporary sub-slab soil vapor points using the Geoprobe® Post Run Tubing (PRT) System and 6-liter SUMMA® canisters and 0.5-hour flow controllers (i.e., flow rate of approximatley 167 milliliters per minute [mL/min]). The PRT System allows for the collection of soil vapor samples at the desired sampling depth while significantly reducing the chances of rod leakage and ambient air contamination. O-ring connections enable the PRT System to deliver a vacuum-tight seal that prevents sample contamination from ambient air and assures that the sample is taken from the desired depth at the bottom of the boring.

To assess the potential presence of MGP-related and/or non-MGP-related chemical constituents in sub-slab soil vapor at the Site, one round of sub-slab soil vapor sampling will be conducted. The sub-slab soil vapor sampling event will consist of collecting one soil vapor sample from each temporary sub-slab soil vapor sampling point using the methods described in the FSP.

The sub-slab soil vapor samples will be submitted to the laboratory for the analysis of the EPA Method TO-15 target analyte list provided in the QAPP (Appendix B of this SC Work Plan). This target analyte list includes compounds for which Method TO-15 has been validated and additional analytes that may assist with identifying MGP-related vapors. These additional analytes are identified in the NYSDOH's guidance document (NYSDOH, 2006) as indicator compounds for MGP sites.

3.4.3 Indoor Air Quality Sampling

A summary of the SC activities and sampling rationale is presented in Table 1. NGRID anticipates that the SC VI investigation will consist of collecting indoor air quality samples in select tenant spaces in the strip mall that overlie the former MGP structures (i.e., co-located with the sub-slab soil vapor samples) and one ambient air sample at a location upwind of the strip mall. The number of proposed indoor air quality samples and their locations will be provided in a SC Work Plan Addendum following the completion of the soil and groundwater investigation. The final locations of the indoor air quality samples may be modified in the field based on Site constraints within the tenant spaces.

Prior to collecting the indoor air quality samples, a building survey and chemical inventory will be conducted to assess potential indoor air sources that may contain the same compounds as MGP-related volatile constituents. The NYSDOH Indoor Air Quality Questionnaire and Building Inventory Field Form will be completed for each tenant space where an indoor air quality sample is collected.

The indoor air quality and ambient air samples will be collected using 6-liter SUMMA® canisters and 8-hour flow controllers (i.e., flow rate of approximately 11.5 mL/min). The SUMMA® canisters will be situated on a stable platform (e.g., box or crate) so that the sampling zone is approximately 3 feet above the floor or ground surface (i.e., representative of the breathing zone).

To assess the potential presence of MGP-related and/or non-MGP-related chemical constituents in indoor air at the Site, one round of indoor air quality sampling will be conducted. The indoor air quality sampling event will consist of collecting one indoor air quality sample from each location using the methods described in the FSP (Appendix A of this SC Work Plan).

The indoor air quality and ambient air samples will be submitted to the laboratory for the analysis of the EPA Method TO-15 target analyte list provided in the QAPP (Appendix B of this SC Work Plan), and will be consistent with the sub-slab soil vapor analyte list.

4. Site Characterization Report

This section presents an outline for the SC Report that will be prepared to describe the SC field investigation activities and results. Following receipt of the analytical results

for the samples collected during the SC field activities, the results will be reviewed by a qualified data validator. A Data Usability Summary Report (DUSR) will be prepared for each sample delivery group. The validated analytical data will be presented in the SC Report. The text of the SC Report will include a discussion of the following general topics:

- Site and project background
- Field activities completed
- Methodologies used to complete the field activities
- Findings of the field activities
- Understanding of the conceptual site model including the geologic and hydrogeologic conditions
- Summary of the distribution of MGP-related and/or non-MGP-related chemical constituents (if present) in soil, groundwater, sub-slab soil vapor, and indoor air

The text of the SC Report will be supported by presentation of subsurface logs, analytical data summary tables and figures (as appropriate) illustrating site-specific data, including hydrogeologic conditions and the distribution of constituents in subsurface soil, groundwater, sub-slab soil vapor, and indoor air (if present).

5. Conceptual Target Duration Schedule

This section presents a conceptual target duration schedule for implementing the field investigation activities presented in this SC Work Plan. Once written approval is received from the NYSDEC to implement the SC field activities, a revised schedule with target dates will be submitted to the NYSDEC. The project duration may depend on whether additional investigation efforts are required to meet project objectives due to unforeseen field conditions and findings. Changes in the schedule will be made in consultation with NGRID and the NYSDEC.

Work Activity	*Duration*
SC Work Plan Approval	--
Mobilization (including scheduling of drilling subcontractor and utility clearance)	3 weeks
Implement SC Soil and Groundwater Investigation Field Activities	4 weeks
Laboratory Analysis of Samples	2 weeks
Data Validation	2 weeks
Implement SC VI Investigation Field Activities	1 week
Laboratory Analysis of Samples	2 weeks
Data Validation	2 weeks
Prepare SC Report and submit to NYSDEC	6 weeks

Note:
Schedule assumes that appropriate access agreements and/or permits are in place prior to mobilization.

6. References

Environmental Data Resources, Inc. 2008. Aerial Photo Decade Package from 1954 – 2006, July 2008.

McClymonds, N.E. and Franke, O.L. 1972. Water-Transmitting Properties of Aquifers on Long Island, New York. United States Geological Survey Professional Paper 627-E.

New York State Department of Environmental Conservation (NYSDEC). 2002. Draft DER-10 Technical Guidance for Site Investigation and Remediation. December 2002.

New York City Planning Commission Zoning Map. October 11, 2005.

Sanborn Library, LLC. Fire Insurance Maps for 1895, 1906, 1930, 1950, 1966, 1983, 1994, and 1996.

Smolensky, D.A., Buxton, H.T., and Shernoff, P.K. 1989. Hydrologic Framework of Long Island, New York. U.S. Geological Survey Hydrologic Investigations Atlas HA-709.

Table 1. Summary of Proposed Site Characterization Activities and Sampling Rationale, Former Dangman Park MGP Site, Brooklyn, New York.

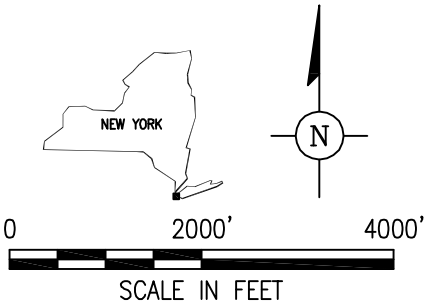
Sample Location	Sample Method	Sample Sequence	Rationale	Proposed Total Depth or Height	Samples Collected[1, 2]	Sample Analysis
Soil Borings/Monitoring Wells						
MW-1	HSA with Split-Spoon Sampler	1	•Evaluate shallow soil and groundwater quality at the upgradient edge of Site •Boring will extend to 20 ft bls which is anticipated to be approximately 10 feet below the water table •This well will be screened across the water table surface •Assess shallow groundwater flow direction in the vicinity of the Site	20 ft bls	•1 soil sample collected from upper 5 ft •If no impacts are observed then 1 soil sample collected just above the water table •If impacts are observed then 1 soil sample collected from the depth interval where the greatest degree of impacts is observed	2-3 Soil Samples and 1 Groundwater Sample Analyzed for: TCL VOCs, TCL SVOCs, Pesticides, PCBs, TAL Metals, Free Cyanide
MW-2	HSA with Split-Spoon Sampler	2	•Evaluate shallow soil and groundwater quality at the upgradient edge of Site •Boring will extend to 20 ft bls which is anticipated to be approximately 10 feet below the water table •This well will be screened across the water table surface •Assess shallow groundwater flow direction in the vicinity of the Site	20 ft bls	•1 soil sample collected from upper 5 ft •If no impacts are observed then 1 soil sample collected just above the water table •If impacts are observed then 1 soil sample collected from the depth interval where the greatest degree of impacts is observed	2-3 Soil Samples and 1 Groundwater Sample Analyzed for: TCL VOCs, TCL SVOCs, Pesticides, PCBs, TAL Metals, Free Cyanide
MW-3	HSA with Split-Spoon Sampler	4	•Evaluate shallow soil and groundwater quality along the western edge of Site and in the vicinity of the former Generating House •Boring will extend to 20 ft bls which is anticipated to be approximately 10 feet below the water table •This well will be screened across the water table surface •Assess shallow groundwater flow direction in the vicinity of the Site	20 ft bls	•1 soil sample collected from upper 5 ft •If no impacts are observed then 1 soil sample collected just above the water table •If impacts are observed then 1 soil sample collected from the depth interval where the greatest degree of impacts is observed	2-3 Soil Samples and 1 Groundwater Sample Analyzed for: TCL VOCs, TCL SVOCs, Pesticides, PCBs, TAL Metals, Free Cyanide
MW-4	HSA with Split-Spoon Sampler	5	•Evaluate shallow soil and groundwater quality along the eastern edge of Site and in the vicinity of one of the former Gas Holders •Boring will extend to 20 ft bls which is anticipated to be approximately 10 feet below the water table •This well will be screened across the water table surface •Assess shallow groundwater flow direction in the vicinity of the Site	20 ft bls	•1 soil sample collected from upper 5 ft •If no impacts are observed then 1 soil sample collected just above the water table •If impacts are observed then 1 soil sample collected from the depth interval where the greatest degree of impacts is observed	2-3 Soil Samples and 1 Groundwater Sample Analyzed for: TCL VOCs, TCL SVOCs, Pesticides, PCBs, TAL Metals, Free Cyanide
Soil Borings						
SB-1	HSA with Split-Spoon Sampler	6	•Assess the presence/absence of the former Tar Tank •Boring will extend to a minimum depth of 20 ft bls, which is anticipated to be approximately 10 feet below the water table, and to a maximum depth of 50 ft bls	20 - 50 ft bls	•1 soil sample collected from upper 5 ft •If no impacts are observed then 1 soil sample collected just above the water table •If impacts are observed then 1 soil sample collected from the depth interval where the greatest degree of impacts is observed	2-3 Soil Samples Analyzed for: TCL VOCs, TCL SVOCs, Pesticides, PCBs, TAL Metals, Free Cyanide
SB-2	HSA with Split-Spoon Sampler and HydroPunch® Sampler	7	•Assess the presence/absence of the former southern Gas Holder subgrade structure and the contents (if present) •Boring will extend to a minimum depth of 20 ft bls, which is anticipated to be approximately 10 feet below the water table, and to a maximum depth of 50 ft bls •Assess whether tetrachloroethene impacts are present in groundwater in the apparent downgradient direction from Kurt Cleaners	20 - 50 ft bls	•1 soil sample collected from upper 5 ft •If no impacts are observed then 1 soil sample collected just above the water table •If impacts are observed then 1 soil sample collected from the depth interval where the greatest degree of impacts is observed	2-3 Soil Samples Analyzed for: TCL VOCs, TCL SVOCs, Pesticides, PCBs, TAL Metals, Free Cyanide
SB-3	HSA with Split-Spoon Sampler	3	•Assess potential impacts associated with the former northwestern Gas Holder and the former Cistern •Boring will extend to a minimum depth of 20 ft bls, which is anticipated to be approximately 10 feet below the water table, and to a maximum depth of 50 ft bls	20 - 50 ft bls	•1 soil sample collected from upper 5 ft •If no impacts are observed then 1 soil sample collected just above the water table •If impacts are observed then 1 soil sample collected from the depth interval where the greatest degree of impacts is observed	2-3 Soil Samples Analyzed for: TCL VOCs, TCL SVOCs, Pesticides, PCBs, TAL Metals, Free Cyanide
Sub-Slab Soil Vapor Points						
TBD	Direct Push with PRT System and SUMMA® canister	9	•Assess the potential for soil vapor intrusion •Evaluate, to the extent practicable, whether there are complete exposure pathways of soil vapor to indoor air	2 inches below floor slab	•1 sub-slab soil vapor sample collected from directly beneath the floor slab at each sample location	Sub-Slab Soil Vapor Samples Analyzed for: TO-15 Target Analytes[3]

See footnotes on last page.

Sample Location	Sample Method	Sample Sequence	Rationale	Proposed Total Depth or Height	Samples Collected [1, 2]	Sample Analysis
Indoor and Ambient Air Quality Samples						
TBD	SUMMA® canister	9	•Assess the potential for soil vapor intrusion •Evaluate, to the extent practicable, whether there are complete exposure pathways of soil vapor to indoor air	3 feet above floor or ground surface	•1 indoor air quality sample collected from the breathing zone at each sample location •1 ambient air quality sample collected from a location upwind of the strip mall	Indoor and Ambient Air Quality Samples Analyzed for: TO-15 Target Analytes[3]

1 A third soil sample ("un-impacted" soil) may also be collected below apparent"impacted" soil to aid in vertical delineation, if warranted.
2 One round of groundwater samples will be collected from the monitoring wells.
One round of sub-slab soil vapor samples will be collected from the temporary sub-slab soil vapor points.
One round of indoor air quality samples will be collected.
3 See Quality Assurance Project Plan for Target Analyte List.
HSA Hollow-stem auger.
TCL Target compound list.
VOC Volatile Organic Compounds.
SVOC Semi-Volatile Organic Compounds.
PCBs Polychlorinated biphenyls.
TAL Target analyte list.
TBD To be determined.
PRT Post Run Tubing.
ft bls Feet below land surface.

MAP SOURCE: USGS 7.5 MINUTE QUADRANGLE CONEY ISLAND, NEW YORK–NEW JERSEY, 1979



NATIONAL GRID USA
FORMER DANGMAN PARK MGP SITE
BROOKLYN, NEW YORK

SITE CHARACTERIZATION WORK PLAN

SITE LOCATION

ARCADIS

FIGURE
1

CITY:MELVILLE-NY DIV/GROUP:ENR1 DB:ALS LD: PIC:JN PM:SF TM:CK LYR:ON=*;OFF=*REF*
G:\APROJECT\National Grid\Dangman Park\CAD\FIGURE 1.dwg LAYOUT: 1SAVED: 12/24/2008 1:48 PM ACADVER: 17.1S (LMS TECH) PAGESETUP: ---PLOTSTYLETABLE: ARCADIS_MELVILLE.CTB PLOTTED: 12/24/2008 1:59 PM BY: SANCHEZ, ADRIAN
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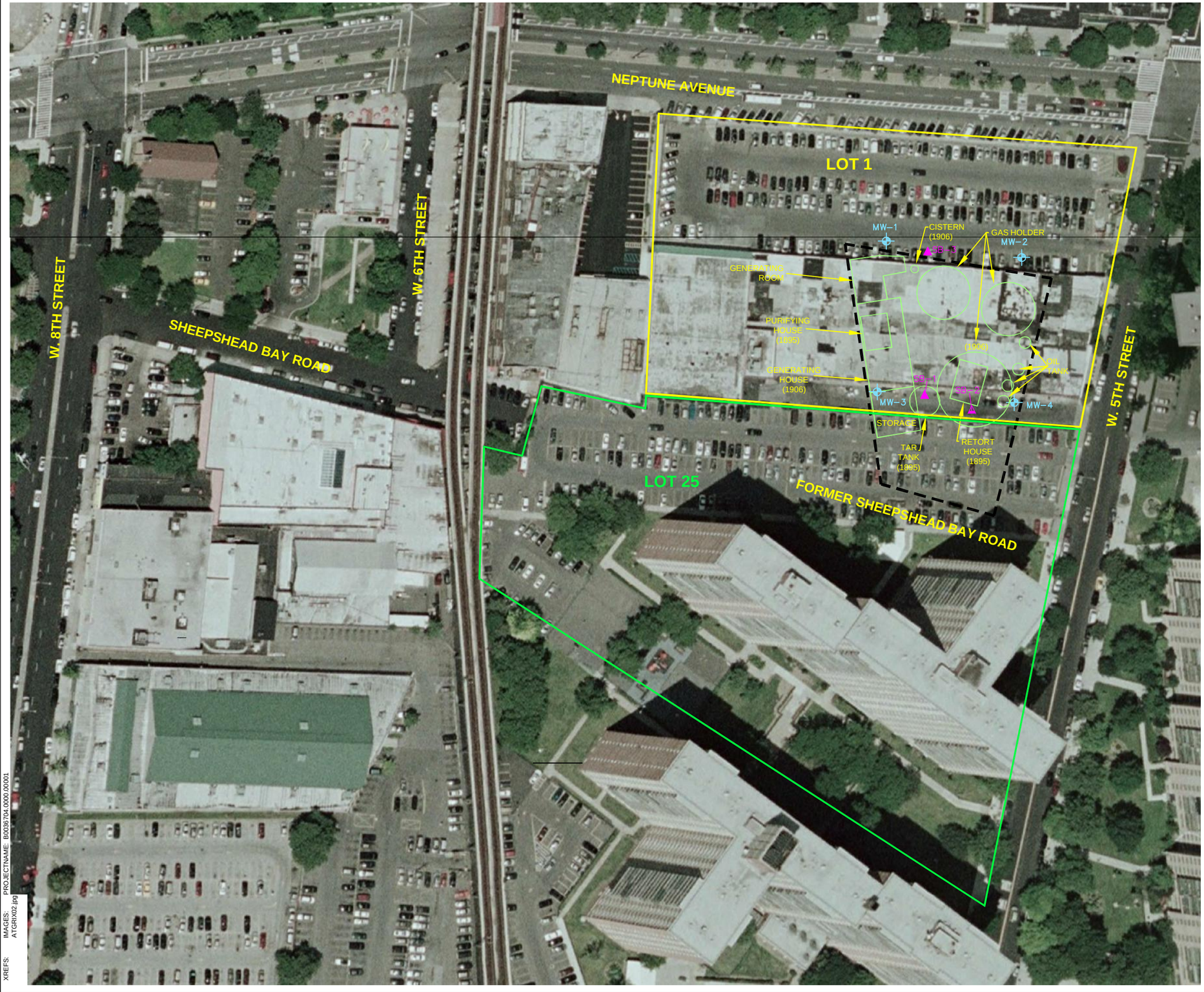
CONEY ISLAND.TIF



N

LEGEND:

- APPROXIMATE BOUNDARY OF BLOCK 7273, LOT 1
- APPROXIMATE BOUNDARY OF BLOCK 7273, LOT 25
- APPROXIMATE FORMER MGP BOUNDARY
- FORMER MGP FEATURE (1895 AND/OR 1906 SANBORN FIRE INSURANCE MAPS)
- SB–1 PROPOSED SOIL BORING LOCATION
- SB–2 PROPOSED SOIL BORING/ HYDROPUNCH® SAMPLING LOCATION
- MW–1 PROPOSED MONITORING WELL LOCATION

NOTES:

1. IMAGE OBTAINED FROM GOOGLE EARTH © 2008 TELE ATLAS ON JULY 29, 2008.
2. PROPOSED SAMPLE LOCATIONS WILL BE ADJUSTED IN THE FIELD AS NEEDED BASED ON ACCESSIBILITY AND UTILITY CLEARANCE.
3. LOCATIONS OF MGP FEATURES ARE APPROXIMATE.

0 100 200
SCALE IN FEET
(APPROXIMATE)

NATIONAL GRID USA
FORMER DANGMAN PARK MGP SITE
BROOKLYN, NEW YORK
SITE CHARACTERIZATION WORK PLAN

PROPOSED SAMPLE LOCATIONS

ARCADIS

FIGURE
2

CITY:MELVILLE-NY DIV/GROUP:ENR1 DB:ALS LD:AS PIC:JN PM:SF TM:CK LYR:ON=*;OFF=*REF*
G:\PROJECT\National Grid\Dangman Park\CAD\Figure 2.dwg LAYOUT: 2SAVED: 3/11/2009 2:39 PM ACADVER: 17.1S (LMS TECH) PAGESETUP: ---PLOTSTYLETABLE: ARCADIS_MELVILLE.CTB PLOTTED: 3/11/2009 2:48 PM BY: SANCHEZ, ADRIAN
XREFS: IMAGES: PROJECTNAME: B0036704.0000.00001
ATGRIX02.jpg

ARCADIS

Attachment 1

Dangman Park Former MGP Site
Records Search, GEI Consultants

GEI Consultants

April 6, 2007

Geotechnical
Environmental and
Water Resources
Engineering

Ms. Tracey Bell
Project Manager
KeySpan Corporation
Environmental Asset Management
One Metro Tech Center
Brooklyn, NY 11201-3850

Re: Dangman Park Former MGP Site
Site Number 224047
Records Search

Dear Ms. Tracey Bell:

KeySpan Corporation (KeySpan) requested that GEI Consultants, Inc. (GEI) perform a records search at the Dangman Park Former Manufactured Gas Plant (MGP) site.

This letter summarizes the results of the records search for the Dangman Park Former MGP site.

This letter report was prepared in accordance with GEI's March 20, 2007 *Cost Proposal to Conduct Records Search for Five Sites, Brooklyn and Queens, New York.* The work was performed according to the cost and assumptions provided in this document and the labor rates were in accordance with Environmental Consulting Services for MGP Sites Agreement between GEI and KeySpan executed in May 2006.

While this report includes elements found in environmental site assessment reports, this report is not intended to comply with the ASTM E 1527-05 *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, ASTM E 1528 *Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process*, or the U.S. Environmental Protection Agency's *Standards and Practices for All Appropriate Inquiry.*

Records Search Scope of Work

As part of the Proposal, KeySpan requested a record search report for the Dangman Park Former MGP site including:

- Environmental data and information currently available
- History and description of site including nature of operations
- Types, quantities, physical state, locations, methods and dates of disposal or release of hazardous wastes
- Current site security
- Identity of other PRPs at the site

GEI Consultants, Inc.
455 Winding Brook Drive, Suite 201, Glastonbury, Connecticut 06033
860.368.5300 fax 860.368.5307

A Freedom of Information Law (FOIL) request was submitted to the NYSDEC on March 23, 2007. A response to the FOIL has not been received as of April 6, 2007. A search of the New York State Department of Environmental Conservation (NYSDEC) Spill Incidents and Environmental Site Remediation databases was conducted, Sanborn Fire Insurance (Sanborn) maps (Appendix A) were reviewed, and an EDR Radius Map with GeoCheck report was reviewed.

Current Site Conditions

GEI visited the Dangman Park Former MGP site on April 2, 2007. Representative photographs are included as Appendix B. The area where the former MGP was located includes a commercial and a residential parcel. The site is developed with a strip mall and a parking lot for a high-rise apartment building. The strip mall is a 1 story brick building with a parking lot and entrances facing Neptune Avenue. The parking lot is a pay lot and is fenced with gated entrances on W 5th Street. A delivery access driveway is located in the rear of the building with an entrance on W 5th Street. The permit only apartment parking lot is fenced and is located south of the strip mall with an entrance on W 5th Street. The site is entirely paved or covered with buildings. A recent aerial photograph is shown on Figure 1.

The current property owners are listed below.

Owner	**Block 7273 Lot 1** 450 Neptune Associates LLC.	Parcel Address Occupant/Land Use	486 Neptune Avenue Brooklyn, NY 11224 Commercial
Owner	**Block 7273 Lot 25** Trump Village Section 4, Inc.	Parcel Address Occupant/Land Use	2898 W 5th Street Brooklyn, NY 11224 Residential

The former MGP occupied the above parcels as shown on Figure 1.

Site History

According to Sanborn maps, the Dangman Park Former MGP and associated buildings were constructed on the site sometime prior to 1895. The 1895 Sanborn map shows 2 gas holders, a retort house, pit tanks, a tar tank, an engine room, a purifying house, and a shed. By 1906 the MGP was operated by the Brooklyn Borough Gas Company and an additional holder had been constructed. No MGP structures were depicted on the 1930 Sanborn map.

In 1930 a club house is shown on the property. By 1966 the Trump Village Shopping Center was located at the site. The shopping center, parking lot and parking for an adjacent apartment building currently occupy the site.

Records of Materials Handling, Storage Processes, and Waste Generation

A search of the NYSDEC spill incidents and environmental site remediation databases was conducted, Sanborn maps were reviewed, and an EDR Radius Map with GeoCheck report was reviewed. Records of materials handling, storage processes, and waste generation were not identified for the site.

Possible Subsurface Structures

It is unknown if any of the Dangman Park Former MGP foundations are present at the site. Subsurface investigations and/or remote sensing methods would be required to evaluate whether any subsurface structures are still present. The location of the former MGP is shown on Figure 1.

No other records of possible subsurface structures or product lines were identified through the NYSDEC database search, Sanborn maps or the EDR Radius report.

Environmental Records Information

An EDR Radius Map with GeoCheck report was reviewed, a FOIL request was submitted to the NYSDEC and a search of the NYSDEC spill incidents and environmental site remediation databases were conducted. A response to the FOIL request has not been received.

Environmental records information and known discharges on the site were identified based on the records search and are listed below.

Name and Location	Description
Trump Village, Section 4 2928 West 5th Street	Two #2 fuel oil leaking underground storage tanks discovered during tank test (2 incidents), petroleum bulk storage facility
Kurt French Cleaners 508 Neptune Avenue	Small Quantity Generator
Kurt Cleaners 502A Neptune Avenue	Small Quantity Generator

No environmental records information or known discharges for properties abutting the site were identified.

Current/former storage/disposal of petroleum products or potentially hazardous waste

An EDR Radius Map with GeoCheck report was reviewed, a FOIL request was submitted to the NYSDEC and a search of the NYSDEC spill incidents and environmental site remediation databases were conducted. A response to the FOIL request has not been received.

Current or former storage of petroleum or hazardous waste on the site was identified based on the records search and are listed below.

Name and Location	Description
Trump Village, Section 4 2928 West 5th Street	Two #2 fuel oil underground storage tanks, petroleum bulk storage facility
Kurt French Cleaners 508 Neptune Avenue	Small Quantity Generator
Kurt Cleaners 502A Neptune Avenue	Small Quantity Generator

No current or former storage of petroleum or hazardous waste for properties abutting the site were identified.

Identity of Other PRPs

Sanborn maps were used to identify other PRPs. These businesses that are on site or abutting the site have a potential to have impacted the subsurface soil or groundwater on site.

No PRPs were identified on the Dangman Park Former MGP site.

One PRP that abuts the site was identified and is shown below.

Name and Location	Direction and Distance From Site	Facility Operations
BMT/Coney Island Brooklyn Railroad	East, adjacent	Early 1900's-1950's, car barns and repair shop, the operation may have had moderate chemical/oil use and moderate potential for release, side gradient from site

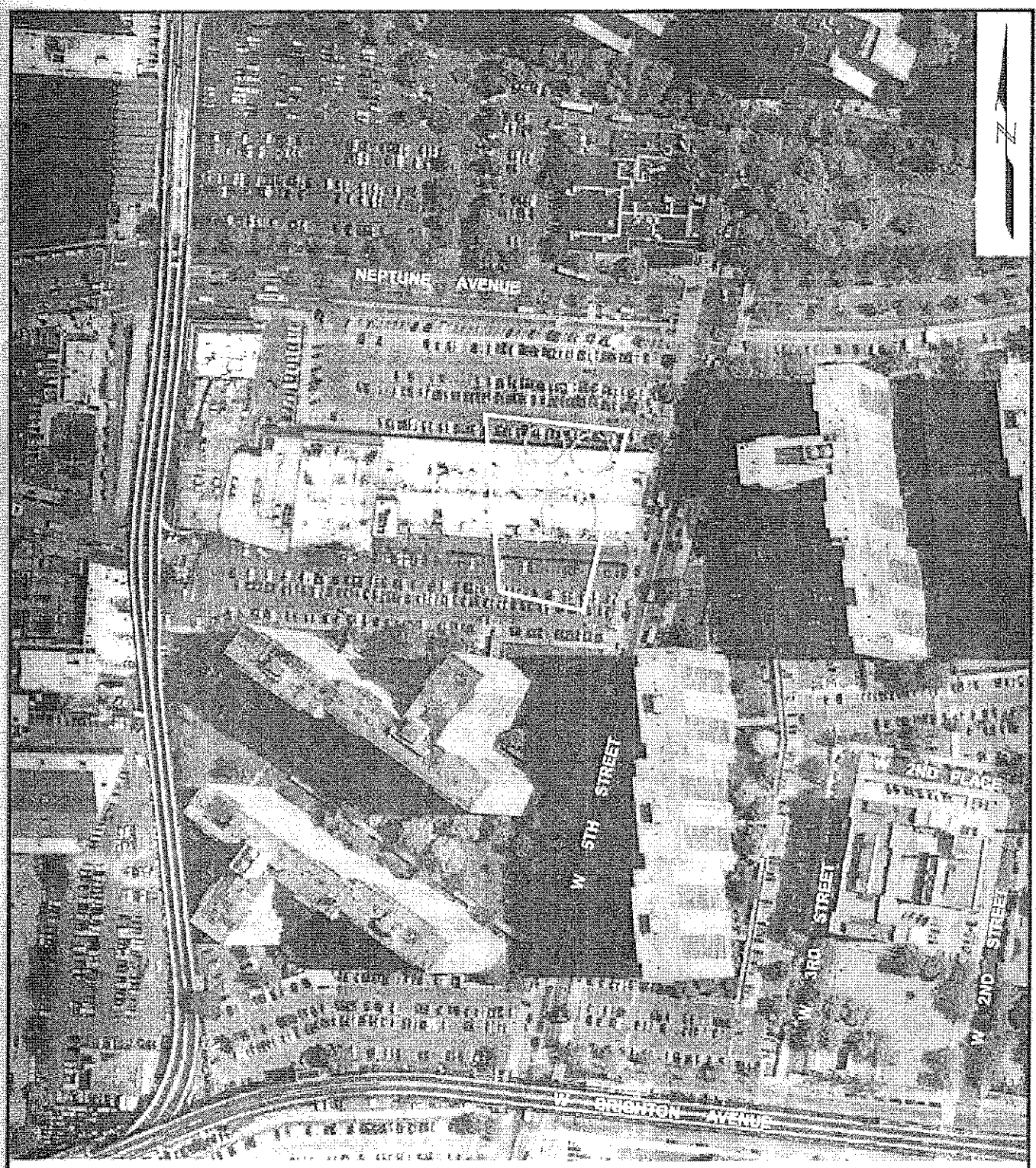
If you have any questions, please contact me or David Terry at (860) 368-5300.

Sincerely,

Melissa Felter

Melissa Felter
Project Manager

MF/amm
c: David Terry, GEI



LEGEND:

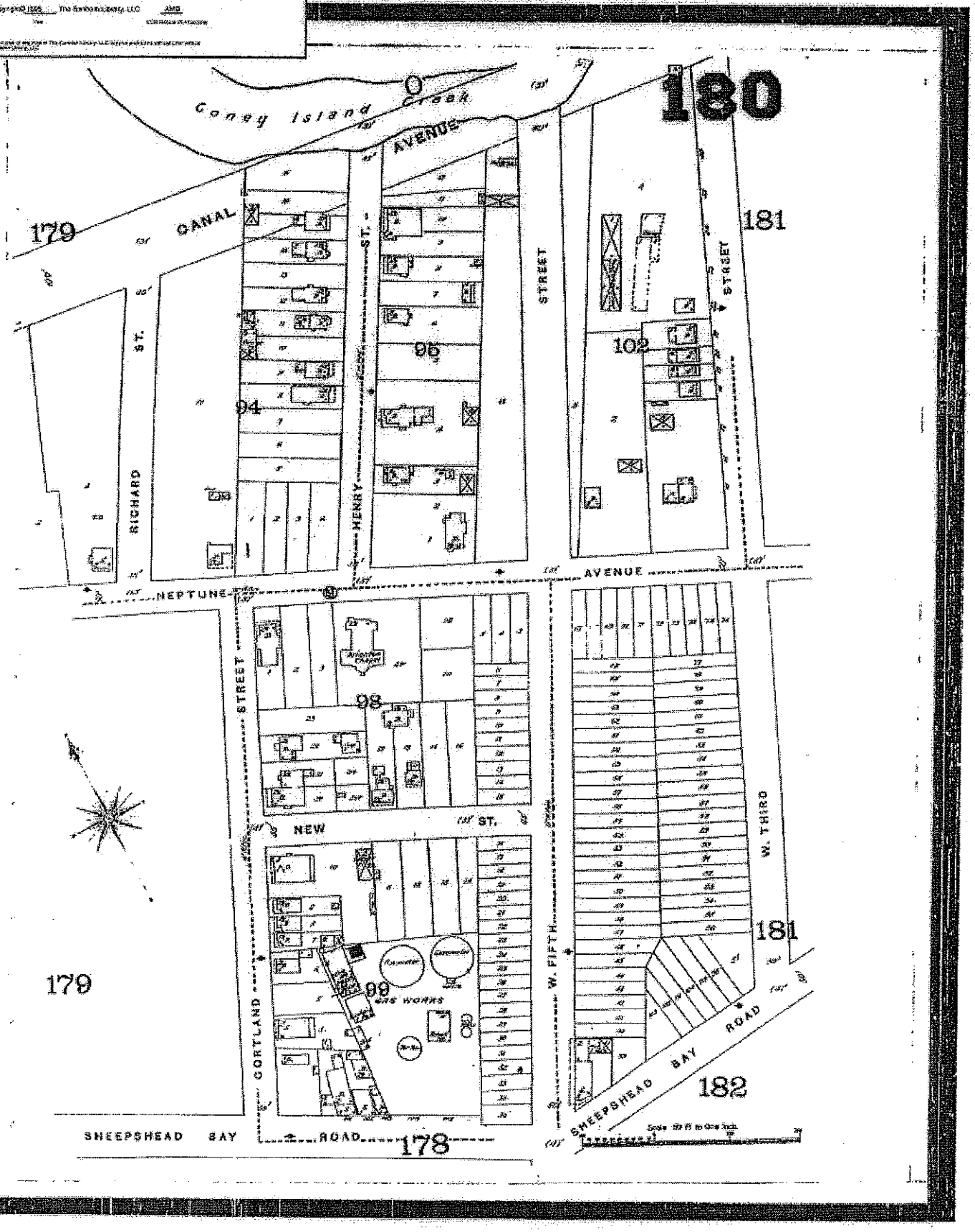
HISTORIC GAS HOLDER LOCATION

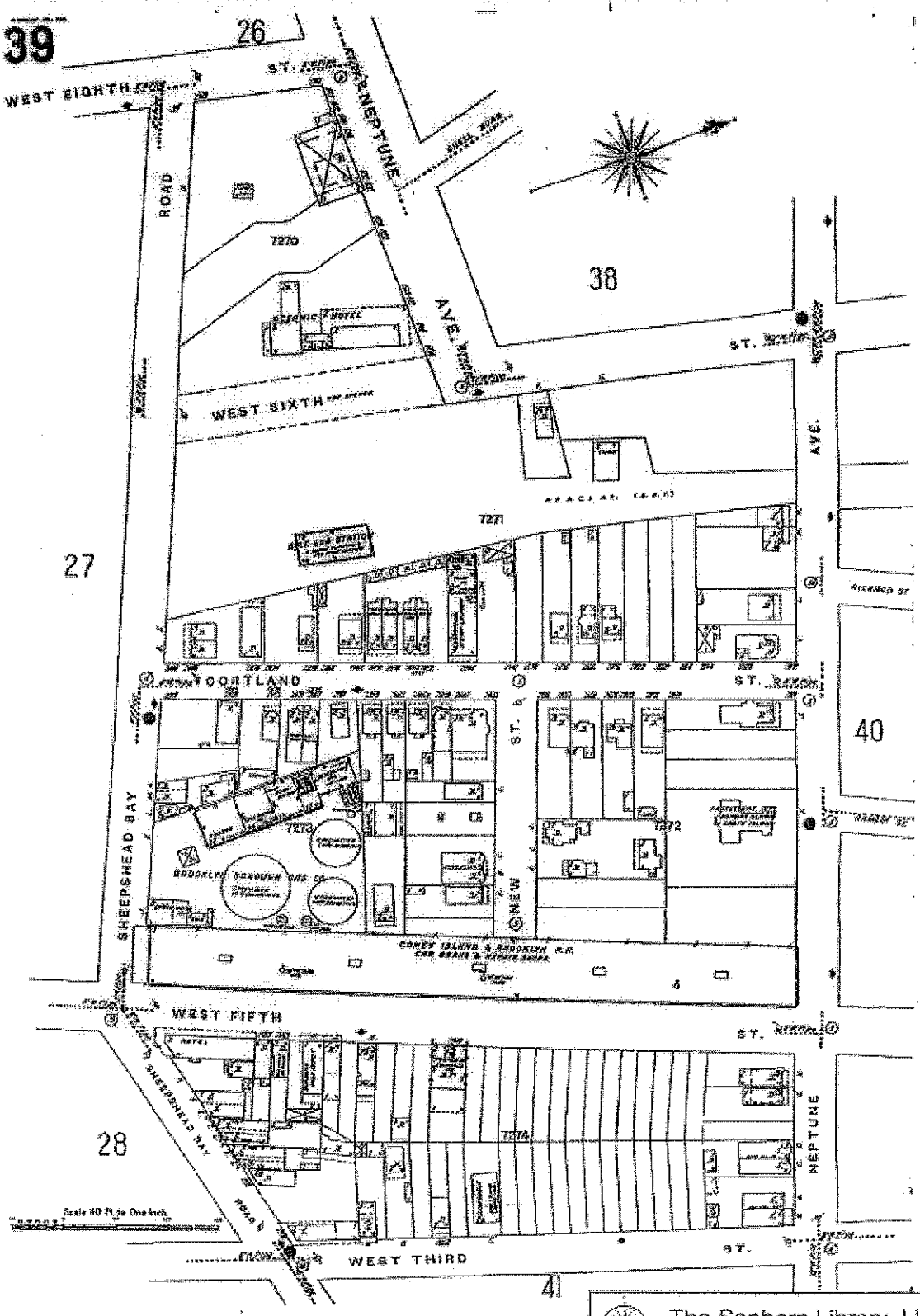
RECORDS SEARCH REPORT DANGMAN PARK FORMER MGP SITE BROOKLYN, NEW YORK	GEI Consultants	DANGMAN PARK FORMER MGP SITE
KEYSPAN CORPORATION	Project 070920-1000	April 2007 Figure 1

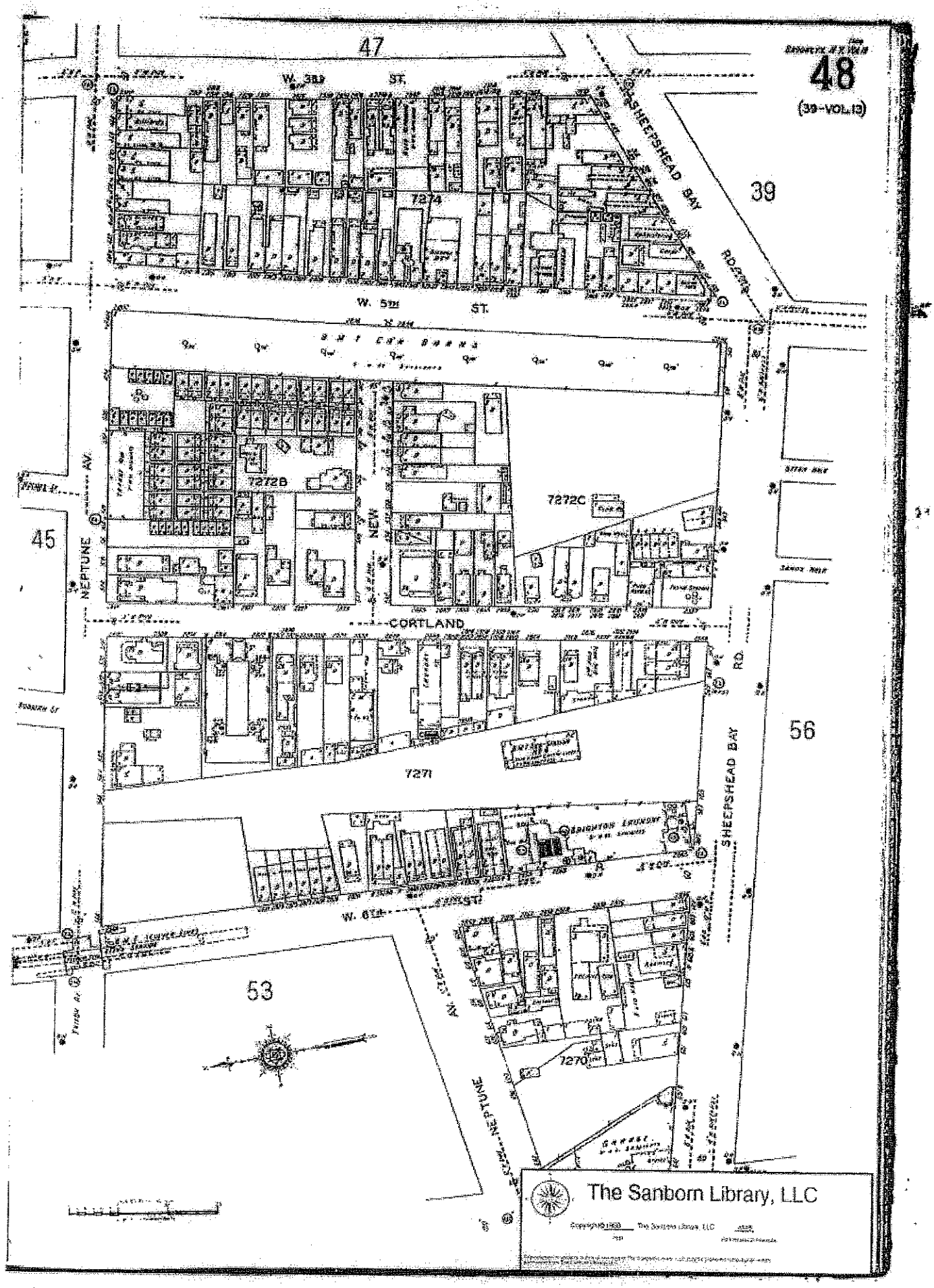
I:\GEI\KEYSPAN\6 SITES RECORDS SEARCH\Peoples and Dangman Sites.dwg \Apr 05, 2007

Appendix A

Representative Sanborn Fire Insurance Maps



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7274
W. 5TH ST.
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7272C
NEPTUNE AV.
NEW
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CORTLAND
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SHEEPSHEAD BAY RD.
W. 6TH ST.
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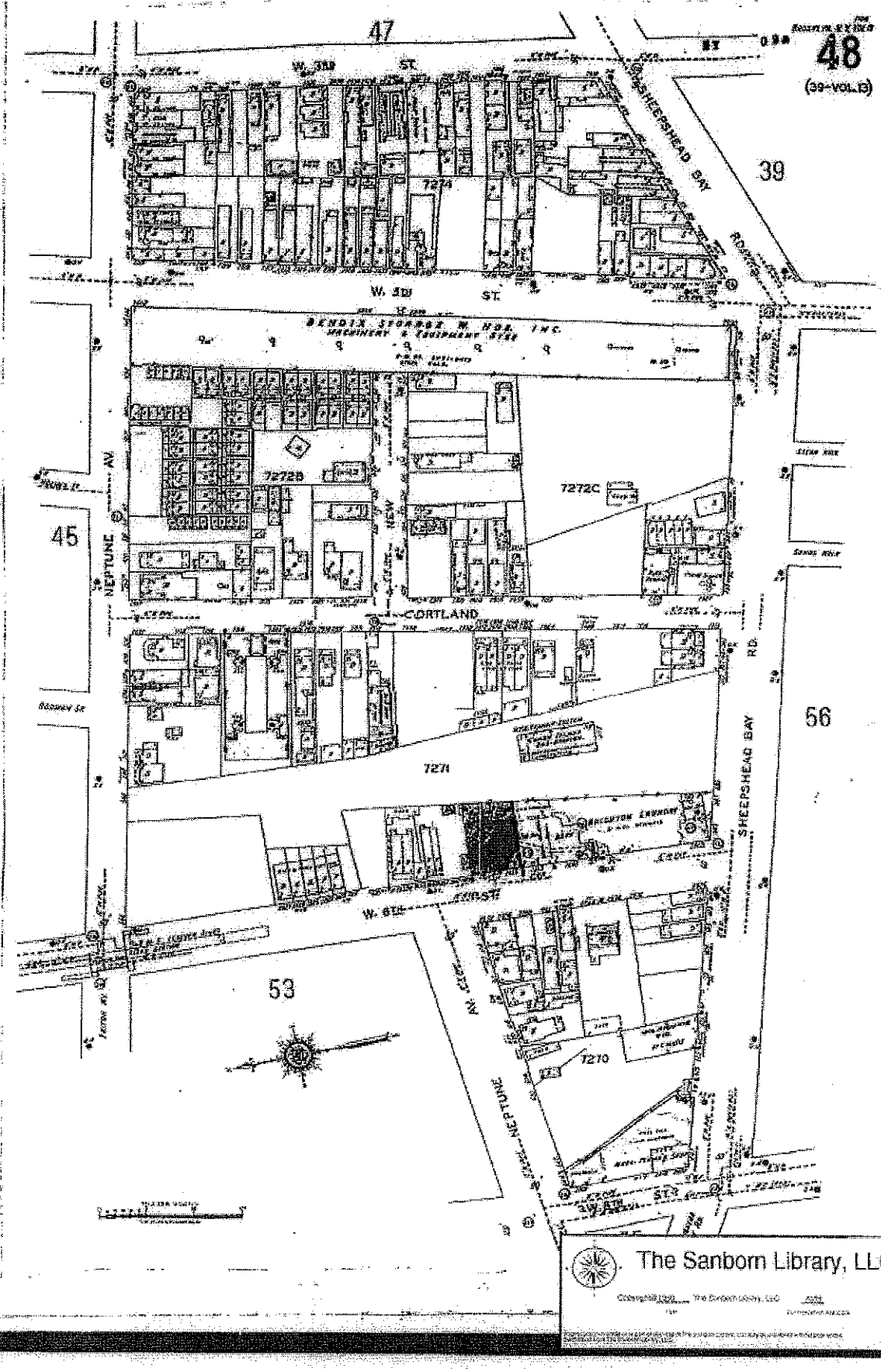
7270
NEPTUNE
The Sanborn Library, LLC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W. 3RD ST.
SHEEPSHEAD BAY
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W. 8TH ST.
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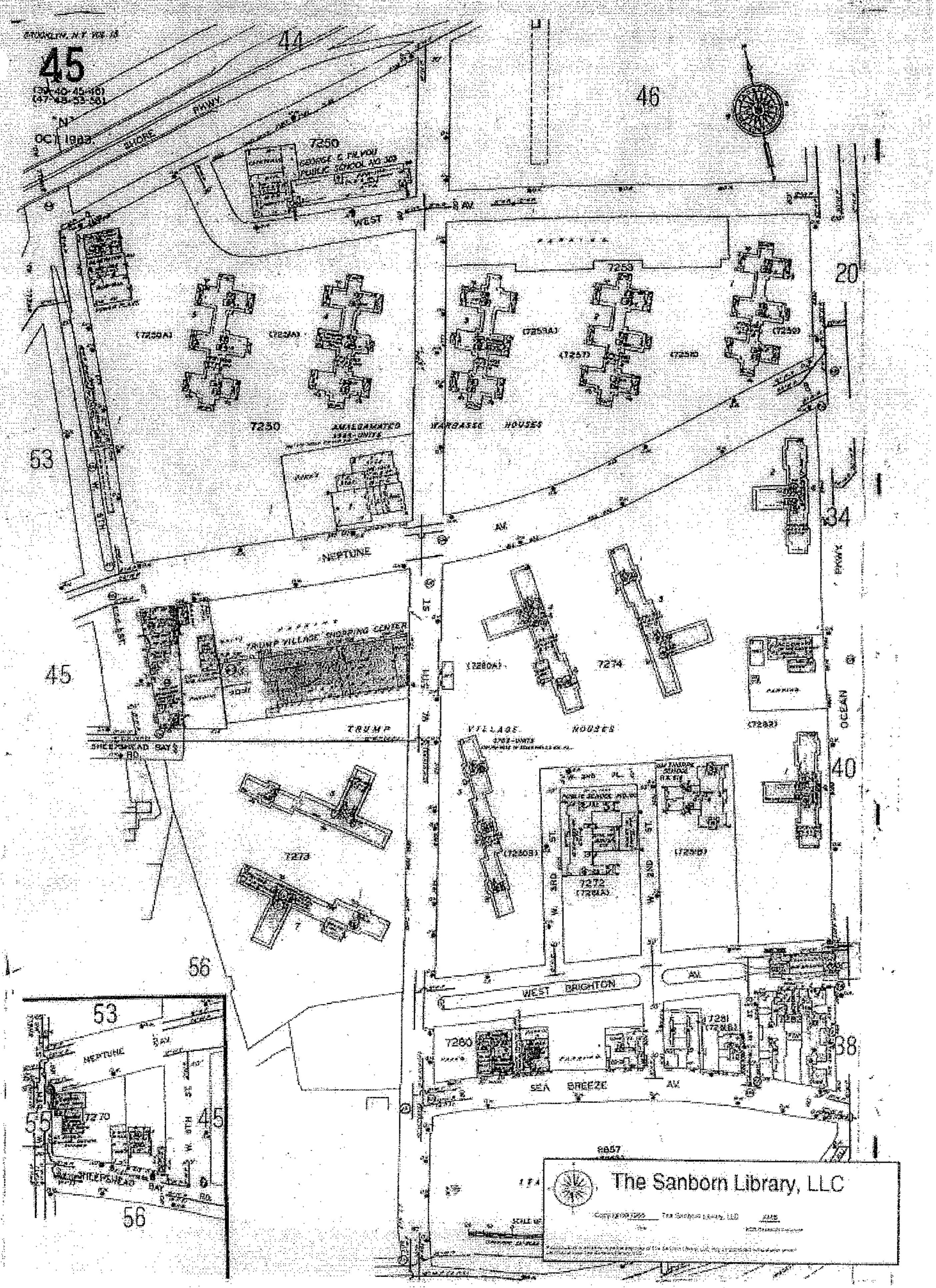
NEPTUNE
The Sanborn Library, LLC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SHORE PKWY.
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WEST 8 AV
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AMALGAMATED WARBASSE HOUSES
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34
NEPTUNE AV
TRUMP VILLAGE SHOPPING CENTER
45
7274
TRUMP VILLAGE HOUSES
SHEEPSHEAD BAY RD.
OCEAN PKWY
40
7273
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WEST BRIGHTON AV
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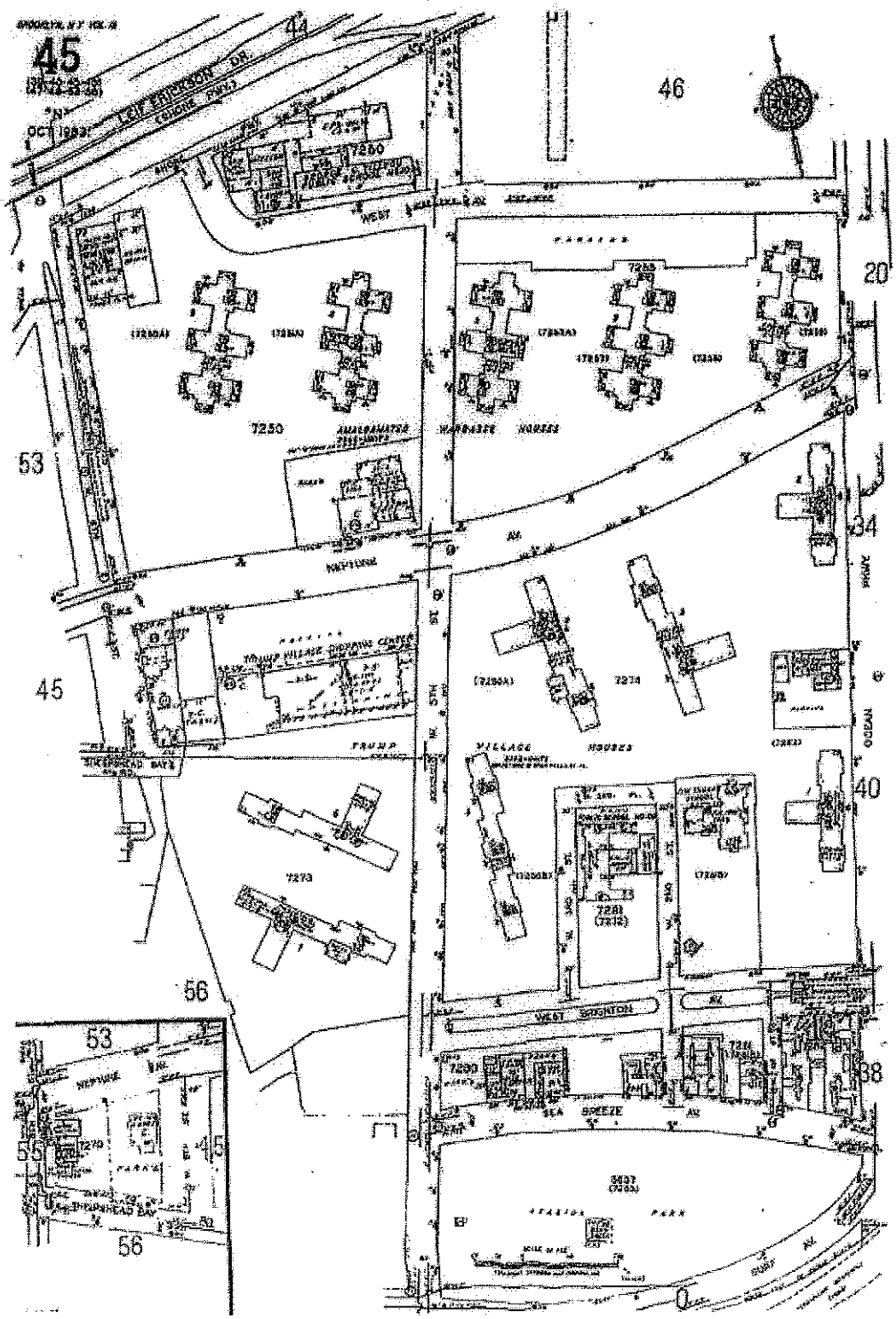
The Sanborn Library, LLC

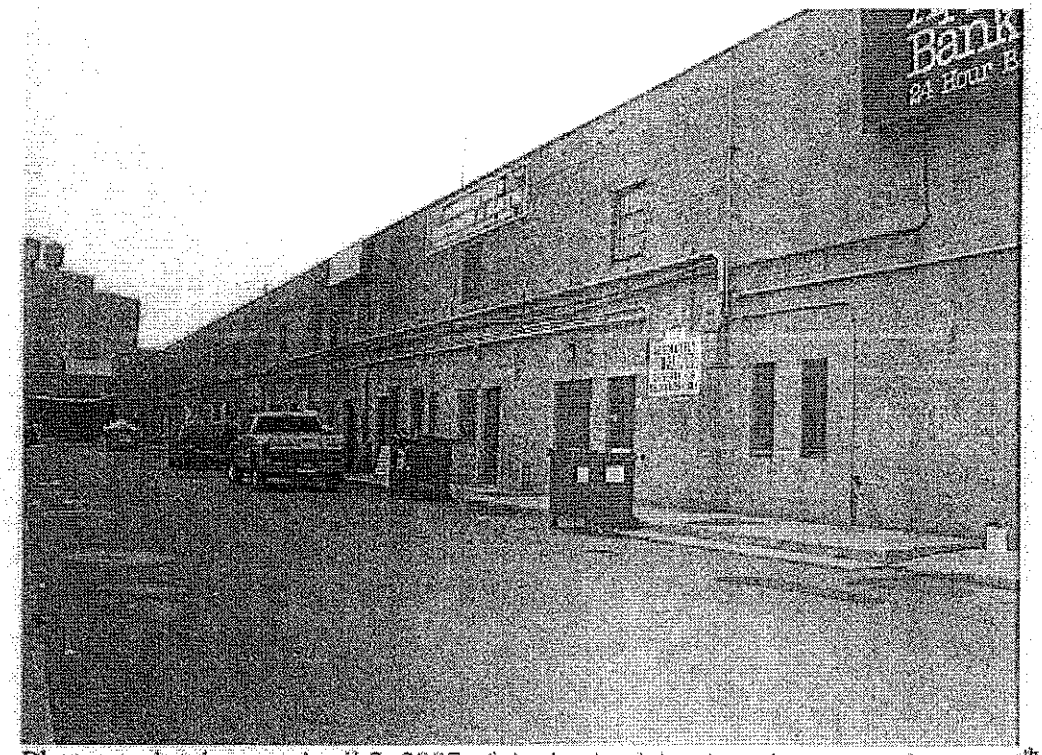


Appendix B

Representative Site Photographs

Photograph taken on April 2, 2007 from W 5th Street of the parking lot and shopping center looking southwest.

Photograph taken on April 2, 2007 from Neptune Avenue of the parking lot and shoppin center looking south.



Photograph taken on April 2, 2007 of the back of the shopping center from W 5th Street.

Photograph taken on April 2, 2007 of the Trump Village parking lot on the southern portion of the site from W 5th Street.

Attachment 2

Historical Documentation

Dangman Park MGP
Brooklyn, Kings County

GEI Consultants

Current Owner/Operator Information

The Dangman Park Manufactured Gas Plant (MGP) site is owned and operated by Trump Village Construction Corporation at 486 Sheepshead Bay Road in Brooklyn, New York 11224-3607.

Site Information

The address of the Dangman Park MGP site is 486 Neptune Avenue in Brooklyn, New York 11224. It is located on the west side of West 5th Street. The site is in Kings County, and the latitude is 40.57947°N, and the longitude is 73.97270°W.

Site's Environmental History

A manufactured gas plant operated on the site from at least 1985 to sometime between 1906 and 1930 according to Sanborn Fire Insurance Maps. A clubhouse is shown on the site on the 1930 and 1950 Sanborn map. The Trump Village Shopping Center was constructed at the site in 1966, and continues to occupy the site.

To KeySpan's knowledge, a Phase I Environmental Site Assessment has not been completed on this site. No other existing environmental information, studies, reports, or other such data have been found for this site.

Adjacent Property Information

The attached table indicates current and historic land use locations of hazardous materials nearby the Dangman Park MGP.

Table 1
Dangman Park MGP
Brooklyn, New York

DRAFT

On Site				Abutting Properties			Properties within One Block		
Parcel I.D. No.	Company Name	Facility Operations (years)	Ranking	Parcel I.D. No.	Company Name	Facility Operations (years)	Parcel I.D. No.	Company Name	Facility Operations (years)
				1	BMT/Coney Island Brooklyn Railroad	Car Barns and Repair Shop (1900 to 1940's)[1]	2	Unknown	Gasoline Station and Automobile Repair (1920's to early1960's)[2]
							3	Brighton Laundry	Large Clothes Cleaning Facility (1920's to 1988)
							4	Amalgamated Warbasse House, Inc.	Power Plant (1963-present)
							5	Unknown	Garage/Gasoline USTs (1920's to present)

Notes:
1 Formerly an abutting property, currently on site.
2 Formerly located west of site, currently on site

LEGEND

- APPROXIMATE FORMER MGP BOUNDARY
- APPROXIMATE CURRENT PROPERTY BOUNDARY

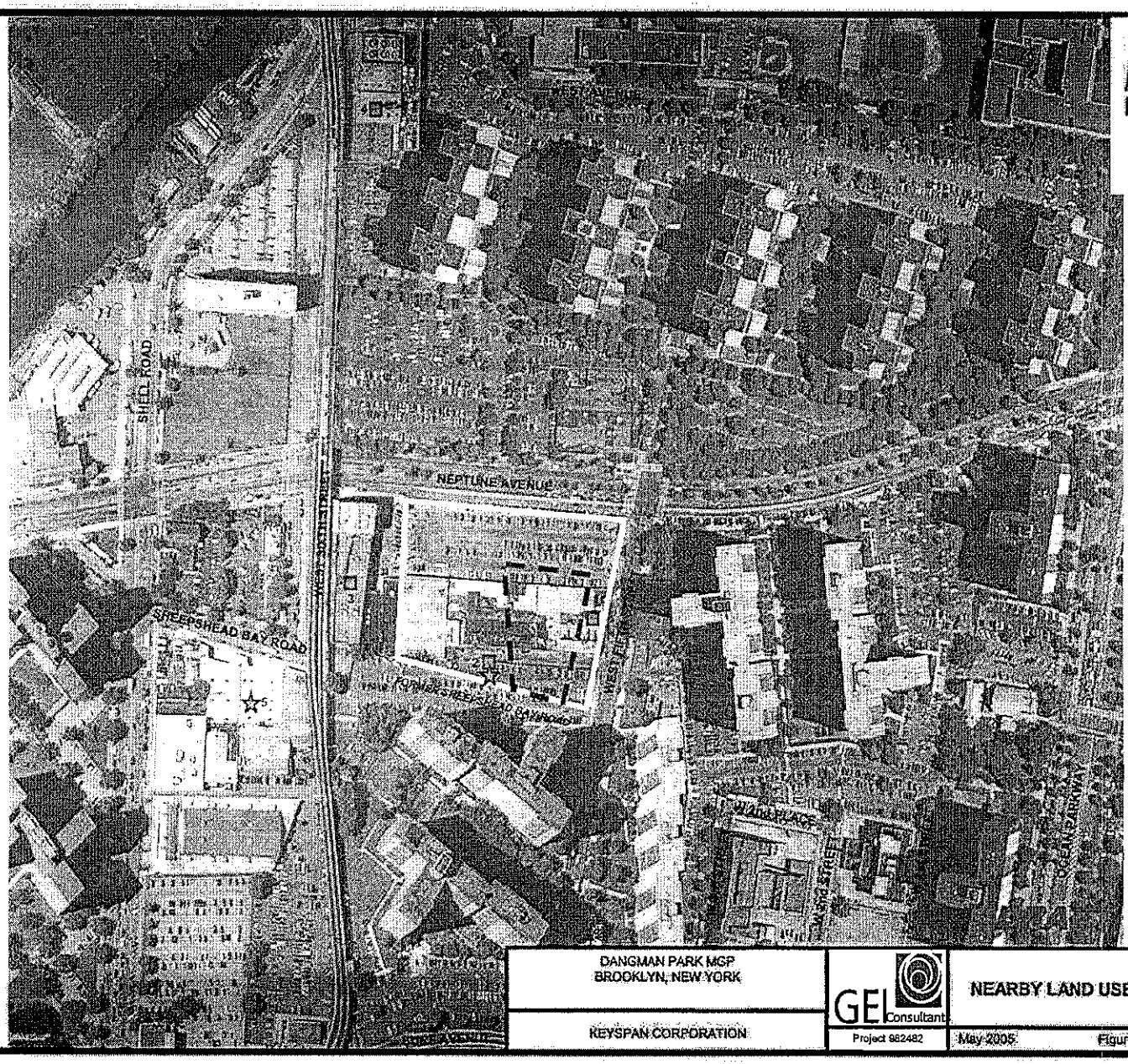
RECENT REGULATORY RECORDS

- RCRA (TSDF, CORRACTS), CERCLIS, VCP, LANDFILL, DISPOSAL SITE
- RCRA (LQG, SQG)
- MAJOR OIL OR CHEMICAL STORAGE
- MINOR OIL STORAGE
- SPILLS, TRIS

HISTORIC LAND USE

- COAL YARD/LUMBER YARD
- ASPHALT PLANT/COAL TAR PRODUCT CO
- MANUFACTURING AND COMMERCIAL
- OIL/PETROCHEMICAL
- CHEMICAL/PAINT/FERTILIZER/PLASTIC
- MULTIPLE

NOTE:
SEE TABLE 1 FOR INFORMATION ABOUT THESE SITES



SOURCE:

NOTE: NOT TO SCALE

DANGMAN PARK MGP
BROOKLYN, NEW YORK

KEYSPAN CORPORATION

GEL Consultants

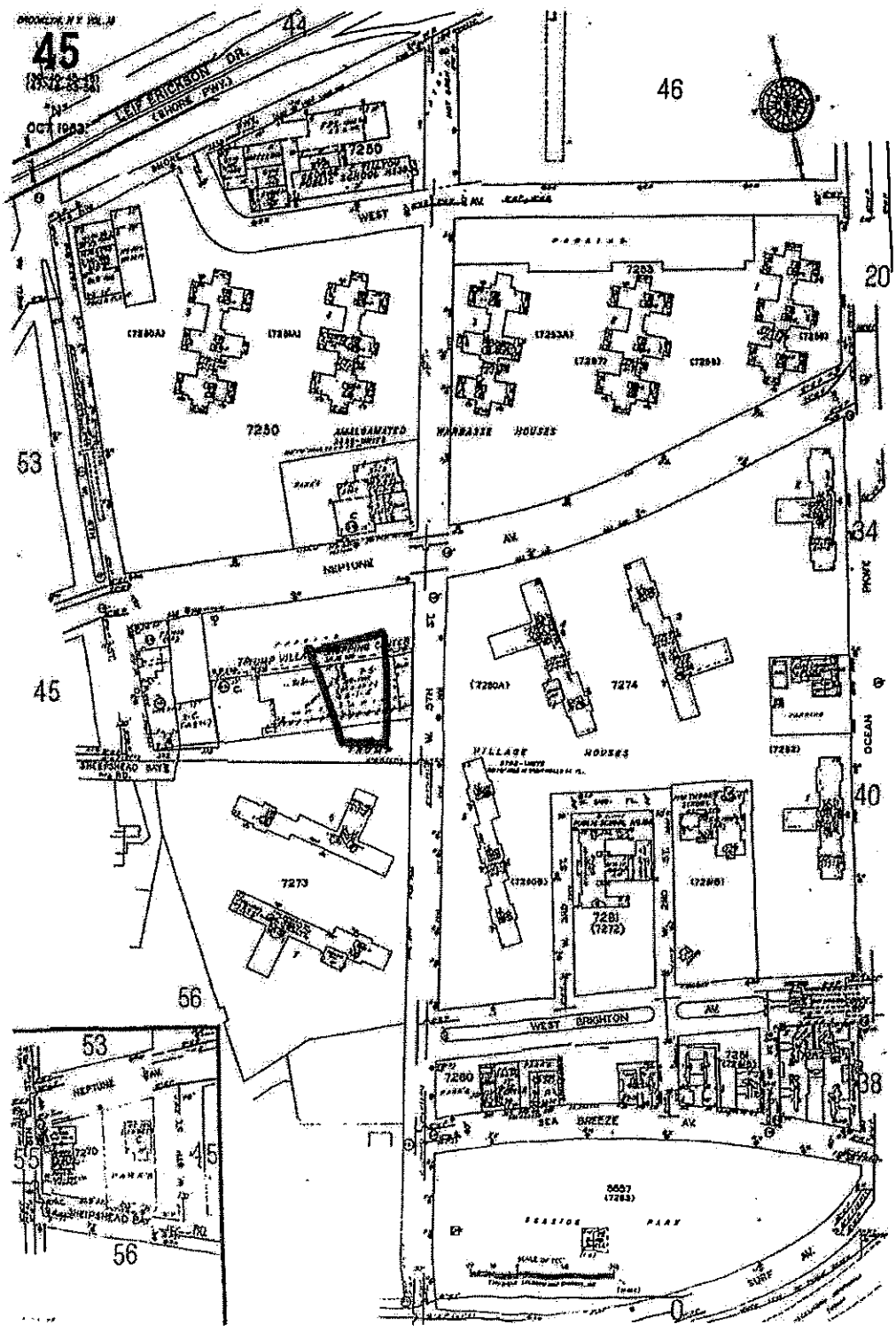
Project 982482

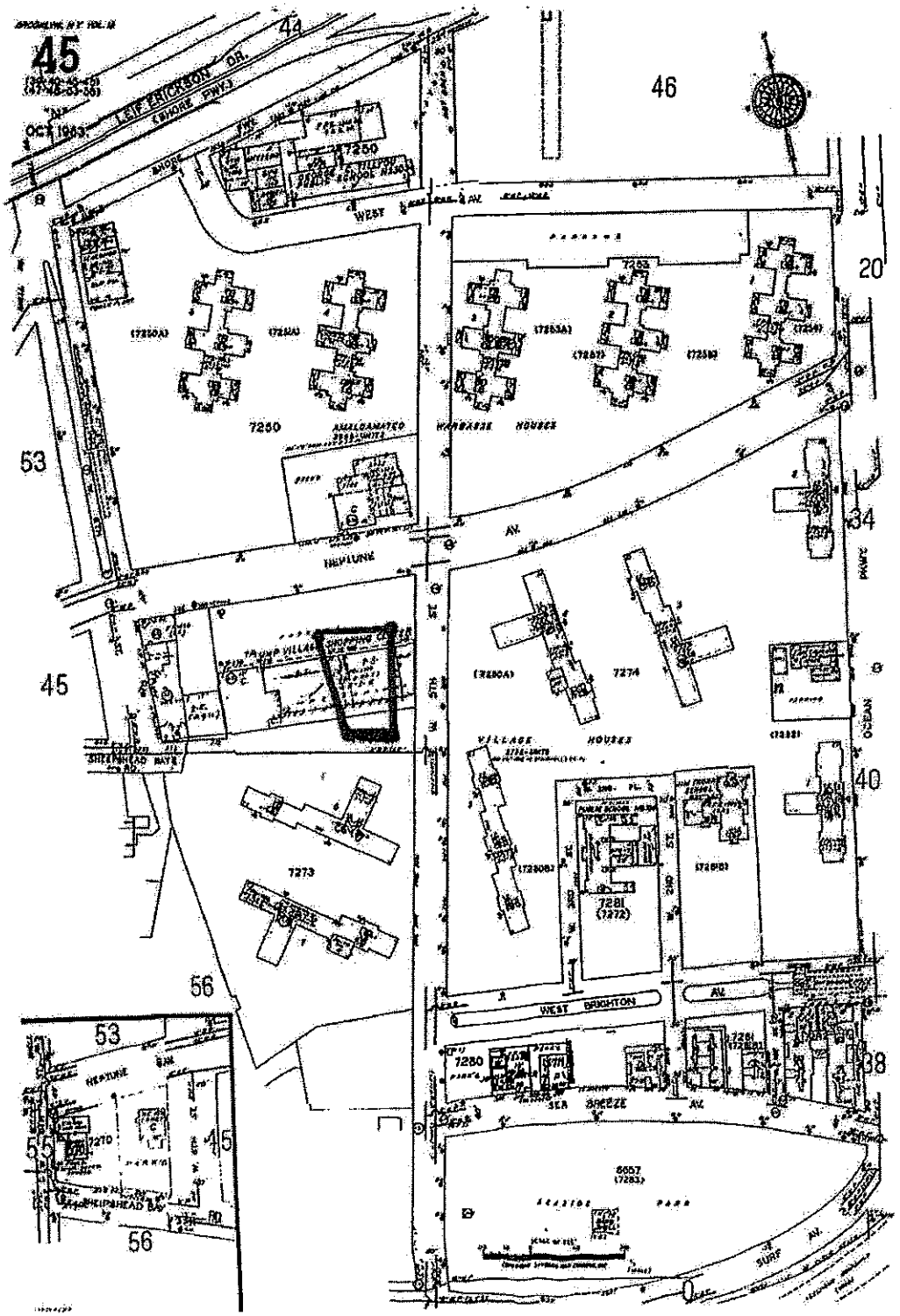
NEARBY LAND USE

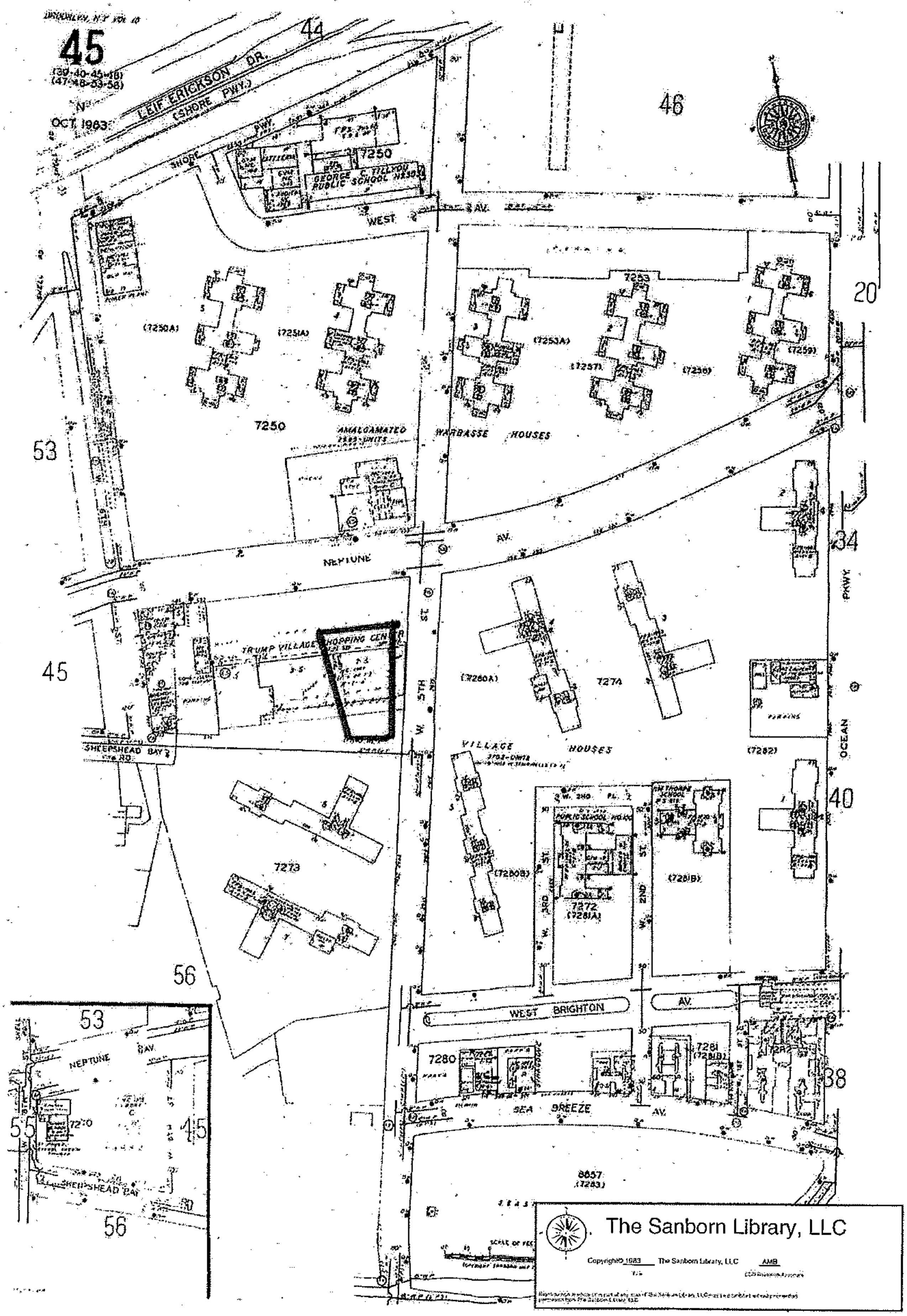
May 2005

Figure 1

KEYSPAN\BCP-APPLICATION\AERIAL PHOTOS\BCPAERIALS.PPT







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(7250A)
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(7253A)
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WARBASSE HOUSES
NEPTUNE AV.
TRUMP VILLAGE SHOPPING CENTER
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VILLAGE HOUSES
(7282)
SHEEPSHEAD BAY RD.
W. 5TH ST.
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W. 3RD ST.
W. 2ND PL.
W. 2ND ST.
PUBLIC SCHOOL
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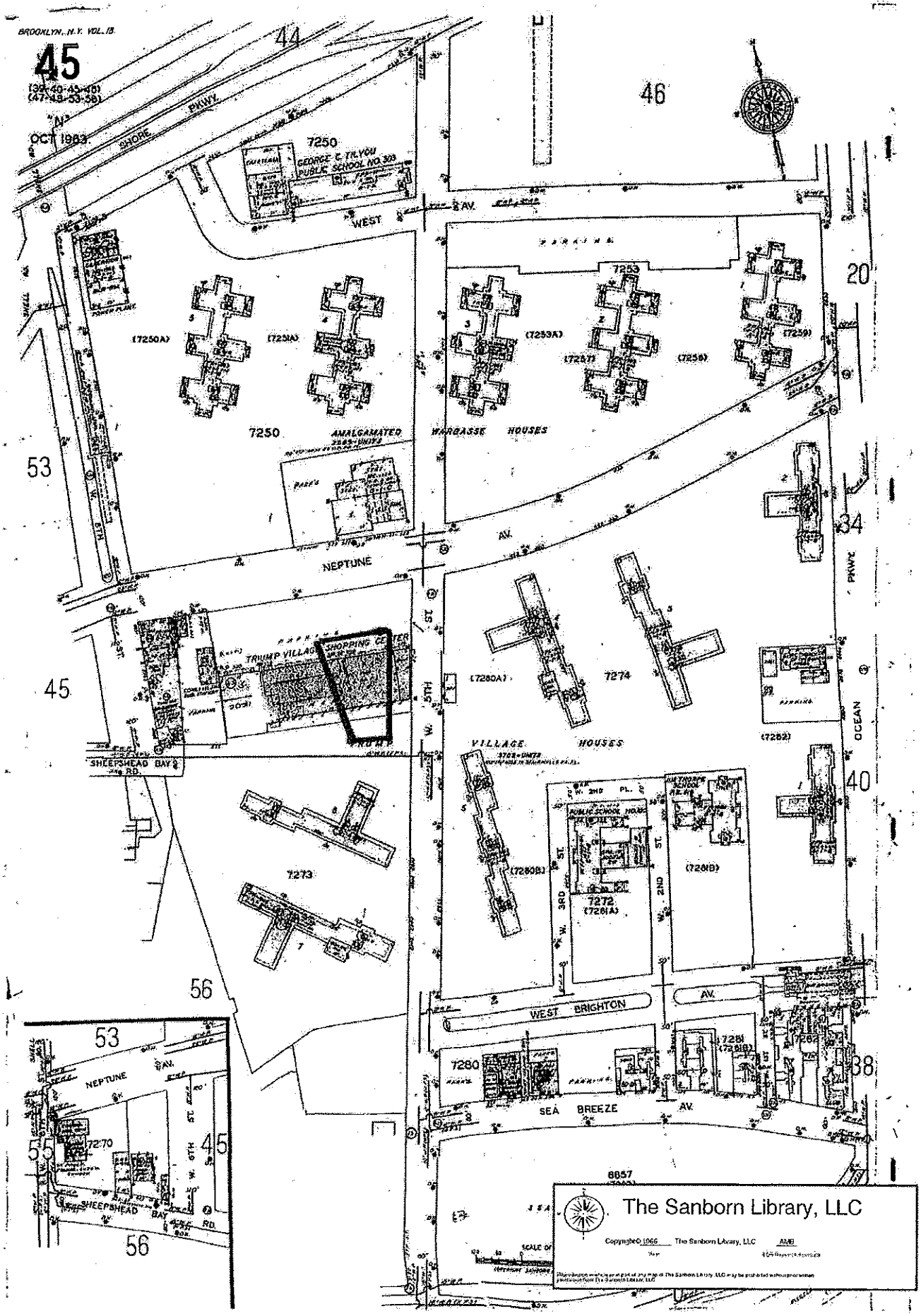
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WEST BRIGHTON AV.
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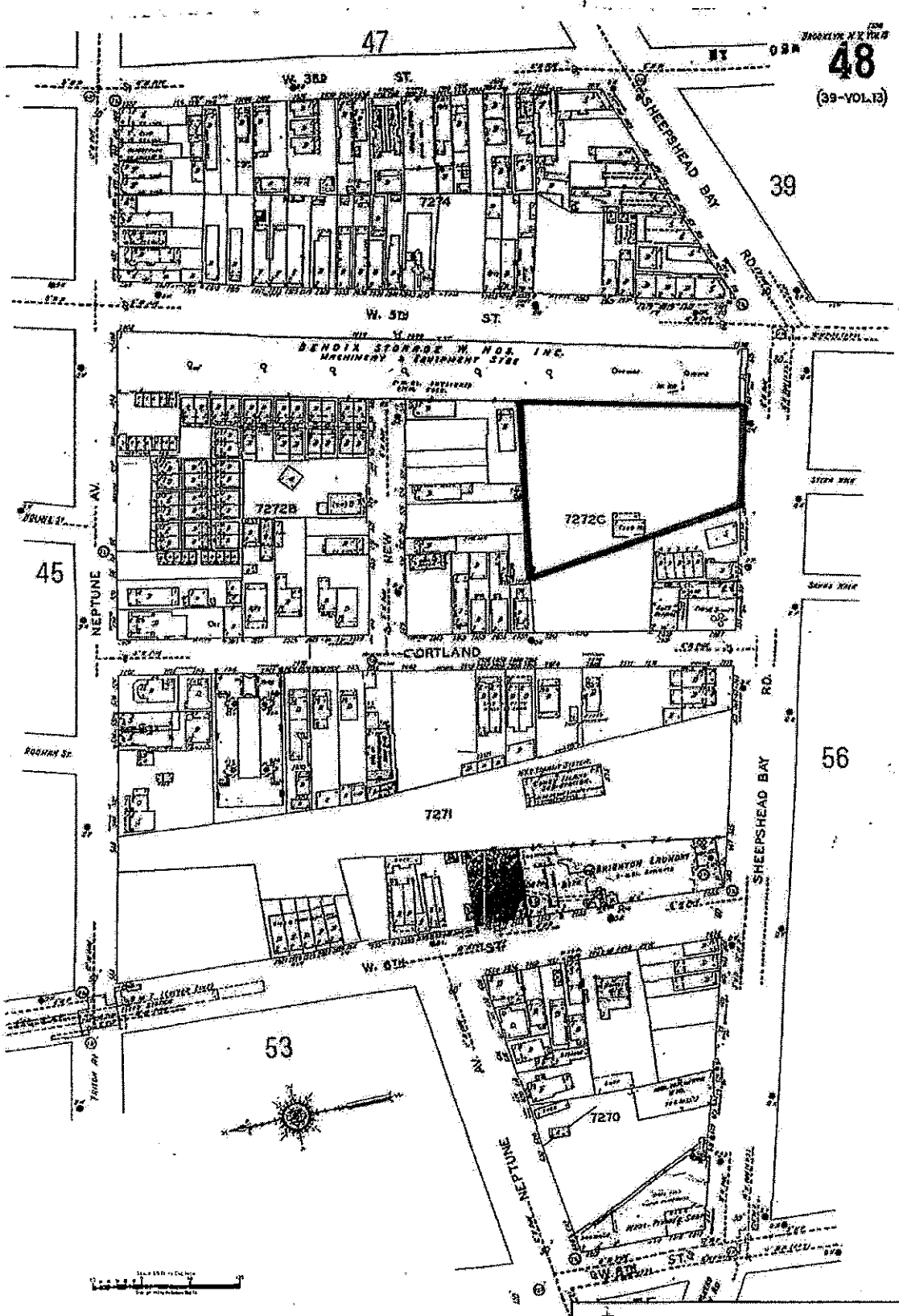

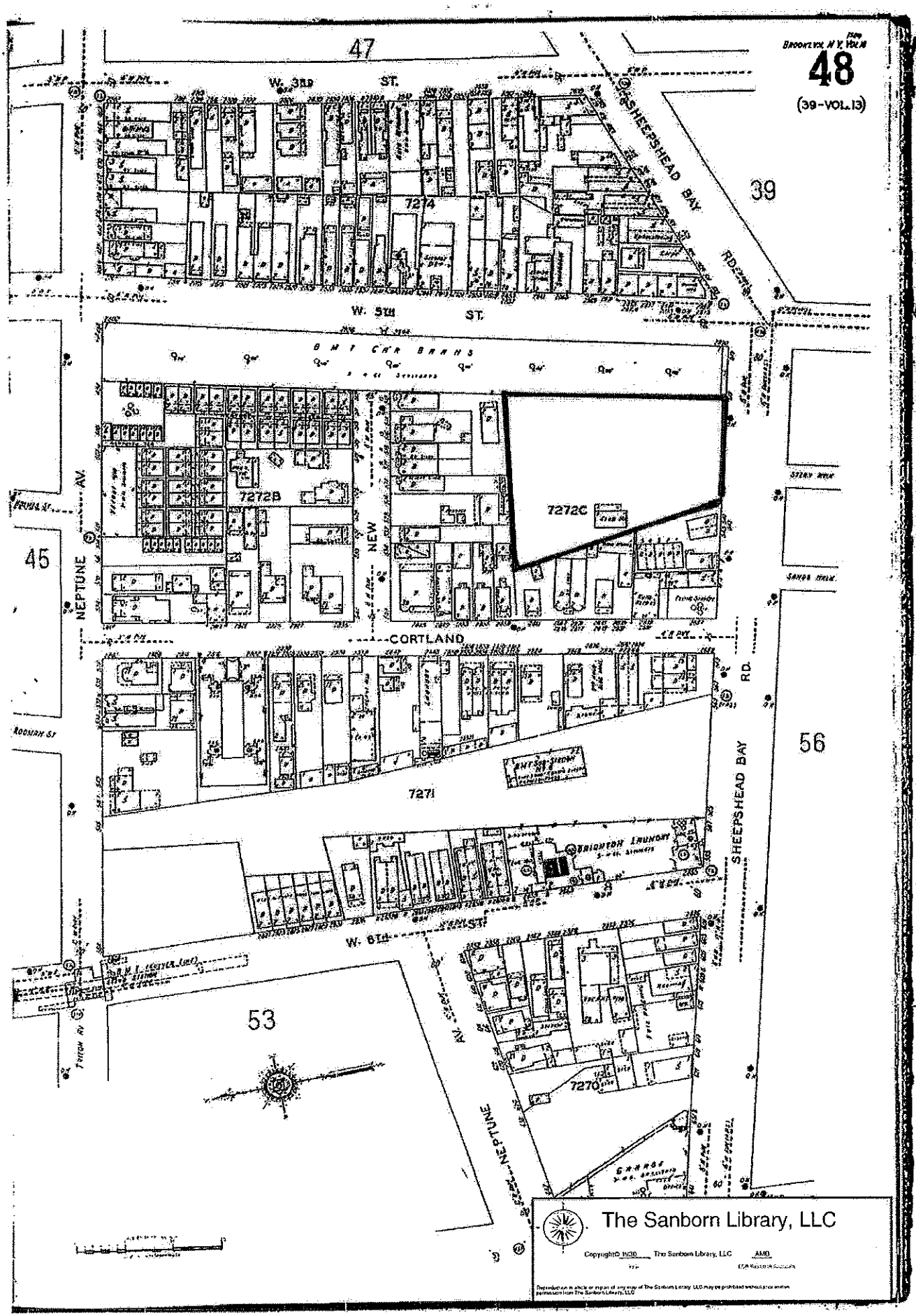
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7272C
NEPTUNE AV.
NEW
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CORTLAND
7271
RD.
56
SHEEPSHEAD BAY
BRIGHTON LAUNDRY
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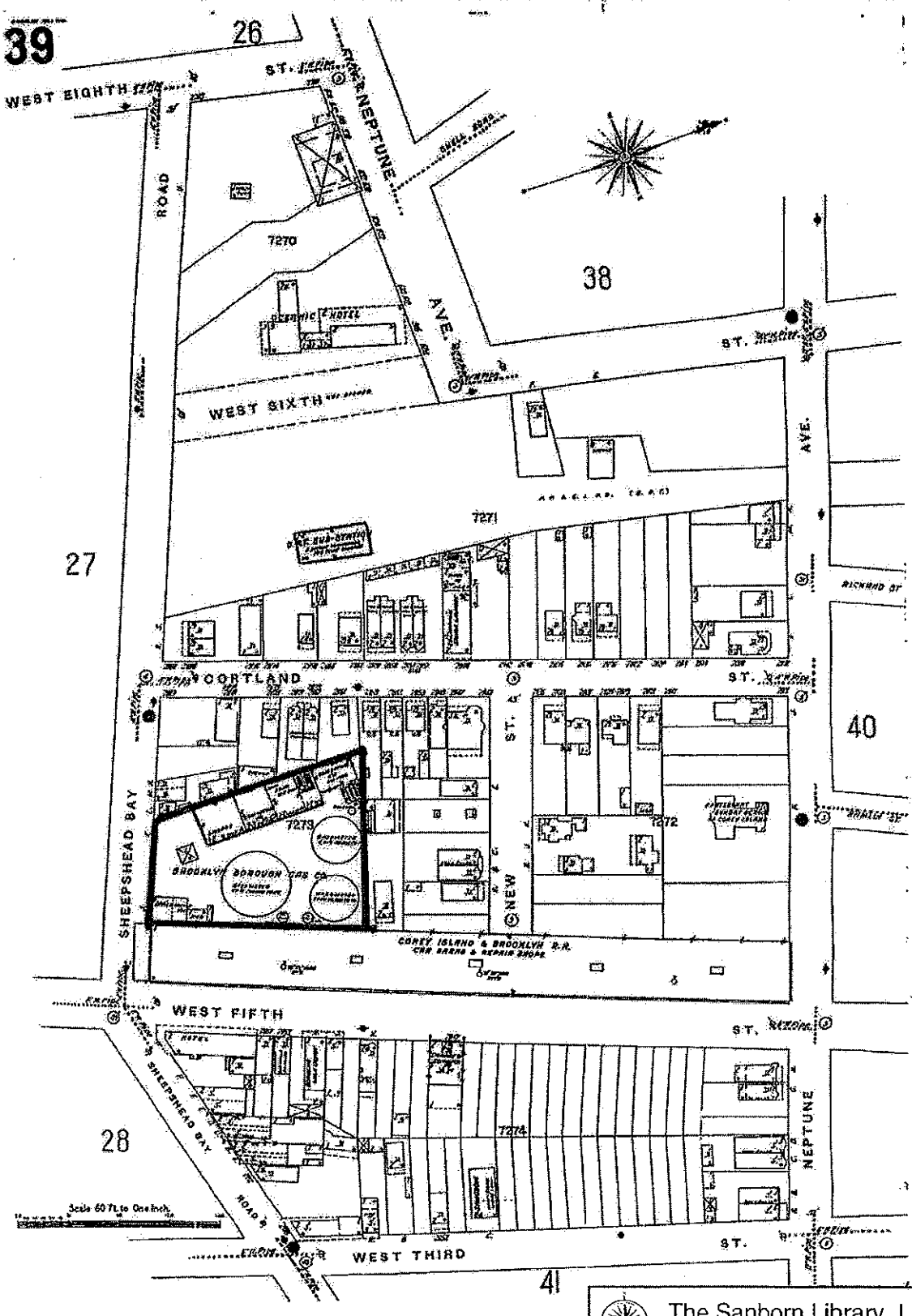

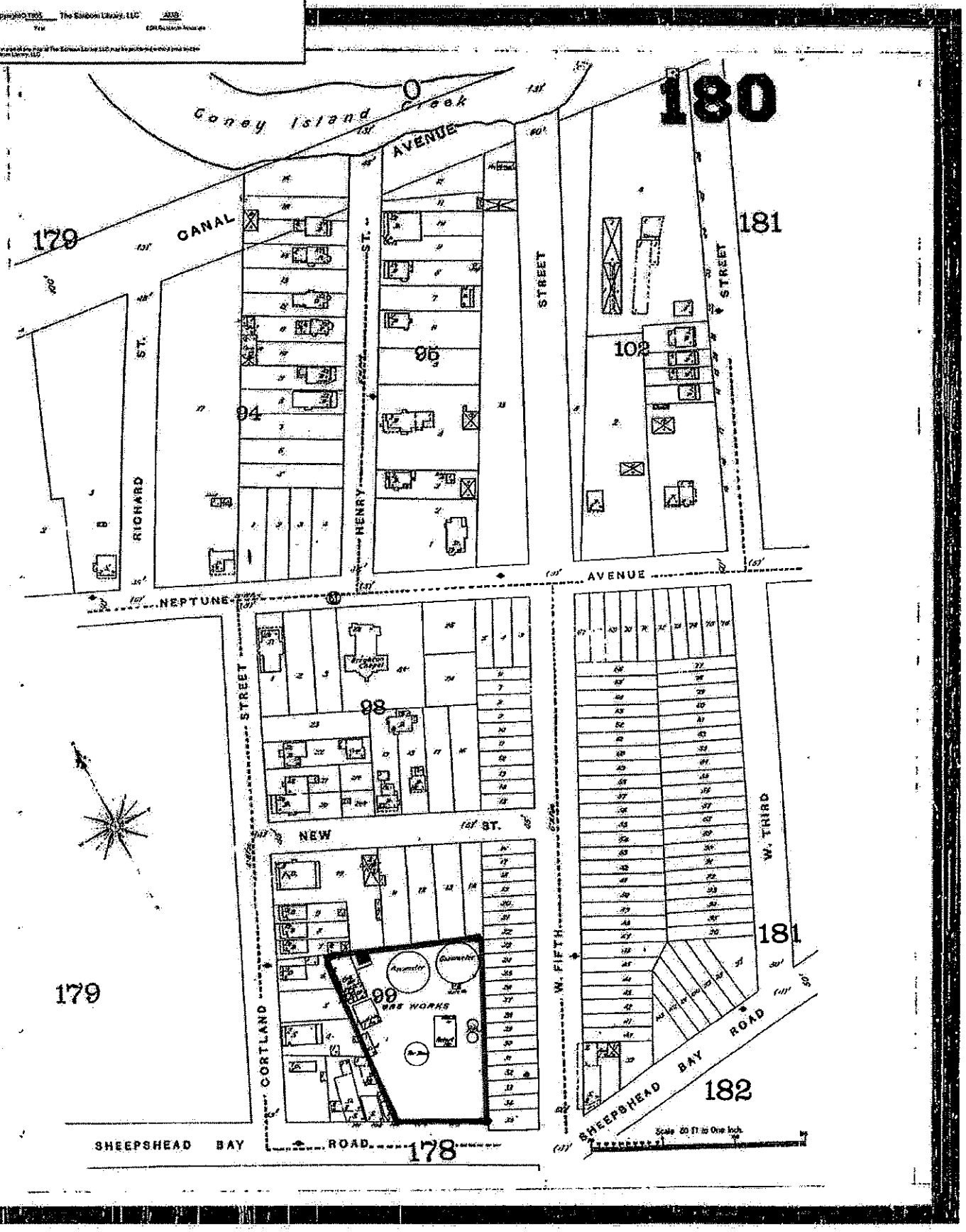

Former Dangman Park MGP Site
486 Neptune Avenue
Brooklyn, NY 11224

Inquiry Number: 2272962.3
July 21, 2008

The EDR Aerial Photo Decade Package

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDRs professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Date EDR Searched Historical Sources:

Aerial Photography July 21, 2008

Target Property:

486 Neptune Avenue
Brooklyn, NY 11224

Year	*Scale*	*Details*	*Source*
1954	Aerial Photograph. Scale: 1"=750'	Panel #: 2440073-E8/Flight Date: February 23, 1954	EDR
1966	Aerial Photograph. Scale: 1"=750'	Panel #: 2440073-E8/Flight Date: February 22, 1966	EDR
1975	Aerial Photograph. Scale: 1"=750'	Panel #: 2440073-E8/Flight Date: April 01, 1975	EDR
1984	Aerial Photograph. Scale: 1"=750'	Panel #: 2440073-E8/Flight Date: April 27, 1984	EDR
1994	Aerial Photograph. Scale: 1"=750'	Panel #: 2440073-E8/Flight Date: March 13, 1994	EDR
2006	Aerial Photograph. Scale: 1"=487'	Flight Year: 2006	EDR


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INQUIRY #: 2272962.3

YEAR: 1966

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YEAR: 1975

= 750'

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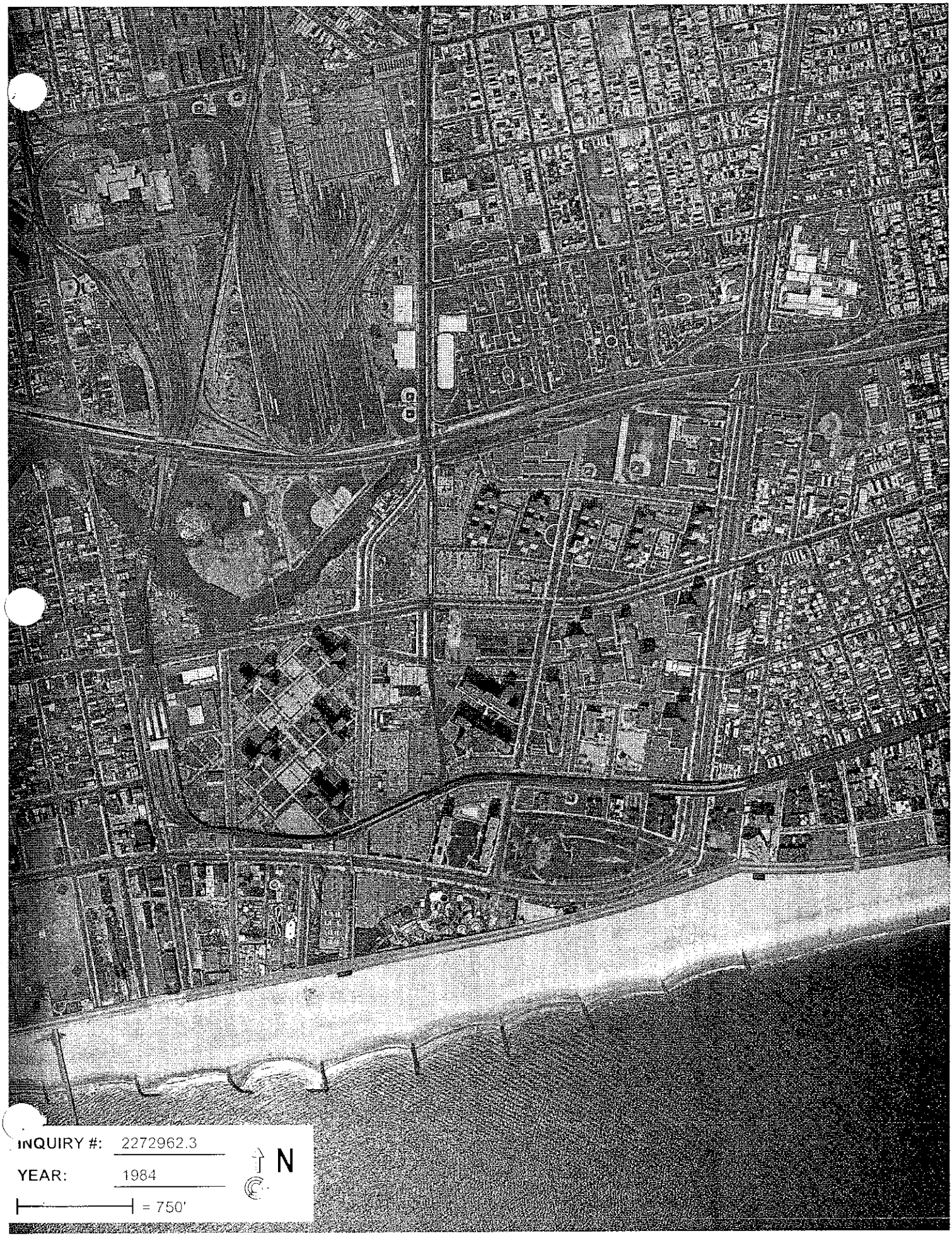
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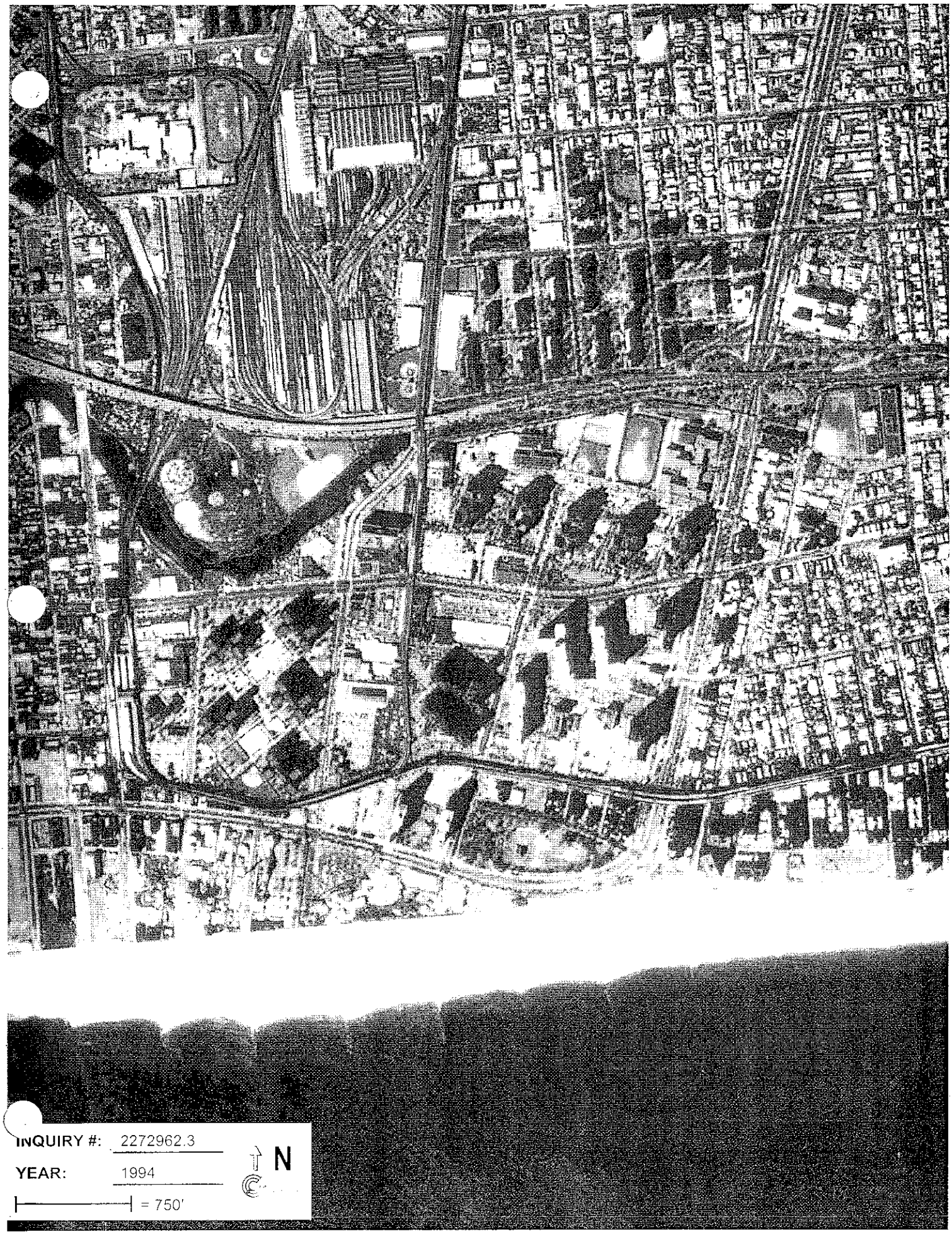
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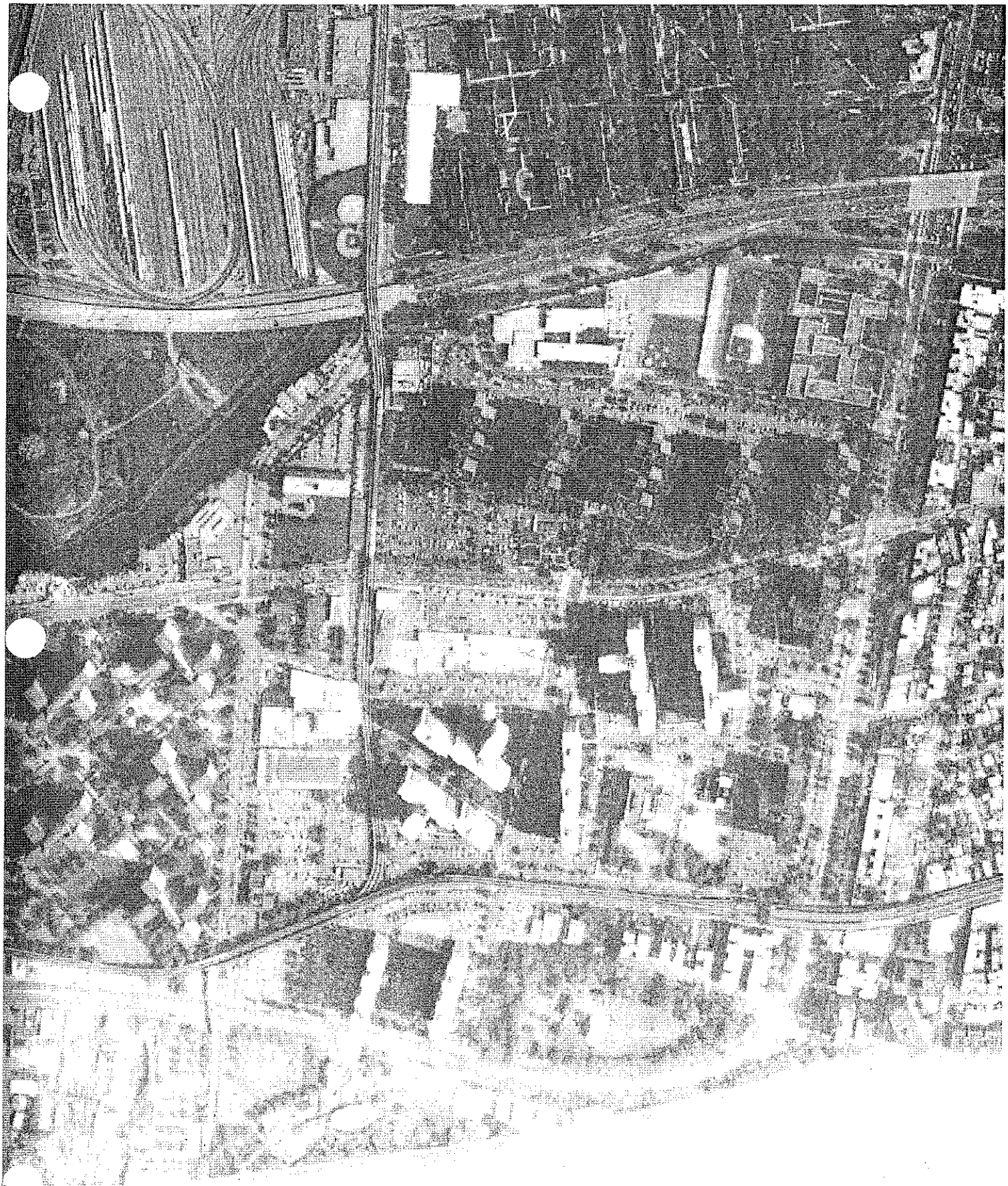

INQUIRY #: 2272962.3

YEAR: 2006

= 487'

N

Attachment 3

DNAPL Contingency Plan

Attachment 3: DNAPL Contingency Plan

This dense non-aqueous phase liquid (DNAPL) Contingency Plan specifies the procedures to be followed to limit the potential for remobilization and downward migration of DNAPL, should DNAPL be encountered during drilling at the Site. These procedures apply to the soil borings and monitoring wells that will be completed during the Site Characterization (SC) field activities.

Procedures

Continuous soil samples will be collected during drilling. Sampling procedures and soil characterization requirements are outlined in the Field Sampling Plan (FSP) (Appendix A of the SC Work Plan). These procedures include soil core descriptions and field screening (photoionization detector [PID] measurements) to determine the relative concentrations of organic vapors in soil samples. In addition, the field geologist will carefully review each sample for the presence of sheens, staining, and NAPL. Indications that soil may contain MGP-related impacts will be documented in the field notes.

If NAPL is observed, the field staff will first judge if the NAPL is lighter or denser than water (i.e., light non-aqueous phase liquid [LNAPL] or DNAPL). If an easy determination cannot be made, a representative soil sample will be selected for a shake test. To perform a shake test, the field staff will place a small sample of NAPL-containing soil in a clear jar. The jar will then be filled ¾ full with water, closed, and manually shaken for several seconds. The jar will then be allowed to sit for up to five minutes, if needed, to allow any potential emulsions to settle. Determination of LNAPL or DNAPL can be made by observing whether the NAPL floats or sinks.

If the NAPL is judged to be denser than water, the field staff will make a qualitative judgment whether the apparent quantity of DNAPL represents a pool that could be remobilized, or is immobile (residual) DNAPL. The presence of a DNAPL pool would be suggested by an apparent DNAPL volume of greater than 5 to 10 percent of the total soil sample volume.

If it is determined that a DNAPL pool is likely to be present, drilling may continue through the DNAPL-impacted interval to determine the approximate vertical extent, except where continued drilling would risk breaching a confining unit or MGP-related structure (confining with respect to DNAPL). If DNAPL is encountered immediately above a potential confining unit or MGP-related structure and the confining unit/structure has been identified through soil sampling, then one of the following four possible actions will be implemented upon consultation with National Grid USA (NGRID) and the New York State Department of Environmental Conservation (NYSDEC):

1. If deeper drilling and characterization are desired at such locations where a confining unit is identified, the borehole may be properly abandoned and an alternate nearby location will be selected. Drilling will proceed at the alternate location by casing off the interval from the bottom of the probable DNAPL pool to the land surface by grouting a casing in place. Should the borehole diameter of the original boring be adequate for installing casing and grout, an alternate drilling location would not be required. Drilling will resume inside the casing once the grout has set. If a DNAPL pool is identified below the potential confining unit, and no

deeper confining unit has been identified in which an outer casing may be set, the borehole will be abandoned and grouted.

2. If deeper drilling and characterization are desired at such locations where a former MGP-related structure is identified (e.g., gas holder floor) with significant accumulations of NAPL above the structure, the borehole will be properly abandoned and an alternate nearby location will be selected immediately outside of the footprint of the former structure.

3. If deeper drilling and characterization are not desired at such locations, the borehole should be properly abandoned by grouting from the bottom of the borehole to land surface using a tremie pipe.

4. If NAPL characterization data or NAPL recovery are desired at such locations, a monitoring well may be installed inside the borehole with a 2-foot sump (at a minimum).

If a confining unit or former MGP-related structure is not observed, drilling should be discontinued when approximately 6 feet of clean soil (or the top of bedrock) has been observed below the DNAPL-impacted interval. Action numbers 3 or 4 outlined above will be implemented under this scenario.

NAPL Monitoring

If intervals potentially containing NAPL are encountered while drilling, NAPL monitoring wells may be installed at these locations, based on the boring's location and the nature of the NAPL-impacted interval. The determination of NAPL at boring locations will be made by visual and olfactory observations, as well as by completing a shake test on selected soil samples (as specified above).

The length and slot size of NAPL monitoring well screens will depend on the nature of the stratigraphic interval containing NAPL. If NAPL accumulates in a NAPL monitoring well, then NAPL recovery tests can be performed at the NAPL monitoring well to assess the recoverability of the NAPL. The schedule and protocol for NAPL recovery (if required) will be agreed upon with NGRID and the NYSDEC prior to completion of the SC field activities.

Appendix A

Field Sampling Plan

ARCADIS

Infrastructure, environment, facilities

Imagine the result

nationalgrid

Appendix A
Field Sampling Plan

Former Dangman Park Manufactured Gas Plant
Site
Brooklyn, New York
Site No. 224047
Index # A2-0552-0606

April 7, 2009

ARCADIS

Christopher D. Keen
Task Manager/Senior Scientist

Steven M. Feldman
Project Manager/Principal Scientist

Appendix A
Field Sampling Plan

Former Dangman Park
Manufactured Gas Plant Site
Brooklyn, New York
Site No. 224047
Index # A2-0552-0606

Prepared for:
National Grid USA

Prepared by:
ARCADIS
Two Huntington Quadrangle
Suite 1S10
Melville
New York 11747
Tel 631.249.7600
Fax 631.249.7610

Our Ref.:
B0036704.0000.00001

Date:
April 7, 2009

1. Introduction

On behalf of National Grid USA (NGRID, formerly KeySpan Corporation [KeySpan]), ARCADIS has prepared this Field Sampling Plan (FSP) as a component of the Site Characterization (SC) Work Plan for the former Dangman Park Manufactured Gas Plant (MGP) site (Site) located at 486 Neptune Avenue, Brooklyn, New York. The FSP describes the methods and procedures to be used for environmental sample collection during implementation of the investigation field activities.

The FSP should be used in conjunction with the SC Work Plan, the Quality Assurance Project Plan (QAPP), the Health and Safety Plan (HASP), and the Community Air Monitoring Plan (CAMP). The SC Work Plan presents the Site background and defines the field sampling program. The QAPP presents the quality assurance/quality control (QA/QC) procedures to be used during implementation of the SC Work Plan, as well as a description of the general field and laboratory procedures. The QAPP, CAMP, and HASP are provided in Appendices B, C, and D, respectively.

1.1 Plan Organization

This FSP contains the following sections:

- Section 2: Site Description
- Section 3: "Site Characterization Activities" summarizes the type of sampling to be performed in accordance with the FSP
- Section 4: "Pre-Field Preparation and Equipment" describes preparation and equipment needed prior to mobilization to the field
- Section 5: "Investigation Field Activities" describes the sampling and data collection associated with the following SC activities:
    - Drilling of soil borings and collection of soil and groundwater samples
    - Drilling and installation of monitoring wells
    - Collection of groundwater samples from monitoring wells

- Collection of hydraulic (water-level and fluid-level) measurements from monitoring wells
- Drilling of temporary sub-slab soil vapor points and collection of sub-slab soil vapor samples
- Collection of indoor and ambient (outdoor) air quality samples
- Drilling of temporary soil vapor points and collection of exterior soil vapor samples (if warranted)

- Section 6: Investigation-Derived Waste (IDW) Sampling
- Section 7: Sample Collection, Labeling, Handling, and Analysis
- Section 8: Field Decontamination Procedures
- Section 9: Waste Management and Disposal

2. Site Description

The Site is located at 486 Neptune Avenue in the Borough of Brooklyn, New York City, Kings County, New York and is identified by Tax Map Number: Block 7273, Lots 1 and 25. As shown on Figure 1 of the SC Work Plan, the Site is located approximately 1,300 feet southeast of Coney Island Creek and approximately 2,400 feet north of New York Bay. The Site is generally flat with an elevation of approximately 6 feet above mean sea level (amsl). The closest natural surface water body is Coney Island Creek, which is located approximately 0.25 miles to the northwest of the Site.

The Site is located in the Coney Island community district of Brooklyn on approximately 4 acres of land, and is bounded by Neptune Avenue to the north, W. 5th Street to the east, a residential parcel to the south, and a commercial parcel to the west. Currently, the Site is developed with a strip mall and a parking lot for a high-rise apartment building.

3. Site Characterization Activities

The primary objectives of the proposed SC activities are listed in Section 1.1 of the SC Work Plan. Sample collection efforts include obtaining discrete soil and groundwater

samples from soil borings, groundwater samples from monitoring wells, sub-slab soil vapor samples from temporary points, indoor and ambient air quality samples, soil vapor samples from temporary points (if warranted), and IDW solid and liquid media samples for waste characterization purposes.

4. Pre-Field Preparation and Equipment

The following sections describe the preparation that will be performed and equipment that is needed prior to mobilization to the field to conduct the activities specified in this FSP. The field project team (scientists, engineers, and technicians) will be responsible for obtaining, operating, and maintaining the required equipment, collecting the samples as specified herein, and for procuring and maintaining sample containers or canisters pertinent to the collection of environmental samples. The following text describes these procedures in detail.

In general, the pre-cleaned environmental sample containers (bottles) or canisters (SUMMA® canisters) will be provided by the analytical laboratory in accordance with procedures and requirements set forth in the QAPP (Appendix B of the SC Work Plan). The sample containers or canisters will be inventoried and inspected prior to sampling to verify that the required containers or canisters are present and in good condition. Specific sample container and canister inspection procedures are as follows:

- Water and soil sample bottles will be inventoried and inspected to ensure that the required bottles are present, visually clean, unbroken, and have been properly preserved (see QAPP) by the laboratory.

- SUMMA® canisters (for soil vapor, indoor air quality, and ambient air quality sample collection) will be inventoried and inspected to ensure that the required canisters and flow controllers are present, the canisters have the proper initial vacuum (see QAPP), and the gauges are working properly.

Field equipment will be inventoried and inspected by the field team members performing the work. The equipment and forms listed below will be available and used during the course of the field activities:

- Personal Protective Equipment (PPE) and air monitoring equipment, as defined in the HASP and CAMP.

- Health and safety forms as specified in the HASP.

- Field daily logs or bound logbook, as specified in the QAPP.
- Weighted tape measure, accurate to one-hundredth of one foot.
- Micro-90® low-phosphate detergent or Alconox and new scrub brushes.
- Sufficient quantities of distilled water.
- 4-millimeter thick plastic sheeting.
- Digital Camera.

The following additional equipment/forms shall be used during collection of soil samples for lithologic characterization and/or laboratory analysis:

- Sample/Core Logs, calibration logs, and chain-of-custody forms (as specified in the QAPP).
- Portable table for logging soil samples.
- Two, plastic 5-gallon buckets for soil core sampler (i.e., split-spoon sampler) decontamination (decontamination procedures are provided in Section 8 of this FSP).
- Stainless steel spoon, trowel, and bowls for soil sample collection.
- Plastic coolers for sample preservation, storage, and shipment.
- Soil sample containers (dependent on analysis performed; refer to the QAPP).

The following additional equipment/forms shall be used during collection of groundwater samples from soil borings and monitoring wells:

- Water Sampling Logs, Low-flow Groundwater Sampling Logs, calibration logs, and chain-of-custody forms (as specified in the QAPP).
- HydroPunch® sampler.

- Variable speed, 2-inch diameter submersible pump, motor lead, support cable, submersible pump control box, and portable 110-volt or 230-volt generator.
- New polyethylene tubing.
- Electronic water-level indicator, accurate to one-hundredth of one foot.
- Portable field parameter meters including pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), conductivity, temperature, turbidity, and the associated calibration standards.
- Purge water containers (Department of Transportation [DOT]-approved 55-gallon steel drums).
- Plastic coolers for sample preservation, storage, and shipment.
- Water sample containers (dependent on analysis performed; refer to the QAPP).

Other required equipment not specified herein will be provided by the drilling subcontractor.

The following additional equipment/forms shall be used during collection of sub-slab soil vapor and soil vapor samples from temporary sub-slab soil vapor and soil vapor points:

- Sub-Slab Soil Vapor and Soil Vapor Sampling Logs, calibration logs, and chain-of-custody forms (as specified in the QAPP).
- New ¼-inch inside diameter (I.D.) Teflon®-lined tubing.
- New ¼-inch outside diameter (O.D.) Teflon® tubing.
- Fittings and wrenches.
- A portable vacuum pump capable of producing very low flow rates (i.e., 100 to 200 milliliters per minute [mL/min]).
- Rotameter or an electric flow sensor.

- Tracer gas source (i.e., helium) (for exterior soil vapor samples, if executed).
- Helium detector (for exterior soil vapor samples, if executed).
- Stainless steel SUMMA® canisters.
- Flow controllers with in-line particulate filters and vacuum gauges; flow controllers are pre-calibrated to specified sample duration (e.g., 30 minutes) or flow rate (e.g., 167 mL/min).
- Stainless steel "T" fitting (for collecting duplicate samples).

Other required equipment not specified herein will be provided by the drilling subcontractor.

The following additional equipment/forms shall be used during collection of indoor and ambient air quality samples:

- Indoor and Ambient Air Sampling Logs and chain-of-custody forms (as specified in the QAPP).
- Wrenches.
- Stainless steel SUMMA® canisters.
- Flow controllers with in-line particulate filters and vacuum gauges; flow controllers are pre-calibrated to specified sample duration (e.g., 8 hours) or flow rate (e.g., 11.5 mL/min).
- Stainless steel "T" fitting (for collecting duplicate samples).
- Box, crate, or tripod for elevating SUMMA® canisters above floor or ground surface.

5. Investigation Field Activities

The following sections describe the sampling methods associated with the SC activities. The QAPP provides additional details regarding Field Records and QA/QC samples frequency and protocols, sample labeling, and sample custody.

5.1 Sample Locations

The locations of the proposed soil borings and monitoring wells as part of the SC are shown on Figure 2 of the SC Work Plan. The locations of the proposed sub-slab soil vapor points, indoor and ambient air quality samples, and exterior soil vapor points (if necessary) will be provided in a SC Work Plan Addendum.

5.2 Soil Borings

This section describes the methods to collect soil and groundwater samples from soil borings. The soil borings will be drilled using hollow-stem auger drilling methodology. Soil cores will be collected from the soil borings using a split-spoon sampler. Groundwater samples will be collected from the soil borings using a HydroPunch® sampler.

Soil investigation objectives for the SC are described in Section 3.2.1 of the SC Work Plan. Soil and groundwater samples will be analyzed for the analytes specified in the SC Work Plan and the QAPP (Appendix B of the SC Work Plan). Additional details on soil and groundwater sample collection are described below.

Underground utilities will be identified prior to any drilling or subsurface sampling. Public and privately owned utilities will be located by contacting responsible agencies by phone (New York City/Long Island One Call Dig Safely) so that their underground utilities can be marked at the Site. Other potential on site hazards such as traffic, overhead power lines, and building hazards will be identified during a Site reconnaissance visit. The work will be planned, in conjunction with Site occupants, to minimize impacts and promote safe conditions for workers and visitors.

The drilling and sampling of soil borings will include the following activities:

1. Determine location of the soil boring and avoid overhead/underground utilities, per the HASP.

2. The approximate location will be measured and shown on a location sketch.

3. The drill rig will be mobilized to the proposed location.

4. If asphalt or concrete pavement is present, the driller will drill or core through the pavement, exposing the underlying surface soil.

5. The proposed location will be cleared of utilities to a depth of approximately 5 feet below land surface (ft bls) by hand or by air knife.

6. Drilling will commence and soil cores will be collected as specified in the SC Work Plan.

7. The field geologist (in coordination with Driller) will monitor the formation drilled through evaluation of collected soil cores.

8. Soil and groundwater samples will be collected for the specified analyses (see SC Work Plan and QAPP for details).

9. Boreholes will be abandoned as described below.

Discrete soil cores will be collected using a split-spoon sampler. The general sequence of soil core collection (by Driller), lithologic logging (by field Geologist), soil sample collection (by field Geologist), and record keeping is as follows:

- Assemble the sampler by aligning both sides of barrel and then screwing the drive shoe on the bottom and the head piece on top.

- Lower the sampler to the desired sampling depth (by Driller).

- Drive the sampler through the bottom of the borehole with a 140-pound hammer dropped 30 inches vertically repeatedly (by Driller). Do not drive past the bottom of the head piece or compression of the sample will result.

- Record on the Sample/Core Log the length of the sampler used to penetrate the material being sampled and the number of blows, per six inches of sampler penetration, required to obtain the depth (by Field Geologist).

- Withdraw the sampler from the borehole and open by unscrewing the drive shoe and head piece and splitting the barrel (by Driller). Record the amount of recovery and soil type on the Sample/Core Log (by field Geologist). The soil type will be described using the Field Descriptions of Samples for Former Manufactured Gas Plant (MGP) Sites (NGRID) provided in Attachment A-1 of this FSP. Specific information recorded should include:

  - Soils will be logged using the Unified Soil Classification System (USCS) (ASTM D2488-00).
  - The structure of the soils sampled, including layering/stratification features, and the dominant soil types.
  - The color of soils.
  - The moisture content of soils.
  - Soil grain features, including grain sizes, degree of sorting, angularity, and mineralogy.
  - Identification of any rock fragments, organic material, or other components.

- Following collection, the soil core will be screened for volatile organic compounds (VOCs) using the jar headspace method and a photoionization detector (PID). The HASP provides health and safety action levels.
- Soil samples will be collected for the appropriate laboratory analysis (see QAPP and Table 1 of the SC Work Plan).
- Sample collection, labeling, and handling procedures are described in Section 7 of this FSP.
- If a monitoring well will not be installed at the soil boring location, then the borehole will be abandoned by pumping a cement/bentonite grout mixture through a tremie pipe into the hollow stem augers, and slowly removing the augers as grouting is conducted.
- Residual soil will be containerized in a DOT-approved 55-gallon steel drum.
- The split-spoon sampler will be decontaminated in accordance with Section 8 of this FSP.

Discrete groundwater samples will be collected using a HydroPunch® sampler. The HydroPunch® sampler collects a groundwater sample through the effect of in-situ hydrostatic head; therefore, the top of the sample chamber must be a minimum of 5

feet below the water table for sample acquisition. The general sequence of HydroPunch® sampler deployment and retrieval (by Driller), groundwater sample collection (by field Geologist), and record keeping is as follows:

- Assemble the sampler by placing the lower check valve with attached filter screen into the bottom of the sampler body and placing the upper check valve in the top of the sampler (by Driller).

- Insert a disposable drive cone into the drive shoe, ensuring that a seal is made by the O-ring. Place the sleeve over the juncture of the drive cone and drive shoe (by Driller).

- Lower the sampler to the desired sampling depth (by Driller). Do not set the sampler down on the bottom of the borehole and pick it up. This will open the sampler and compromise the sample integrity. Damage to the sampler may be incurred if it is driven after being opened. Also, caution must be taken not to back hammer when driving the sampler for the above stated reason.

- Drive the sampler to the desired depth through the bottom of the borehole with a 140-pound hammer dropped 30 inches vertically repeatedly (by Driller). Pull back the sampler approximately 2 feet. Soil friction will hold the drive cone in place. Accurately measure the distance the sampler is driven and the distance pulled back. Never pull the sampler back farther than it is driven into the undisturbed soil. This may result in cross contamination of the sample from other zones in the borehole.

- Ground water flows into the intake screen past the lower check valve, into the sample chamber and finally out the top check valve.

- The sampler is pulled to the surface, increasing the hydrostatic head within the sampler, which closes the two check valves (by Driller).

- At the surface the sampler is inverted and the sample is decanted through a discharge valve and tubing into the sample containers (by field Geologist). Groundwater samples will be collected for the appropriate laboratory analysis (see QAPP and Table 1 of the SC Work Pan).

- Record on the Water Sampling Log visual and olfactory observations and field parameters (i.e., pH, temperature, conductivity, and turbidity) (by Field Geologist).

- Sample collection, labeling, and handling procedures are described in Section 7 of this FSP.

- The HydroPunch® sampler will be decontaminated in accordance with Section 8 of this FSP. The screen is disposable and must be discarded.

5.3 Monitoring Well Drilling, Installation, and Development

This section describes the methods to drill, install, and develop monitoring wells. The monitoring wells will be drilled using hollow-stem auger drilling methodology. Based on the subsurface conditions that are encountered during drilling (e.g., the depth of groundwater, the depth of a confining layer, and the presence/extent of NAPL), one or more of the monitoring wells may be installed to straddle the water table. Based on available information on the local geology, bedrock is expected to be present at a depth greater than 100 ft bls; thus, bedrock is not expected to be encountered at the Site. After completion of drilling and well installation, the monitoring wells will be developed to establish hydraulic connection between the well and the formation. The following procedures will be used to drill, install, and develop monitoring wells.

5.3.1 Overburden Drilling

The drilling and geological logging methods to be completed in connection with monitoring well installation are as follows:

- Boreholes in the overburden will be drilled with hollow-stem augers. Soil borings will be completed to a depth as discussed in the SC Work Plan.

- Continuous soil sampling will be conducted at the monitoring well borings using a 2-foot long, 2-inch outside diameter (OD) split-spoon sampler.

- The designated field geologist will log borehole geology (using the USCS [ASTM D2488-00]) and monitoring well specifications in the field book and/or field forms.

- A plywood sheet may be placed around the auger when drilling to contain cuttings.

- Soil cuttings will be placed in a drums supplied by the drilling subcontractor. Decontamination water will be placed in drums supplied by the drilling subcontractor or a polyethylene tank supplied by NGRID. Soil cuttings and decontamination water will be containerized at the end of each work day. The open-top drums used to contain IDW will be covered when not in use.

5.3.2 Overburden Monitoring Well Specifications

The overburden monitoring wells will be installed according to the following specifications:

- 2-inch diameter threaded, flush-joint Schedule 40 polyvinyl chloride (PVC) casing and 10-foot long, 20 slot (0.020-inch) screens will be installed.

- A sump, 2 feet in length and sealed in with bentonite pellets, may be attached to the bottom of the screen for potential collection of dense non-aqueous phase liquid (DNAPL), if present (or suspected).

- The annulus around the screens will be backfilled with an appropriate size silica sand such as Morie #1 (or equivalent) sand to a minimum height of 1 foot above the top of the screen, assuming there is sufficient room to install an appropriate surface seal above the sand.

- An approximately 1-foot thick bentonite seal (pellets or slurry [30 gallons water to 25 to 30 pounds bentonite, or relative proportions]) will be placed above the sand pack. The pellet seal must be allowed to partially hydrate before placing grout above the seal.

- The remainder of the annular space will be filled with a cement/bentonite grout to approximately 2 ft bls (provided that there is sufficient room to install grout above the bentonite seal). The grout will be placed from the bottom up using a tremie pipe. The grout will consist of a cement mixture of one 94-pound bag of Portland cement, approximately 5 pounds of granular bentonite, and approximately 7 gallons of water. The grout will be allowed to set for a minimum of 48 hours before wells are developed if the grout is placed below the water table.

- Each monitoring well will be completed with an 8-inch diameter water-tight flush-mount protective casing. A 2-foot by 2-foot cement pad extending approximately 1 ft bls will be installed around the well. The well casing will extend to within approximately 6 inches below land surface and will include a locking cap.

- The north side of the top of the PVC well casing will be marked and the elevation determined by a relative elevation survey to the nearest 0.01 foot, relative to a Site reference point.

- The measuring point on wells will be the marked location on the innermost PVC casing.

The following characteristics of each newly installed monitoring well will be recorded in the field log book:

- Date/time of construction
- Drilling method and drilling fluid (if used)
- Approximate well location
- Borehole diameter and well casing diameter
- Well depth
- Drilling and lithologic logs
- Casing materials
- Screen materials and design
- Casing and screen joint type
- Screen slot size/length
- Filter pack material/size
- Filter pack placement method

- Sealant materials
- Sealant placement method
- Surface seal design/construction
- Well development procedure
- Type of protective well cap
- Detailed drawing of well (including dimensions)

If saturated conditions are encountered just above a confining layer, then a monitoring well will be installed to the top of the confining layer and the screen will be placed to straddle the water table, if feasible. If a sump is being installed to monitor for the potential presence of DNAPL, the sump should be installed such that the top of the bentonite and sump are at or slightly below the top of the confining layer.

Monitoring wells will be installed by placing the screen and casing assembly with bottom cap into the auger string after the screen interval has been selected. At that time, the silica sand pack will be placed in the annular space around the screen to 1 to 2 feet above the top of the screen as the auger string is removed from the borehole. Bentonite pellets will then be added to the annulus to 1 to 2 feet above the sand pack as the augers are removed. A cement/bentonite grout will be added above the bentonite pellets during the removal of the augers to land surface. During placement of the sand pack and bentonite, frequent measurements will be made to check the height of the sand pack and thickness of the bentonite seal using a weighted tape measure.

A flush-mount protective casing will be installed around the well casing. The flush-mount protective casing will be secured in a neat Portland cement seal. A locking cap will be placed on the well and the flush-mount protective casing secured with a bolt-down cover.

The on-site geologist shall specify the monitoring well design to the drilling contractor before installation. An alternate monitoring well construction method may be used if the water table is within approximately 4 feet of land surface. If these conditions are encountered, the thickness of the sand pack and bentonite seal would be reduced as necessary and the depth of the protective casing would be modified as necessary.

Monitoring wells will be labeled with the appropriate designation on the outer well casings.

5.3.3 Monitoring Well Development

A minimum of 48 hours after installation, or the day after installation if the grout is located above the water table, the monitoring wells will be developed by surging/bailing, using a centrifugal pump and dedicated polyethylene tubing, by Waterra inertial pumps (or equivalent) and dedicated polyethylene tubing, or other methods at the discretion of the field geologist. The development water will be containerized in drums to be provided by the drilling subcontractor or in a polyethylene tank provided by NGRID. The wells will be developed until the turbidity is reduced to 50 nephelometric turbidity units (NTUs) or less or until the pH and conductivity measurements have stabilized. Following development, the monitoring wells will be allowed to equilibrate for a minimum of two weeks before groundwater sampling is conducted. Monitoring well development will be overseen by a qualified person and the duration, method of development, and approximate volume of water removed will be recorded in the field book.

5.4 Hydraulic Measurements in Monitoring Wells

Hydraulic (i.e., water-level and fluid-level) measurements will be collected using the following procedures:

1. For each monitoring well location, water-level measurements will be collected by measuring the depth to groundwater from the surveyed measuring point.

2. The water-level measurements will be made to the nearest one-hundredth of one foot with a decontaminated electronic water-level indicator.

3. For wells expected to contain NAPL, the fluid-levels (i.e., NAPL/water interface) will be measured with a decontaminated interface meter and the bottom of the well will be sounded.

4. The electronic water-level indicator or interface meter will be decontaminated between well locations using the methods described in Section 8 of this FSP.

5. Water-level and fluid-level measurements and other pertinent information (e.g., well designation) will be recorded as outlined in the QAPP.

The measurements will be made in as short a timeframe as practical to minimize temporal fluctuations in hydraulic conditions. A round of fluid-level elevations will be collected in conjunction with each groundwater sampling event, as discussed in the SC Work Plan.

5.5 Monitoring Well Groundwater Sample Collection

This section describes the methods to collect groundwater samples from monitoring wells. Groundwater investigation objectives for the SC are described in Section 3.3.1 of the SC Work Plan. Groundwater samples will be analyzed for the analytes specified in the SC Work Plan and the QAPP (Appendix B of the SC Work Plan). Additional details on groundwater sample collection are described below.

During heavy precipitation events, groundwater sampling will be discontinued until precipitation ceases. When one round of water levels is collected to generate water-elevation data, the water levels will be collected consecutively at one time prior to sampling or other activities.

General pre-sampling activities that will be performed during monitoring well groundwater sample collection include accessing the well, preparing the well for purging and sampling, and collecting initial measurements. To access the well, the protective casing will be unlocked and surficial soil will be cleaned from around the wellhead. Plastic sheeting will be placed around the well and secured at the corners. The depth to water in the well will be measured to the nearest one-hundredth of one foot with an electronic water-level indicator or interface meter and the total depth of the well will be measured. If NAPLs are determined to be present, then a groundwater sample will not be collected. A representative NAPL sample may be collected (if required) using a bailer. Information pertinent to the purging and sampling activities will be recorded as outlined in the QAPP.

The monitoring wells will be purged and sampled using low-flow groundwater sampling procedures. Monitoring wells will be purged and sampled using a decontaminated, non-dedicated, variable speed, 2-inch diameter stainless steel submersible pump following EPA low-flow (minimal drawdown) groundwater sampling procedures (EPA 1996) as follows:

- Polyethylene tubing will be connected to the pump and the pump and tubing will be gradually lowered so as to place the pump intake within the

approximate center of the well screen zone or the midpoint of the saturated portion of the screen if the well bridges the water table.

- Groundwater will then be extracted from each well using low-flow techniques and will be directed into a flow-through cell. The flow-through cell will contain the DO, ORP, pH, conductivity, and temperature probes. Turbidity will be measured external to the flow-through cell. The wells will be purged at rates that do not exceed 500 mL/min. Ideally, the pump rate should cause little water-level drawdown in the well (less than 0.3 feet and the water level should stabilize). The water level should be monitored every five minutes (or as appropriate) during pumping. Care should be taken not to cause the pump suction to be broken or entrainment of air in the sample. Record pumping rate adjustments and depths to water. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to avoid pumping the well dry and/or to ensure stabilization of indicator parameters. If the recharge rate of the well is very low, purging should be interrupted so as not to cause the drawdown within the well to advance below the pump. However, a steady flow rate should be maintained to the extent practicable. Sampling should commence as soon as the volume in the well has recovered sufficiently to permit sample collection.

- Field parameters (dissolved oxygen [DO], oxidation-reduction potential [ORP], pH, conductivity, temperature, and turbidity) will be measured initially and at approximately five minute intervals during purging and will be recorded on Low-Flow Groundwater Sampling Logs. Field parameters will be monitored with calibrated meters that will be calibrated daily according to the manufacturer's instructions. Completion of purging, and therefore, the actual volume of water purged from each well, will be based on the stabilization protocols described in the low-flow method.

- Following stabilization of field parameters, the purge rate will then be reduced to approximately 100 mL/min and the groundwater samples will be collected directly from the pump discharge. If a peristaltic pump is used for sample collection, the SVOC samples will be collected directly from the pump discharge and the VOC sample will be collected using a disposable bailer.

- Once sampling is complete, the non-dedicated submersible pump will be gradually removed from the well and dedicated sampling equipment (e.g., tubing) will be disconnected from the pump and secured inside the well casing.

The well will be closed and locked and the submersible pump will be decontaminated.

5.6 Temporary Sub-Slab Soil Vapor Points

This section describes the methods to collect sub-slab soil vapor samples from temporary sub-slab soil vapor points. Sub-slab soil vapor samples will be collected using 6-liter SUMMA® canisters and 0.5-hour flow controllers. The temporary sub-slab soil vapor point boreholes will be drilled using a core drill or rotary hammer drill and a manual slide hammer. Sub-slab soil vapor samples will be collected from the temporary sub-slab soil vapor points using the Geoprobe® Post Run Tubing (PRT) System. The PRT System allows for the collection of soil vapor samples at the desired sampling depth while significantly reducing the chances of rod leakage and ambient air contamination. O-ring connections enable the PRT System to deliver a vacuum-tight seal that prevents sample contamination from ambient air and assures that the sample is taken from the desired depth at the bottom of the boring.

The temporary sub-slab soil vapor point samples are intended to serve as screening-level samples that will be collected from a temporary point; therefore, temporal repeat sampling of temporary sub-slab soil vapor point sample intervals will not be performed.

Sub-slab soil vapor sample collection rationale for the soil vapor portion of the SC is described in Section 3.4.1 of the SC Work Plan. Sub-slab soil vapor samples will be analyzed for the analytes specified in the QAPP (Appendix B) and Table 1 of the SC Work Plan. Additional details on temporary sub-slab soil vapor point sample collection are described below.

5.6.1 Temporary Sub-Slab Soil Vapor Point Drilling and Soil Vapor Sampling

Sub-slab soil vapor samples will be collected from temporary sub-slab soil vapor points using the Geoprobe® PRT System. The general sequence of temporary sub-slab soil vapor point advancement (by Driller), sub-slab soil vapor sample collection (by field Geologist), and record keeping is as follows:

- A 1.5-inch diameter borehole will be advanced through the concrete floor slab using a core drill or rotary hammer drill.

- A temporary sub-slab soil vapor sampling point consisting of 1.25-inch diameter steel drive rods will be advanced using a manual slide hammer to a depth of approximately 3 inches below the bottom of the floor slab.

- An expendable PRT System point holder and expendable PRT System point will be affixed at the downhole end of the rods. Once a depth of 3 inches below the bottom of the floor slab is reached, the sampling assembly will be retracted approximately 3 inches, allowing the expendable point to disengage from the rods, and creating a void in the subsurface for sub-slab soil vapor sample collection.

- A bentonite seal will be placed around the outside of the rods at the floor slab surface.

- Teflon®-lined tubing (¼-inch I.D.) and a PRT adapter will then be inserted down the center of the rods. A bentonite seal will be placed around the outside of the tubing and the inside of the rods. The system is airtight and the potential for rod leakage is significantly reduced using O-ring connections and the bentonite seals. New Teflon®-lined tubing will be used at each sample location.

- A portable vacuum pump and rotameter will be used to purge at least 1.5 volumes of air from the temporary sub-slab soil vapor point and tubing at a rate of approximately 100 to 200 mL/min.

- A laboratory pre-calibrated 0.5-hour flow controller (i.e., calibrated to collect the soil vapor sample at a rate of approximately 167 mL/min) with an in-line particulate filter will be attached to the SUMMA® canister.

- Following purging, the ¼-inch I.D. Teflon®-lined tubing will be connected to the ¼-inch O.D. Teflon® tubing using a reducing coupling and the ¼-inch O.D. Teflon® tubing will be connected to the flow controller and the SUMMA® canister. A duplicate sub-slab soil vapor sample will be collected at one of the locations using a stainless steel "T" fitting and a second SUMMA® canister.

- The SUMMA® canister valve will be opened, the sample start time and initial vacuum will be recorded, and the sub-slab soil vapor sample will be collected.

- The SUMMA® canister vacuum and sample time duration (approximately 30 minutes) will be monitored during sampling and the SUMMA® canister valve will be closed when the vacuum is between 5 and 10 inches of mercury (Hg).

- The sample end time and final vacuum will be recorded. Weather-related data such as barometric pressure and wind speed will also be recorded.

- Sub-slab soil vapor samples will be collected for the appropriate laboratory analysis (see QAPP and Table 1 of the SC Work Plan).

- Sample collection, labeling, and handling procedures are described in Section 7 of this FSP.

- The borehole will be backfilled with clean sand to the bottom of the floor slab and the concrete floor slab will be restored with hydraulic cement.

- The rods will be decontaminated in accordance with Section 8 of this FSP.

5.7 Indoor and Ambient Air Quality Sample Collection

This section describes the methods to collect indoor and ambient air quality samples. Indoor and ambient air quality samples will be collected using 6-liter SUMMA® canisters and 8-hour flow controllers.

Indoor air quality sample collection rationale for the indoor air portion of the SC is described in Section 3.4.1 of the SC Work Plan. Indoor and ambient air quality samples will be analyzed for the analytes specified in the QAPP (Appendix B) and Table 1 of the SC Work Plan. Additional details on indoor and ambient air quality sample collection are described below.

5.7.1 Indoor and Ambient Air Quality Sampling

The general sequence of indoor and ambient air quality sample collection and record keeping is as follows:

- A laboratory pre-calibrated 8-hour flow controller (i.e., calibrated to collect the indoor air quality sample at a rate of approximately 11.5 mL/min) with an in-line particulate filter will be attached to the SUMMA® canister. A duplicate indoor

air quality sample will be collected at one of the locations using a stainless steel "T" fitting and a second SUMMA® canister.

- Place the SUMMA® canister at the sampling location. The SUMMA® canister will be situated on a stable platform (e.g., box or crate) so that the sampling zone is approximately 3 feet above the floor for indoor air quality samples (i.e., representative of the breathing zone) or 3 feet above the ground surface for ambient air quality samples.

- The SUMMA® canister valve will be opened, the sample start time and initial vacuum will be recorded, and the indoor and ambient air quality samples will be collected.

- The SUMMA® canister vacuum and sample time duration (8 hours) will be monitored during sampling and the SUMMA® canister valve will be closed when the vacuum is between 5 and 10 inches of Hg. The initial, intermediate (i.e., at 4 hours), and final vacuum of the SUMMA® canister will be recorded.

- The sample end time and final vacuum will be recorded. Weather-related data such as barometric pressure and relative humidity will also be recorded.

- Indoor and ambient air quality samples will be collected for the appropriate laboratory analysis (see QAPP and Table 1 of the SC Work Plan).

- Sample collection, labeling, and handling procedures are described in Section 7 of this FSP.

5.8 Temporary Soil Vapor Points

If warranted, based on the soil, groundwater, and sub-slab soil vapor quality data, exterior temporary soil vapor points will be advanced. This section describes the methods to collect soil vapor samples from temporary soil vapor points. Soil vapor samples will be collected using 6-liter SUMMA® canisters and 0.5-hour flow controllers. The temporary soil vapor point boreholes will be drilled using direct push drilling methodology. Soil vapor samples will be collected from the temporary soil vapor points using the Geoprobe® PRT System. A tracer gas (i.e., helium) test will be conducted at all of the temporary soil vapor point locations to check the seal established around the sampling point.

The temporary soil vapor point samples are intended to serve as screening-level samples that will be collected from a temporary point; therefore, temporal repeat sampling of temporary soil vapor point sample intervals will not be performed.

Additional details on temporary soil vapor point sample collection are described below.

5.8.1 Temporary Soil Vapor Point Drilling and Soil Vapor Sampling

Soil vapor samples will be collected from temporary soil vapor points using the Geoprobe® PRT System. The general sequence of temporary soil vapor point advancement (by Driller), soil vapor sample collection (by field Geologist), and record keeping is as follows:

- A temporary soil vapor sampling point consisting of 1.25-inch diameter steel drive rods will be advanced to a depth of approximately 5 feet below land surface (ft bls).

- An expendable PRT System point holder and expendable PRT System point will be affixed at the downhole end of the rods. Once the desired sample depth is reached, the sampling assembly will be retracted approximately 6 inches, allowing the expendable point to disengage from the rods, and creating a void in the subsurface for soil vapor sample collection.

- A bentonite seal will be placed around the outside of the rods at the ground surface.

- Teflon®-lined tubing (¼-inch I.D.) and a PRT adapter will then be inserted down the center of the rods. A bentonite seal will be placed around the outside of the tubing and the inside of the rods. The system is airtight and the potential for rod leakage is significantly reduced using O-ring connections and the bentonite seals. New Teflon®-lined tubing will be used at each sample location.

- A portable vacuum pump and rotameter will be used to purge at least 1.5 volumes of air from the temporary soil vapor point and tubing at a rate of approximately 100 to 200 mL/min. Tracer gas (i.e., helium) testing will be conducted during purging to check the seal established around the temporary soil vapor point. Organic vapor levels will be measured with a PID and the purged air will be monitored for the presence of helium using the helium

detector. It is anticipated that helium will not be detected in the purged air. However, if helium is detected at a concentration less than 10 percent then soil vapor sampling will proceed. If helium is detected at a concentration greater than 10 percent then the seal will need to be repaired or replaced.

- A laboratory pre-calibrated 0.5-hour flow controller (i.e., calibrated to collect the soil vapor sample at a rate of approximately 167 mL/min) with an in-line particulate filter and vacuum gauge will be attached to the SUMMA® canister.

- Following purging and tracer gas testing, the ¼-inch I.D. Teflon®-lined tubing will be connected to the ¼-inch O.D. Teflon® tubing using a reducing coupling and the ¼-inch O.D. Teflon® tubing will be connected to the flow controller and the SUMMA® canister. A duplicate soil vapor sample will be collected at one of the locations using a stainless steel "T" fitting and a second SUMMA® canister.

- The SUMMA® canister valve will be opened, the sample start time and initial vacuum will be recorded, and the soil vapor sample will be collected.

- The SUMMA® canister vacuum and sample time duration (approximately 30 minutes) will be monitored during sampling and the SUMMA® canister valve will be closed when the vacuum is between 5 and 10 inches of Hg.

- The sample end time and final vacuum will be recorded. Weather-related data such as barometric pressure and wind speed will also be recorded.

- Soil vapor samples will be collected for the appropriate laboratory analysis.

- Sample collection, labeling, and handling procedures are described in Section 7 of this FSP.

- The borehole will be backfilled with clean sand and any paved surfaces will be restored with either cold patch asphalt or ready mix concrete.

- The rods will be decontaminated in accordance with Section 8 of this FSP.

6. Investigation-Derived Waste Sampling

In general, IDW will be containerized in DOT-approved 55-gallon steel drums. Solid and liquid samples will be collected to support IDW characterization for disposal purposes. Solid IDW samples will be collected from the 55-gallon drums by opening the drums, collecting a number of grab samples using a stainless steel spoon/trowel, compositing the grab samples in a stainless steel bowl (except samples collected for VOC analysis), and transferring the sample into the sample containers. The VOC sample will be immediately transferred directly into the laboratory-supplied sample bottles. Liquid/water IDW samples will be collected from the 55-gallon drums by opening the drum, collecting a grab sample using a bailer, and decanting the sample directly into the sample containers. Samples will be analyzed by the laboratory for the parameters specified by the receiving/disposal facility.

7. Sample Collection, Labeling, Handling, and Analysis

This section describes sample collection, labeling, handling, and analysis.

7.1 Soil Samples

Soil sampling to be conducted as part of the SC includes the collection of soil samples from soil borings (see SC Work Plan for details). Soil samples will be collected from the appropriate two-foot interval using a decontaminated stainless steel spoon or trowel. The VOC sample will be immediately transferred directly into the laboratory-supplied sample bottles. A sufficient amount of the remaining soil will be homogenized by mixing the sample in a decontaminated stainless steel bowl with a decontaminated stainless steel spoon or trowel. Laboratory-supplied sample containers for other analytes (i.e., SVOCs, pesticides, polychlorinated biphenyls [PCBs], metals, and free cyanide) will then be filled. All sample bottle caps will be secured snugly, but not over-tightened.

The soil cores will be screened for organic vapors using the jar headspace method and a PID. In addition, a geologist will be onsite during the drilling operations to describe each sample in accordance with the document entitled "Field Descriptions of Samples for Former Manufactured Gas Plant (MGP) Sites" (NGRID) (Attachment A-1 of this FSP), and will include:

- Depth

- Sample recovery
- Soil type and sorting
- Color (natural color, discoloring due to impacts should be described as staining)
- Moisture content (dry, moist, wet)
- Texture
- Grain size and shape
- Relative density
- Consistency (degree of plasticity for fine-grained soils; viscosity for NAPL such as taffy-like, etc.)
- Representativeness
- Visible evidence of residues (petroleum-like sheen, tar-like material, oil-like material, ash-like material, etc.; also describe distribution and percentage of area impacted)
- Miscellaneous observation (obvious odors – e.g., faint odor, moderate odor, strong odor, etc.)

Samples (including QA/QC samples specified in the QAPP) will be properly labeled and identified, and the Sample/Core Log and the Chain-of-Custody Form will be completed. The QAPP provides additional details regarding Field Records and QA/QC samples, frequency and protocols, and sample custody. Sample containers will be checked for proper identification/labeling and compared to the Chain-of-Custody Form for accuracy prior to packaging the sample for shipment. The Chain-of-Custody Form will be placed in a sealed plastic bag and taped to the underside of the cooler lid. The sample containers will be wrapped with a cushioning material to preclude sample container breakage during shipment and placed in a cooler. Sufficient amounts of bagged ice will be placed in the cooler to keep the soil samples at 4 degrees Celsius until arrival at the laboratory. The cooler will be sealed with packaging tape and

custody seals will be placed in such a manner that any opening of the cooler prior to arrival at the laboratory can be visually detected.

Samples will be delivered by overnight carrier or laboratory courier to the analytical laboratory following sample custody requirements specified in the QAPP. The laboratory will be prepared to receive the samples and perform preliminary extractions or analyses within the analytical method recommended holding times.

Soil samples will be analyzed by TestAmerica Laboratories, Inc., located in Shelton, Connecticut (see Attachment B-4 of QAPP). Analytes are specified in the QAPP (Appendix B of the SC Work Plan).

7.2 Groundwater Samples

Groundwater samples will be collected directly into the laboratory-supplied sample bottles. The flow of water from the sampling equipment will be adjusted to ensure slow, laminar flow so that no entrained air bubbles are present in VOC samples. Special care will be taken in filling and capping volatile organic analysis (VOA) vials so that headspace/air bubbles are not present in the groundwater samples. In addition, overflowing bottles will be avoided to prevent the loss of floating substances or preservatives that may have already been added to the bottle. All sample bottle caps will be secured snugly, but not over-tightened.

The groundwater samples will be described in accordance with the document entitled "Field Descriptions of Samples for Former Manufactured Gas Plant (MGP) Sites" (NGRID) (Attachment A-1 of this FSP), and will include any visual observations of impacts, odors, or coating of sampling equipment. This information will be recorded on the Water Sampling Log or Low-Flow Groundwater Sampling Log.

Samples (including QA/QC samples specified in the QAPP) will be properly labeled and identified, and the Low-Flow Groundwater Sampling Log and Chain-of-Custody Form will be completed. The QAPP provides additional details regarding Field Records and QA/QC samples, frequency and protocols, sample labeling, and sample custody. Sample containers will be checked for proper identification/labeling and compared to the Chain-of-Custody Form for accuracy prior to packaging any sample for shipment. The Chain-of-Custody Form will be placed in a sealed plastic bag and taped to the underside of the cooler lid. The samples will then be wrapped with a cushioning material to preclude sample container breakage during shipment and placed in a cooler. Sufficient amounts of bagged ice will be placed in the cooler to

keep the groundwater samples at 4 degrees Celsius until arrival at the laboratory. The cooler will be sealed with packaging tape and custody seals will be placed in such a manner that any opening of the cooler prior to arrival at the laboratory can be visually detected.

Samples will be delivered by overnight carrier or laboratory courier to the analytical laboratory following sample custody requirements specified in the QAPP. The laboratory will be prepared to receive the samples and perform preliminary extractions or analyses within the analytical method recommended holding times.

Groundwater samples will be analyzed by TestAmerica Laboratories, Inc., located in Shelton, Connecticut (see Attachment B-4 of QAPP). Analytes are specified in the QAPP (Appendix B of the SC Work Plan).

7.3 Sub-Slab Soil Vapor, Indoor and Ambient Air Quality, and Soil Vapor Samples

Sub-slab soil vapor samples, indoor and ambient air quality samples, and soil vapor samples (if warranted) will be collected directly into the laboratory-supplied SUMMA® canisters. Sample time duration will be monitored during sampling and the SUMMA® canister valve will be closed when the vacuum is between 5 and 10 inches of Hg.

Samples (including QA/QC samples specified in the QAPP) will be properly labeled and identified, and the Sub-Slab Soil Vapor Sampling Log, Indoor Air Sampling Log, Ambient Air Sampling Log, or Soil Vapor Sampling Log and Chain-of-Custody Form will be completed. The QAPP provides additional details regarding Field Records and QA/QC samples, frequency and protocols, sample labeling, and sample custody. SUMMA® canisters will be checked for proper identification/labeling and compared to the Chain-of-Custody Form for accuracy prior to packaging any sample for shipment. The Chain-of-Custody Form will be placed in a sealed plastic bag and placed in the canister shipping box. The canister shipping box will be sealed with packaging tape and custody seals will be placed in such a manner that any opening of the box prior to arrival at the laboratory can be visually detected.

Samples will be delivered by overnight carrier to the analytical laboratory following sample custody requirements specified in the QAPP. The laboratory will be prepared to receive the samples and perform analyses within the analytical method recommended holding times.

Sub-slab soil vapor, indoor and ambient air quality, and soil vapor samples (if warranted) will be analyzed by Air Toxics Ltd., located in Folsom, California (see Attachment B-5 of QAPP). Analytes are specified in the QAPP (Appendix B) and Table 1 of the SC Work Plan.

8. Field Decontamination Procedures

Decontamination procedures for non-dedicated field equipment are presented in detail in this section and include decontamination procedures associated with non-dedicated sampling equipment and downhole drilling tools and equipment. In general, after decontamination is completed, items will be stored in a manner to preserve their decontaminated condition prior to use.

8.1 Drilling Equipment Decontamination

A decontamination pad will be constructed, lined with plastic sheeting, and will contain a sump for water collection. The sump will be lined with plastic and be of sufficient volume to accommodate the decontamination water generation needs. Drilling equipment including the rear-end of the drilling rig (if necessary), augers, bits, drill rods, tools, and tremie pipe will be cleaned on the decontamination pad with a high-pressure hot water "steam cleaner" unit and scrubbed with a wire brush, as needed, to remove foreign material (e.g., soil, tar, and oil). The equipment will be decontaminated prior to the start of drilling activities, between each borehole, and prior to leaving the Site. If heavy accumulations of tars or oils are present on the downhole tools, a citrus-based cleaner (e.g., Citra-Solv®) may be used to aid in equipment cleaning. Tools, drill rods, and augers will be placed on sawhorses, decontaminated pallets, or polyethylene plastic sheets following steam cleaning. Direct contact with the ground will be avoided. Decontamination water will be containerized in DOT-approved 55-gallon open-top steel drums or a dedicated polyethylene tank. Open-top drums will remain closed when not in use.

Following decontamination of Site equipment, the decontamination pad will be decommissioned. The decommissioning will be completed by:

- Transferring the bulk of the remaining liquids and solids into the drums or tanks to be provided by the drilling subcontractor or NGRID for these materials.

- Rolling the sheeting used in the decontamination pad onto itself to prevent discharge of the remaining materials to the ground surface. Once rolled up, the polyethylene sheeting will be placed in the drums used for disposal of PPE and disposable equipment.

8.2 Sampling Equipment Decontamination

Soil sampling, groundwater sampling, and soil vapor sampling equipment requiring decontamination includes, but is not limited to, split-spoon samplers, HydroPunch® samplers, stainless steel spoons/trowels/bowls, interface meters, non-dedicated pumps/appurtenances, and Geoprobe® Probe Rods. The sampling equipment will be washed with potable water and a detergent (Micro-90® low-phosphate detergent or Alconox) to remove all foreign material. Decontamination may be conducted at the sampling location as long as liquids are contained in pails or buckets. The sampling equipment will then be rinsed with potable water and a final distilled water rinse. The equipment will be decontaminated before and between each use and prior to demobilization. At no time will washed equipment be placed directly on the ground. Decontaminated equipment will either be used immediately or wrapped in plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location.

Water quality probes and water-level indicators will be decontaminated by rinsing with distilled water. Decontamination fluids will be containerized prior to off-site transportation and disposal as described in Section 9 of this FSP.

Disposable tubing from monitoring well groundwater sampling and soil vapor sampling will be discarded as general trash after each use.

9. Waste Management and Disposal

Solid and liquid IDW generated during sampling activities including, but not limited to, drill cuttings, monitoring well purge water, and decontamination water will be disposed as outlined in this section. Sampling procedures involving the collection of water samples obtained as direct grab samples will be performed in such a manner so as to not generate waste, other than disposable sampling equipment and PPE.

Solid and liquid IDW will be containerized in DOT-approved 55-gallon steel drums, characterized in accordance with the requirements of the receiving/disposal facility, and transported off-site for disposal. IDW generated on-site will be staged at a

designated area on a daily basis until such time as the waste is transported off-site for disposal.

10. References

Puls, Robert W. and Barcelona, Michael J. 1996. Ground Water Issue Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, U.S. Environmental Protection Agency, Office of Research and Development, Office of Solid Waste and Emergency Response, EPA/540/S-95/504. April 1996.

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Attachment A-1

National Grid – Field Descriptions of Samples for Former Manufactured Gas Plant (MGP) Sites

Field Descriptions of Samples for Former Manufactured Gas Plant (MGP) Sites

SOIL SAMPLE DESCRIPTIONS

It is important that descriptive qualifiers are consistently used to characterize degree and nature of contaminant impacts and visual-manual soil classification. The following presents some examples of descriptive qualifiers.

SOIL LOGGING

- All soils are to be logged using the **Unified Soil Classification** (ASTM D 2488 field descriptions)
- **PID or FID** used to screen all soil samples (Jar Headspace method) – maximum readings should be recorded and included on the logs. PID/FID to be calibrated daily at a minimum
- **Moisture terms** are: Dry, Moist, and Wet
- **Color terms** - use geotechnical color charts - colors may be combined: e.g. red-brown. Color terms should be used to describe the "natural color" of the sample as opposed to staining caused by contamination (see below)
- **Log of each sample interval** should be prepared as follows:

  [Coarse Grained Example] NARROWLY GRADED SAND (SP); mostly fine sand; <5% fines; red-brown, moist, environmental/depositional/geologic descriptions.

  [Fine Grained Example] SANDY SILT (ML); heterogeneous till structure, nonplastic, ~30% fine to coarse, subangular sand; ~10% subangular fine gravel, max. size ~ 10 mm; brown; environmental/depositional/geologic descriptions.

- **Representativeness** – Soil logs should include particular notes if the field representative believes that there is a possibility the soil sample being described is not representative of the interval sampled.
- **Intervals for Description** – if using a 2' (split spoon) or 4' (Macro-core) long sampler – the field description should not necessarily be for the entire sample interval. It is important to look for, identify, and describe small-scale units and changes within each sample interval.

DESCRIPTION OF CONTAMINANTS

Visible Contamination Descriptors

- **Sheen** - iridescent petroleum-like sheen. Not to be used to describe a "bacterial sheen", which can be distinguished by its tendency to break up on the water surface at angles whereas petroleum sheen will be continuous and will not break up. A field test for sheen is to put a soil sample in a jar of water and shake the sample (jar shake test), then observe the presence/absence of sheen on the surface of the water in the jar.

- **Stained** - used w/ color (i.e. black or brown stained) to indicate that the soil matrix is stained a color other than the natural (unimpacted) color of the soil.

- **Coated** - soil grains are coated with tar/free product – there is not sufficient free-phase material present to saturate the pore spaces.

- **Blebs** - observed discrete sphericals of tar/free product - but for the most part the soil matrix was not visibly contaminated or saturated. Typically this is residual product.

- **Saturated** - the entirety of the pore space for a sample is saturated with the tar/free product. Care should be taken to ensure that you're not observing water saturating the pore spaces if you use this term. Depending on viscosity, tar/free-phase saturated materials may freely drain from a soil sample.

- **Oil**. Used to characterize free and/or residual product that exhibits a distinct fuel oil or diesel fuel like odor; distinctly different from MGP-related odors/impacts.

- **Tar**. Used to describe free and/or residual product that exhibits a distinct "coal tar" type odor (e.g. naphthalene-like odor). Colors of product can be brown, black, reddish-brown, or gold.

- **Solid Tar**. Used to describe product that is solid or semi-solid phase. The magnitude of the observed solid tar should be described (e.g. discrete granules or a solid layer).

- **Purifier Material**. Purifier material is commonly brown/rust or blue/green wood chips or granular material. It is typically associated with a distinctive sulfur-like odor. Other colors may be present.

Olfactory Descriptors

- Use terms such as " tar-like odor" or "naphthalene-like odor" or "fuel oil-like odor" that provide a qualitative description (opinion) as to the possible source of the odor.
- Use modifiers such as strong, moderate, faint to indicate intensity of the observed odor.

DNAPL/LNAPL

- A jar shake test should be performed to identify and determine whether observed tar/free-phase product is either denser or lighter than water. In addition, MGP residues can include both light and dense phases - this test can help determine if both light and dense phase materials are present at a particular location.

Viscosity of Free-Phase Product – If free-phase product/tar is present a qualitative description of viscosity should be made. Descriptors such as:

- Highly viscous (e.g. taffy-like)
- Viscous (e.g. No. 6 fuel oil or bunker crude like)
- Low viscosity (e.g. No. 2 fuel oil like)

GROUNDWATER SAMPLING OBSERVATIONS

- Any observations of sheen, blebs, free-phase product/tar, staining or coating of the sampling equipment, odor, etc. that are made during sampling of groundwater are to be included in the groundwater sample collection log.

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Appendix B

Quality Assurance Project Plan

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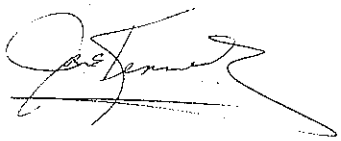
Appendix B
Quality Assurance Project Plan

Former Dangman Park Manufactured Gas Plant
Site
Brooklyn, New York
Site No. 224047
Index # A2-0552-0606

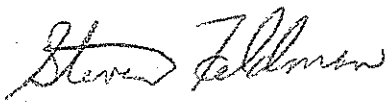
April 7, 2009

ARCADIS

Christopher D. Keen
Task Manager/Senior Scientist



Jane Kennedy
Principal Scientist



Steven M. Feldman
Project Manager/Principal Scientist

Appendix B
Quality Assurance Project Plan

Former Dangman Park
Manufactured Gas Plant Site
Brooklyn, New York
Site No. 224047
Index # A2-0552-0606

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Tables

Attachments

1. Introduction

On behalf of National Grid USA (NGRID, formerly KeySpan Corporation [KeySpan]), ARCADIS has prepared this Quality Assurance Project Plan (QAPP) as a component of the Site Characterization (SC) Work Plan for the former Dangman Park Manufactured Gas Plant (MGP) site (Site) located at 486 Neptune Avenue, Brooklyn, New York. The QAPP presents the quality assurance/quality control (QA/QC) procedures to be used during implementation of the SC Work Plan.

The overall QAPP objective is to ensure that data produced as a result of the various sampling and monitoring, including soil, groundwater, soil vapor, indoor air, and ambient (outdoor) air is of the highest quality and usable for the intended purpose. For the purposes of this QAPP, soil vapor, indoor air, and ambient air samples will be collectively referred to as air samples. This QAPP has been prepared in accordance with the United States Environmental Protection Agency (USEPA) guidance entitled Guidance for Quality Assurance Project Plans EPA QA/G-5 (USEPA, 2002), the New York State Department of Environmental Conservation (NYSDEC) Draft DER-10 Technical Guidance for Site Investigation and Remediation (NYSDEC, 2002), and considering requirements of the Multi-Site Order on Consent (ACO) and Administrative Settlement (Index # A2-0552-0606). This QAPP presents project organization and responsibilities, and QA/QC protocols related to field sampling and analysis activities associated with various sampling and monitoring requirements. The procedures in this QAPP will be implemented to ensure that precision, accuracy, representativeness, completeness, and comparability (PARCC parameters) of the data are documented, as applicable, and that data meet project requirements.

The QAPP should be used in conjunction with the SC Work Plan, the Field Sampling Plan (FSP), the Health and Safety Plan (HASP), and the Community Air Monitoring Plan (CAMP). The SC Work Plan presents the Site background and defines the field sampling program. The FSP describes the methods and procedures to be used for environmental sample collection during implementation of the investigation field activities. The FSP, CAMP, and HASP are provided in Appendices A, C, and D, respectively.

2. Site Description

The Site is located at 486 Neptune Avenue in the Borough of Brooklyn, New York City, Kings County, New York and is identified by Tax Map Number: Block 7273, Lots 1 and 25. As shown on Figure 1 of the SC Work Plan, the Site is located approximately 1,300 feet southeast of Coney Island Creek and approximately 2,400 feet north of New

York Bay. The Site is generally flat with an elevation of approximately 6 feet above mean sea level (amsl). The closest natural surface water body is Coney Island Creek, which is located approximately 0.25 miles to the northwest of the Site.

The Site is located in the Coney Island community district of Brooklyn on approximately 4 acres of land, and is bounded by Neptune Avenue to the north, W. 5th Street to the east, a residential parcel to the south, and a commercial parcel to the west. Currently, the Site is developed with a strip mall and a parking lot for a high-rise apartment building.

3. Site Characterization Activities

The primary objectives of the proposed SC activities are listed in Section 1.1 of the SC Work Plan. Sample collection efforts include obtaining discrete soil samples from soil borings, groundwater samples from soil borings and monitoring wells, air samples (soil vapor samples from sub-slab soil vapor points, indoor and ambient air quality samples, soil vapor samples from exterior soil vapor points [if warranted]), and investigation-derived waste (IDW) solid and liquid media samples for waste characterization purposes.

Samples collected during the investigation will be analyzed in accordance with USEPA SW-846 Test Methods for Evaluating Solid Waste, with USEPA Compendium Method TO-15, with New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP) Revision 2005 (or most recent version), or ASTM International Standard Test Methods.

4. Project Organization and Responsibilities

A Project Organizational Chart is provided as Attachment B-1. The responsibilities of the key project personnel are detailed below.

- The Project Manager is responsible for the following: overseeing the implementation of the project tasks, overall project coordination, adherence to the project schedules, directing, reviewing, and assessing the adequacy of the performance of the Task Managers assigned to the project, implementing corrective action (if warranted), reviewing reports, and maintaining full and orderly project documentation. The Project Manager will review all documents and other correspondence concerning the activities performed pursuant to the project (i.e., all activities associated with the Site). The Project Manager is also

responsible for the overall QA including technical adequacy of the project activities and reports and conformance to the scope of work.

- The Task Manager(s) is responsible for the following: field activity QA/QC, task coordination, adherence to the project schedules, directing, reviewing, and assessing the adequacy of the performance of the technical staff and subcontractors assigned to the project (if warranted), interacting with the Project Manager, preparing reports, and maintaining full and orderly project documentation.

- The project team members include the task managers, field hydrogeologists, sampling team/field technicians, engineers, risk assessors, and support staff (e.g., data processors, project assistants, and in-house experts in engineering, etc.) who are qualified to oversee/perform the work, as appropriate, and will be responsible for work in their respective specialty areas. Project team members will be on-site to supervise all activities specified in the SC Work Plan.

- The Project QA Officer is responsible for performing systems auditing, interfacing with the analytical laboratory to make requests and resolve problems, interfacing with the data validator, and developing a project-specific data usability summary report (DUSR).

- The Site Health and Safety Officer is responsible for implementing the site-specific health and safety directives in the Health and Safety Plan (HASP – see SC Work Plan Appendix D) and for contingency response.

- The Data Validator is responsible for review of laboratory data for compliance with the QA objectives for analytical performance and the PARCC parameters (i.e., precision, accuracy, representativeness, completeness, and comparability) as set forth in this QAPP, and notifications to the Project Manager of any QC deficiencies that impact data usability.

5. Quality Objectives and Criteria for Measurement Data

The overall QA objective for this aspect of the project is to select and implement procedures for field measurements, sampling, and analytical testing that will provide data of known quality to support the intended use of the information.

The data quality objective (DQO) process, as described in the USEPA guidance entitled Guidance for the Data Quality Objectives Process EPA QA/G-4 (USEPA, 2006), is intended to provide a "logical framework" for planning field investigations. The following section addresses, in turn, each of the seven sequential steps in the EPA QA/G-4 QAPP DQO process.

Step 1: Problem Statement

The SC will be conducted at the Site to evaluate if MGP-related and/or non-MGP-related constituents of concern (COCs) are present at the Site. The sampling and analysis program is intended to generate data to initiate a Site database that may potentially support further investigations.

Step 2: Decision Identification

The initial use of the data is descriptive (distribution and concentration) and there is no decision point for this descriptive application. Subsequent to review of the descriptive information, an evaluation will be performed based on the findings of the Site investigation. The decision in this case is to determine if MGP-related and/or non-MGP-related COCs are present at the Site and to evaluate potential exposure pathways and concentrations if constituents are discovered.

Step 3: Identifying Decision Inputs

Decision inputs incorporate both concentration and distribution. A fundamental basis for decision-making is that a sufficient number of data points of acceptable quality are available from the investigation to support the decision. Thus, the necessary inputs for the decision are: 1) the proportion of non-rejected (usable) data points; and 2) the quantity of data needed to thoroughly evaluate whether COCs are present at the Site.

The data will be evaluated for completeness, general conformance with requirements of this QAPP, and consistency among data sets as appropriate.

Step 4: Defining the Study Boundaries

The Site is predominantly covered by a building (i.e., strip mall). The limits of the Site were approximated from a review of historical Sanborn fire insurance maps and recent aerial photographs. The study boundaries will include subsurface soils, groundwater, and air within this area.

Step 5: Developing a Decision Rule

The decision on whether data can be used in the Site evaluation will be based on the validation results. Following validation, the data will be flagged, as appropriate, and any use restrictions noted. The sampling plan has been devised so that the loss of any single data point will not hinder description of the distribution of COCs (if discovered) or the evaluation of further investigation activity. Given this, a reasonable decision rule would be that 90% of the data points not be rejected and deemed unusable for evaluation purposes. Applicable actions would be evaluated, if needed, based on the results of the SC.

Step 6: Limits on Decision Errors

Specifications for this step call for: 1) giving forethought to corrective actions to improve data usability; and 2) understanding the representative nature of the sampling design. This QAPP has been designed to meet both specifications for this step. The sampling and analysis program has been developed based on a review of historical information and knowledge of present Site conditions. The representative nature of the sampling design has been developed by discussions among professionals familiar with the Site.

Step 7: Design Optimization

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody (COC), laboratory analysis, and reporting that will provide results to support the evaluation of the Site data generally consistent with National Contingency Plan (NCP) requirements. Specific procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, data reporting, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

The sampling plan involves a phased approach to both sampling and analysis. This provides the opportunity to evaluate and focus each data collection step to optimize the overall data collection process.

Generally, the specific field sampling and analysis activities to be conducted during this project which require associated QA/QC include SC soil, groundwater, and air sampling (i.e., soil sampling, soil boring groundwater sampling, monitoring well groundwater sampling, temporary sub-slab soil vapor point sampling, indoor air quality sampling, ambient air quality sampling, and liquid and solid waste characterization

sampling). QA/QC protocols will be implemented to ensure the PARCC parameters of the data collected during these field activities meets the objectives of the overall project. Specifically, data will be gathered or developed using procedures appropriate for the intended use of the data. The field measurements and laboratory analyses will be used to support one or more steps in the sampling described above. The PARCC parameters are further defined in Section 12.1.

The QA/QC will include laboratory method performance, field decontamination procedures, calibration and maintenance of field instruments, and QC sample collection and analysis.

A DQO summary for the sampling investigation efforts is presented in the subsequent section. The summary consists of stated DQOs relative to data uses, data types, data quantity, sampling and analytical methods, and data measurement performance criteria.

5.1 Data Categories

Three data categories have been defined to address various analytical data uses and the associated QA/QC effort and methods required to achieve the desired levels of quality. These categories are:

Screening Data: Screening data affords a quick assessment of Site characteristics or conditions. This DQO is applicable to data collection activities that involve rapid, non-rigorous methods of analysis and quality assurance. This objective is generally applied to physical and/or chemical properties of samples, degree of contamination relative to concentration differences, and preliminary health and safety assessment.

Screening Data with Definitive Confirmation: Screening data allows rapid identification and quantitation, although the quantitation can be relatively imprecise. This DQO is available for data collection activities that require qualitative and/or quantitative verification of a select portion of sample findings (10% or more). This objective can also be used to verify less rigorous laboratory-based methods.

Definitive Data: Definitive data are generated using analytical methods such as approved USEPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files.

It is anticipated that both screening and definitive data categories will be generated during the investigation. Field parameters (e.g., turbidity, conductivity, temperature, and pH), which will be obtained during groundwater sampling for use in qualitatively interpreting other Site data, will be determined using screening techniques. Remaining parameters will be determined using definitive techniques.

For this project, only the full analytical data packages with supporting method performance data will be required from the analytical laboratory. The Level 3 data package is defined as follows:

Level 3 – Full Reporting: Full "CLP-type" reporting is used for those analyses that, based on intended data use, require full documentation. The Level 3 report includes analytical data as well as instrument calibration, tuning, and other raw data associated with method performance. This reporting level meets the NYSDEC ASP Superfund and Category B reporting requirements.

The analytical methods to be used during the SC will be USEPA SW-846 methods and USEPA Compendium Method TO-15 with incorporation of the NYSDEC ASP Revision 2005QA/QC requirements, and Category B reporting deliverables. For air analytical samples associated with the SC, the laboratory (Air Toxics Ltd.) will produce a Level IV electronic Comprehensive Validation Package (eCVP); the eCVP will contain all information needed for formal validation of the data. In addition, following preparation by Method 9013A, the following ASTM International Standard Test Method will be used for the free cyanide analysis: ASTM D4282-02 Standard Test Method for Determination of Free Cyanide in Water and Wastewater by Microdiffusion.

5.2 Field Investigations

As part of the SC, field investigations will be conducted to support the DQOs. Details of the field sampling investigations are described in the SC Work Plan (Section 3).

6. Special Training Requirements/Certification

In compliance with the Occupational Safety and Health Administration's (OSHA) final rule, "Hazardous Waste Operations and Emergency Response," 29 CFR 1910.120(e), personnel performing SC activities at the Site will have completed the requirements for OSHA 40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training. Persons in field supervisory positions will have also completed the additional OSHA 8-Hour Supervisory Training.

The analytical laboratory will be accredited under the New York Environmental Laboratory Approval Program (ELAP) for all methods and parameters required, and as certification is afforded under this program.

7. Documentation and Records

Samples of the various media will be collected as described in the SC Work Plan. Detailed descriptions of the documentation and reporting requirements are presented below.

7.1 Sample Designation System

7.1.1 Sample Codes

Samples will be identified with a unique designation system that will facilitate sample tracking. The sample designation system to be employed during the sampling activities will be consistent, yet flexible enough to accommodate unforeseen sampling events and conditions. An alpha-numeric system is considered appropriate and will be used by field personnel to assign each sample with a unique sample identification number. The sample identification number will consist of a two-letter prefix indicating the sample type followed by numbers indicating the sample location.

The samples types will be designated using the following codes:

- Soil Boring – "SB"
- Monitoring Well – "MW"
- Sub-Slab Soil Vapor Point – "SSSV"
- Indoor Air Sample – "IA"
- Ambient Air Sample – "AA"
- Soil Vapor Point – "SV"
- Trip Blank – "TB"
- Equipment Blank – "EB"

Where necessary, the code system will be supplemented to accommodate additional sample identification information. For example, the code for soil samples or soil boring groundwater samples will include a qualifier to identify the section increment (e.g., 0 to 0.5 feet).

Additional sample volumes collected for matrix spike (MS) and matrix spike duplicate (MSD) analysis will be noted on the COC forms. Trip blanks and equipment blanks will use the coding scheme noted above and a six-digit date format (e.g., an equipment blank collected on January 15, 2009 would be named EB011509). Field duplicates will be labeled as "DUP" and a six-digit date format (e.g., a field duplicate collected on January 15, 2009 would be named DUP011509). Duplicate samples will not be identified to the laboratory and the laboratory will analyze them as "blind" quality control samples. The source of the field duplicate will be noted in the field notes.

7.1.2 Field Documentation

Field personnel will complete comprehensive documentation covering aspects of field sampling, field analysis, and sample COC. This documentation constitutes a record that allows reconstruction of field events to aid in the data review and interpretation process. Documents, records, and information relating to the performance of the field work will be retained in the project file.

The various forms of documentation to be maintained throughout the action include:

- Daily Production Documentation – A field notebook consisting of a waterproof, bound notebook that will contain a record of activities performed at the Site.

- Sampling Information – Detailed notes will be made as to the exact sampling location, physical observations, and weather conditions (as appropriate). Forms will be utilized for repetitive data collection, such as depth to water in wells, groundwater sampling, etc. These field forms include a Soil Sample/Core Log, Low-Flow Groundwater Sampling Form, Water-Level Measurement Form, Ambient Air (Canister) Sample Collection Field Form, Indoor Air (Canister) Sample Collection Field Form, New York State Department of Health Indoor Air Quality Questionnaire and Building Inventory Form, Sub-Slab Vapor Air (Canister) Sample Collection Field Form, and Soil Vapor Air (Canister) Sample Collection Field Form as applicable to a specific field task. Forms are provided in Attachment B-2. **For all air samples, the initial canister vacuum and final canister vacuum must be recorded by**

field personnel. The initial canister vacuum should be greater than 28 inches of mercury (Hg). If the initial canister vacuum is less than 28 inches of Hg, then the canister should be returned to the laboratory and a replacement canister should be provided by the laboratory. Canister vacuums should also be recorded throughout the sampling period. **Any data associated with final canister vacuums below 4 inches of Hg will be rejected in accordance with NYSDEC directives.**

- COCs – COC forms will provide the documentation of record of responsibility for sample collection, transport, and receipt by the laboratory. COC forms will be filled out at each sampling location, at a group of sampling locations, or at the end of each day of sampling by ARCADIS' field personnel designated to be responsible for sample custody. In the event the samples are relinquished by the designated sampling person to other sampling or field personnel, the COC form will be signed and dated by the appropriate personnel to document the sample transfer. The original COC form will accompany the samples to the laboratory, and copies will be forwarded to the project files. Sample COC forms are included in Attachment B-3.

Persons will have custody of samples when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

To document the calibration and maintenance of field instrumentation, calibration and maintenance logs will be maintained for each piece of field equipment that is not factory-calibrated.

7.2 Laboratory Documentation Files

7.2.1 Laboratory Project Files

The laboratory will establish a file for pertinent information and communications associated with this project. The file will include correspondence, faxed information, phone logs, and COC forms. Analytical method performance data shall be retained within the laboratory in accordance with internal information and document control procedures. The laboratory will retain project files, supporting analytical method performance raw data, and data packages for a period of 5 years.

7.2.2 Laboratory Logbooks

Workbooks, bench sheets, instrument logbooks, and instrument printouts will be used to trace the history of samples through the analytical process and document important aspects of the work, including the associated quality controls. As such, logbooks, bench sheets, instrument logs, and instrument printouts will be part of the permanent record of the laboratory.

Each page or entry will be dated and initialed by the analyst at the time of entry. Errors in entry will be crossed out in indelible ink with a single stroke, corrected without the use of white-out or by obliterating or writing directly over the erroneous entry, and initialed and dated by the individual making the correction. Pages of logbooks that are not used will be completed by lining out unused portions.

Information regarding the sample, analytical procedures performed, and the results of the testing will be recorded on laboratory forms or electronic information management systems and software as appropriate for the analytical method. Any analyst notes will be dated and will also identify the analyst, the instrument used, and the instrument conditions.

Laboratory notebooks and electronic programs/calculations will be periodically reviewed by the laboratory group leaders for accuracy, completeness, and compliance to this QAPP. Entries and calculations will be verified by the laboratory group leader. If entries are correct, then the laboratory group leader will initial and date as appropriate to document the review process. Corrective action will be taken for incorrect entries before the laboratory group leader signs.

7.2.3 Computer Tape and Hard Copy Storage

Electronic files and deliverables will be retained by the laboratory for not less than 5 years; hard copy data packages (or electronic copies) will also be retained for not less than 5 years.

7.3 Data Reporting Requirements

Data will be reported both in the field and by the analytical laboratory, as described below.

7.3.1 Field Data Reporting

Information collected in the field through visual observation, manual measurement, and/or field instrumentation will be recorded in field notebooks or data sheets and/or on forms. Such data will be reviewed by the appropriate Task Manager for adherence to the FSP and for consistency. Concerns identified as a result of this review will be discussed with the field personnel, corrected if possible, and, as necessary, incorporated into the data evaluation process.

If applicable, field data forms and calculations will be processed and included in appendices to the appropriate reports (when generated). The original field logs, documents, and data reductions will be kept in the project file at ARCADIS' office.

7.3.2 Laboratory Data Reporting

The laboratory that analyzes the soil and groundwater samples is responsible for preparing Level 3 (NYSDEC ASP Category B compliant) data packages for volatile organic compound (VOC), semi-volatile organic compound (SVOC), pesticides, polychlorinated biphenyls (PCBs), metals, and free cyanide. The laboratory that analyzes the air samples is responsible for preparing a Level IV eCVP; the eCVP will contain all information needed for formal validation of the data. Each analytical report shall include a case narrative.

Analytical reports will include, at a minimum, the following items:

Narrative: Summary of activities that took place during the course of sample analysis, including the following information:

- Laboratory name and address
- Date of sample receipt
- Cross-reference of laboratory identification number to field sample identification
- Deviations from specified protocol
- Corrective actions taken

Included with the narrative will be any sample handling documents, including field and internal COC forms, air bills, and shipping tags.

Analytical Results: Reported according to analysis type and including the following information, as acceptable:

- Sample ID
- Laboratory ID
- Date of collection
- Date of receipt
- Date of extraction
- Date of analysis
- Analytical methods used
- Method and Reporting detection limits
- Initial and continuing calibrations
- Instrument tuning
- Summary of quality control data: laboratory control samples, matrix spikes, laboratory duplicates, surrogate recoveries
- Method, preparation, and continuing calibration blanks
- Quantitation reports
- Chromatograms
- Extraction, preparation, digestion, and run logs
- Raw data, and

- Any other documentation required by the ASP Category B reports or Level IV eCVP reports

Sample results on the report forms will be adjusted for sample volume/weight and any applicable dilutions. Soil samples will be reported on a dry weight basis. Results will not be corrected for associated blank contamination.

7.4 Project File

Project documentation will be placed in project files according to ARCADIS' requirements for document management. Project files typically consist of the following components:

1. Proposals/Agreements
2. Purchase Orders/Change Orders
3. Invoices
4. Project Management
5. Correspondence
6. Notes and Data
7. Regulatory Documents
8. Final Reports/Presentations

8. Sampling Process Design

Information regarding the sampling design and rationale and associated sampling locations can be found in the SC Work Plan.

9. Sampling Method Requirements

Groundwater, soil, and air samples will be collected as described in the SC Work Plan and the FSP. The FSP also contains procedures that will be followed to drill and sample soil borings; install and develop monitoring wells; measure water levels; collect

groundwater samples; drill and sample sub-slab soil vapor points; drill and sample soil vapor points; collect indoor and ambient air quality samples; perform field measurements; and handle, package, and ship collected samples.

10. Sample Handling and Custody Requirements

This section presents sample handling and custody requirements.

10.1 Sample Containers and Preservation

Appropriate sample containers (bottles), canisters (SUMMA® canisters), preservation methods, and laboratory holding times for SC samples are shown in Table B-1.

The analytical laboratory will supply appropriate sample containers and preservatives, as necessary, or canisters. The bottles will be purchased pre-cleaned according to USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9240.05A requirements. The canisters will be cleaned and batch certified by the laboratory following the requirements of Method TO-15.

For all air samples, the initial canister vacuum and final canister vacuum must be recorded by field personnel. Canister vacuums should also be recorded throughout the sampling period. Following are special considerations for all air samples.

- The initial canister vacuum should be greater than 28 inches of Hg. If the initial canister vacuum is less than 28 inches of Hg, then the canister should be returned to the laboratory and a replacement canister should be provided by the laboratory.
- The final canister vacuums should be above 5 inches of Hg.
- Once the canister is opened, check the vacuum flow rate at least once approximately one or two hours after initiating sampling to make sure the vacuum is changing consistent with the allocated sampling period. If the sampling period is 30 minutes or less, monitor the canister during the entire sampling period.
- If an unexpected canister vacuum is observed, the gauge will be lightly tapped by hand to make sure it isn't stuck.

- Return to the sampling location approximately two hours prior to the end of the sample period.
    - If the canister has more than 5 inches of Hg, continue to the end of the established sampling period. Close the canister at the end of the allocated sampling period if the vacuum is 10 inches of Hg or less. If the vacuum is greater than 10 inches of Hg, call the project, task or field manager to decide a course of action. Leaving greater than 10 inches of Hg in the canister will likely result in elevated reporting limits.
    - If the canister reaches 5 inches of Hg, close the canister valve and terminate sample collection.
- Canisters valves should be tightened securely when sample collection is completed.

Overall, it should be noted that the analog gauges that are used on SUMMA® canisters are not extremely accurate. When in doubt, follow the pre-determined sampling period as a guide to when the canister should be closed. In all cases, the SUMMA® canister vacuum should NOT be allowed to go to below 5 inches of Hg. If the canister is received by the laboratory with zero pressure (ambient), it will be assumed that a leak occurred and the data may be considered invalid.

The field personnel will be responsible for properly labeling containers and canisters and preserving samples (as appropriate). Sample labeling procedures are discussed in Section 10.2.2.

10.2 Field Custody Procedures

The objective of field sample custody is to assure that samples are not tampered with from the time of sample collection through time of transport to the analytical laboratory. Persons will have "custody of samples" when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

Field custody documentation consists of both field logbooks and field COC forms.

10.2.1 Field Logbooks

Field logbooks will provide the means of recording data collecting activities performed. As such, entries will be described in as much detail as possible so that persons going to the Site could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in a secure location when not in use. Each logbook will be identified by the project specific document number. The title page of each logbook will contain the following:

- Person to whom the logbook is assigned
- Logbook number
- Project name
- Project start date
- End date

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the Site, field sampling or investigation team personnel, and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. Entries will be made in ink, and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark. Whenever a sample is collected or a measurement is made, a detailed description of the location of the station shall be recorded. The number of the photographs taken of the station, if any, will also be noted. Equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in FSP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers. Sample identification numbers will be assigned prior to sample collection.

Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description.

10.2.2 Sample Labeling

Preprinted sample labels will be affixed to sample bottles at the sampling location. The following information is required on each sample label:

- Project
- Date collected
- Time collected
- Sample identification
- Sampler
- Analysis to be performed
- Preservative, as applicable

10.2.3 Field COC Forms

Completed COC forms will be required for samples. COC forms will be initiated by the sampling team in the field. The COC forms will contain the unique sample identification number, sample date and time, sample matrix, preservation (if any), and analyses required. The original COC form will accompany the samples to the laboratory. Copies of the COC will be made prior to shipment (or multiple copy forms used) for field documentation. The COC forms will remain with the samples at all times. The samples and signed COC forms will remain in the possession of the sampling crew until the samples are delivered to the express carrier (e.g., FedEx) or hand delivered to the laboratory or laboratory courier, or placed in secure storage.

Sample labels will be completed for each sample using waterproof ink. The labels will be completed as described above in Section 10.2.2. The completed labels will be affixed to each sample bottle and covered with clear tape.

Whenever samples are split with a government agency or other party, a separate COC will be prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

10.3 Management of Investigation-Derived Materials and Wastes

Management of investigation-derived materials and wastes will be performed consistent with the USEPA guidance Guide to Management of Investigation-Derived Wastes, 9345.3-03FS, dated January 1992. Disposable equipment (including personal protective equipment [PPE]) and debris will be containerized and appropriately labeled during the sampling events, and will be disposed of accordingly. Purged groundwater and water generated during equipment decontamination will be containerized and temporally staged on site in Department of Transportation (DOT)-approved 55-gallon steel drums, and will be disposed of appropriately based on analytical results. Equipment will be decontaminated, as appropriate, as discussed in the FSP. Soil cuttings associated with drilling of soil borings will also be collected and temporally stored on site in DOT-approved 55-gallon steel drums, and disposed of properly following receipt of analytical results.

10.4 Packing, Handling, and Shipping Requirements

Sample packaging and shipment procedures are designed to insure that the samples will arrive at the laboratory, with the COC, intact.

Samples will be packaged for shipment as outlined below:

- Ensure that sample containers have the sample labels securely affixed to the container with clear packing tape.
- Check the caps on the sample containers to ensure that they are properly closed and sealed.
- Complete the COC form with the required sampling information and ensure that the recorded information matches the sample labels. If the designated sampler relinquishes the samples to other sampling or field personnel for packing or other purposes, the sampler will complete the COC prior to this

transfer. The appropriate personnel will sign and date the COC form to document the sample custody transfer.

- Using duct tape, secure the outside drain plug (if present) at the bottom of the cooler.
- Wrap sample containers in bubble wrap or other cushioning material.
- Place 1 to 2 inches of cushioning material at the bottom of the cooler.
- Place the sealed sample containers into the cooler.
- Place ice in plastic bags and seal and place loosely in the cooler.
- Fill the remaining space in the cooler with cushioning material.
- Place COC forms in a plastic bag and seal. Tape the forms to the inside of the cooler lid.
- Close the lid of the cooler and secure with packing tape.
- Wrap strapping tape around both ends of the cooler at least twice.
- Mark the cooler on the outside with the following information: shipping address, return address, "Fragile" labels, and arrows indicating "this side up." Cover the labels with clear plastic tape. Place a signed custody seal over the sample cooler lid.
- For air samples, canisters will be packaged for shipment as outlined below:
    - Check that the canister valves are properly closed.
    - Record the initial and final canister vacuum on the COC form and on the Sample Collection Field Form.
    - Place the canisters into the shipping box.
    - Place COC forms in a plastic bag, seal, and place in shipping box.

- Close the flaps of the shipping box and secure with packing tape.
- Place a signed custody seal over the shipping box flaps.

Samples will be hand-delivered or delivered by an express carrier within 24 hours of the time of collection. Shipments will be accompanied by the COC form identifying the contents. The original form will accompany the shipment; copies will be retained by the sampler for the sampling office records. If the samples are sent by common carrier, a bill of lading will be used. Receipts or bills of lading will be retained as part of the permanent project documentation. Commercial carriers are not required to sign off on the COC form as long as the forms are sealed inside the sample cooler and the custody seals remain intact.

Sample containers, coolers, canisters, shipping boxes, and packing materials will be provided by the analytical laboratory. The filled, labeled, and sealed containers will be placed in a cooler on ice and carefully packed to minimize the possibility of container breakage. The labeled canisters will be placed in a shipping box.

Additional procedures for packing, handling, and shipping environmental samples are presented in the FSP.

10.5 Laboratory Custody Procedures

Upon sample receipt, laboratory personnel will be responsible for sample custody. The original field COC form will accompany all samples requiring laboratory analysis. The laboratory will maintain internal chain of custody in accordance with laboratory policy. Samples will be kept secured in the laboratory until all stages of analysis are complete. Laboratory personnel having samples in their custody will be responsible for maintaining sample integrity.

10.5.1 Sample Receipt and Storage

Immediately upon sample receipt, the laboratory sample custodian will open the cooler or shipping box, document the temperature (not applicable for air samples), and compare the contents against the field COC. If a sample container or canister is missing, a sample container is received broken, a canister appears to have leaked during shipment, the sample is in an inappropriate container, or has not been preserved by appropriate means, ARCADIS will be notified. The laboratory sample custodian will be responsible for logging the samples in, assigning a unique laboratory

identification number to each sample, labeling the sample bottle or canister with the laboratory identification number, and moving the sample to an appropriate storage location to await analysis. The project name, field sample code, date sampled, date received, analysis required, storage location and date, and action for final disposition will be recorded in the laboratory tracking system. Relevant custody documentation will be placed in the project file.

10.5.2 Sample Analysis

Samples will be organized into sample delivery groups (SDGs) by the laboratory. A SDG may contain up to 20 field samples (field duplicates, trip blanks, and equipment blanks are considered field samples for the purposes of SDG assignment). Field samples assigned to a single SDG shall be received by the laboratory over a maximum of 7 calendar days and must be processed through the laboratory (preparation, analysis, and reporting) as a group. A minimum of one site-specific MS/MSD pair will be included per 20 field samples.

10.5.3 Sample Storage Following Analysis

Samples will be maintained by the laboratory for at least one month after the final report is delivered to ARCADIS. The laboratory will be responsible for the eventual and appropriate disposal of the samples. Unused portions of the samples, sample extracts and associated wastes will be disposed of by the laboratory in accordance with applicable rules and regulations as specified in their SOP for waste disposal and federal and state requirements.

11. Analytical Method Requirements

This section presents analytical method requirements.

11.1 Field Parameters and Methods

Field analytical procedures will include the measurement of dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, temperature, conductivity, turbidity, and groundwater levels. Specific field measurement protocols and instrument calibration are provided in the FSP.

11.2 Laboratory Parameters and Methods

All soil, groundwater, air samples will be analyzed by a New York State Department of Health (NYSDOH)-approved laboratory. The methods listed below include the analyses expected to be performed. The Laboratory Quality Assurance Manuals (QAMs) are provided in Attachments B-4 and B-5.

Laboratory analytical requirements presented in the sub-sections below include a general summary of requirements, specifics related to each sample medium to be analyzed, and details of the methods to be used for this project. SW-846 methods, Compendium Method TO-15, and NYSDEC ASP Revision 2005 QA/QC and reporting deliverables requirements will be utilized for all analytes except free cyanide.

The following tables summarize general analytical requirements:

Table	Title
Table B-1	Sample Containers, Analytical Methods, Preservation, and Holding Times
Table B-2	Quality Assurance/Quality Control Sample Summary
Tables B-3A through B-3G	Compound List and Target Reporting Limits for Water, Soil, and Air Analyses

11.2.1 SC Sample Matrices

11.2.1.1. Groundwater

Analyses will be performed following the methods listed in Table B-1. Analytical results for analyses will be reported in the units presented in Tables B-3A through B-3F.

11.2.1.2. Soil

Analyses will be performed following the methods listed in Table B-1. Analytical results will be reported as dry weight, and in the units presented in Tables B-3A through B-3F. Moisture content will be reported separately.

11.2.1.3. Air

Analyses will be performed following the method listed in Table B-1. Analytical results for analyses will be reported in the units presented in Table B-3G.

11.2.2 Analytical Requirements

The primary sources to describe the analytical methods to be used during the investigation are provided in USEPA SW-846 Test Methods for Evaluating Solid Waste, Third Edition as updated, USEPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, and NYSDEC ASP Revision 2005. Detailed information regarding QA/QC is provided in NYSDEC ASP Revision 2005.

12. Quality Control Requirements

This section presents quality control requirements.

12.1 Quality Assurance Indicators

The overall quality assurance objective for this QAPP is to develop and implement procedures for sampling, COC, laboratory analysis, instrument calibration, data reduction and reporting, internal quality control, audits, preventive maintenance, and corrective action, such that valid data will be generated. The PARCC parameters as related to project DQOs are discussed in this section. Specific quality control checks are discussed in Sections 12.2 and 12.3.

Quality assurance indicators are generally defined in terms of five parameters:

1. Precision
2. Accuracy
3. Representativeness
4. Completeness
5. Comparability

Each parameter is defined below. Specific objectives for the Site actions are set forth in other sections of this QAPP as referenced below.

12.1.1 Precision

Precision is the measure of reproducibility of sample results. The goal is to maintain a level of analytical precision consistent with the project objectives. To maximize precision, sampling and analytical procedures will be followed. Work for this investigation will adhere to established protocols presented in the SC Work Plan. Checks for analytical precision will include the analysis of MSDs, field duplicates, and laboratory duplicates. Checks for field measurement precision will include obtaining duplicate field measurements. Further discussion of precision quality control checks is provided in Section 12.4.

12.1.2 Accuracy

Accuracy is the deviation of a measurement from the true value of a known standard. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, internal standards, MSs, blank spikes, and surrogates (system monitoring compounds) will be used to assess the accuracy of the laboratory analytical data. Further discussion of these quality control samples is provided in Section 12.5.

12.1.3 Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent Site conditions, and is dependent on sampling and analytical variability and the variability of environmental media at the Site. The actions have been designed to assess the presence of the chemical constituents at the time of sampling. The SC Work Plan presents the rationale for sample quantities and location. This QAPP presents field sampling and laboratory analytical methodologies. The use of the prescribed field and laboratory analytical methods with associated holding times and preservation requirements are intended to provide representative data.

12.1.4 Completeness

Completeness is defined as a measure of the amount of valid data obtained from an event and/or investigation compared to the total amount that was obtained. This will be determined upon final assessment of the analytical results, as discussed in Section 12.6.

12.1.5 Comparability

Comparability is the degree of confidence with which one data set can be compared to another. Comparability between this investigation, and to the extent possible, with existing data will be maintained through consistent sampling and analytical methodology set forth in the FSP and this QAPP, SW-846 analytical methods, Compendium Method TO-15, with NYSDEC ASP Revision 2005 QA/QC requirements, Category B and Level IV eCVP (for air samples) reporting deliverables, and through use of QA/QC procedures and appropriately trained personnel.

12.2 Field Quality Control Checks

12.2.1 Field Measurements

To verify the quality of data using field instrumentation, duplicate measurements will be obtained and reported for field measurements. A duplicate measurement will involve obtaining measurements a second time at the same sampling location.

12.2.2 Sample Containers

Certified-clean sample containers in accordance with Exhibit I of the NYSDEC ASP Revision 2005 (Eagle Picher pre-cleaned containers or equivalent) will be supplied by the laboratory. Batch certified-clean canisters in accordance with Method TO-15 will be supplied by the laboratory.

12.2.3 Field Duplicates

Field duplicates will be collected from the different environmental media to verify the reproducibility of the sampling methods and potential non-homogeneity of sample locations. Field duplicates will be prepared by placing well homogenized aliquots (except samples for VOC analysis) from the same sample location into individual sample containers, which are submitted blind to the laboratory. Field duplicate water samples, soil, and air samples for VOC analysis will constitute co-located samples rather than homogenized aliquots. In general, field duplicates will be analyzed at a 5% frequency (every 20 samples) for the chemical constituents. Table B-2 provides an estimated number of field duplicates to be collected for environmental media samples to be collected during the SC.

12.2.4 Equipment Blanks

Equipment blanks are used to monitor the cleanliness of the sampling equipment and the effectiveness of the cleaning procedures. Equipment blanks will be prepared and submitted for analysis once per day per matrix when equipment decontamination is performed. Equipment blanks will be prepared by filling sample containers with analyte-free water (supplied by the laboratory) which has been routed through or over a cleaned sampling device. When dedicated sampling devices or sample containers are used to collect the samples, equipment blanks will not be necessary. Table B-2 provides an estimated number of equipment blanks for environmental media samples to be collected during the SC.

12.2.5 Trip Blanks

Trip blanks will be used to assess whether Site samples have been cross-contaminated by volatile constituents during storage and transport. Trip blanks will be analyzed at a frequency of once per day, per cooler containing samples to be analyzed for volatile organic constituents. A trip blank will be prepared by the laboratory and consist of a VOA vial filled with analyte-free water. The trip blanks will be shipped with the empty sample containers by the laboratory, will be returned with the field samples, and will remain unopened until analysis. Trip blanks will be analyzed for VOCs only. Table B-2 provides an estimated number of trip blanks for environmental media samples to be collected during the SC.

12.3 Analytical Laboratory Quality Control Checks

Internal laboratory quality control checks will be used to monitor laboratory method performance and data integrity. These checks will include method blanks, MS/MSDs (not applicable for air samples), laboratory spike blanks, internal standards, surrogate compounds, calibration standards, and reference standards. Project quality control limits for precision and accuracy are identified in Tables B-4A through B-4E.

12.3.1 Method Blanks

Sources of contamination in the analytical process, whether specific analyses or interferences, need to be identified, isolated, and corrected. The method blank is useful in identifying possible sources of contamination within the analytical process. For this reason, it is necessary that the method blank is initiated at the beginning of the analytical process and encompasses all aspects of the analytical work. As such, the

method blank would assist in accounting for any potential contamination attributable to glassware, reagents, instrumentation, or other sources which could affect sample analysis. One method blank will be analyzed with each analytical batch associated with no more than 20 samples.

12.3.2 Laboratory Control Samples

An LCS or LCS Duplicate (LCSD) consists of ASTM Type II water and, where practical, pre-cleaned sand or sodium sulfate for solid matrices, or a purchased performance testing sample. The source of the chemicals utilized for LCS spiking will be from a different supply source than the calibration standards. Where second source standards are not available, the LCS must be spiked with materials from a separate manufacturing lot of the standard. The LCS is generally spiked with all of the analytes of interest near the mid-point of the calibration range as defined by the method. The LCS is processed under the same sample preparation, surrogate and internal standards addition, and analytical protocols as the project samples. LCSs are analyzed at the frequency of 1 per batch of 20 samples or fewer of similar matrices. The recovery of target analytes in the LCS provides an evaluation of method performance and accuracy. Method control may be established based on the subset of compounds listed in the method. LCSDs are analyzed with some methods but are not required QA components. LCSDs are prepared and analyzed by the same protocols as the LCS. LCSD analyses provide precision evaluation of the method performance in addition to the accuracy information.

12.3.3 MS/MSDs

MS/MSDs will be used to measure the accuracy of analyte recovery from the sample matrices and will be site-specific. Except for air samples, MS/MSD pairs will be analyzed at a 5% frequency (every 20 samples or once every week, whichever comes first).

When MS recoveries are outside quality control limits, associated control sample and surrogate spike recoveries will be evaluated, as applicable, to attempt to verify the reason for the deviation and determine the effect on the reported sample results. Table B-2 provides an estimated number of MS and MSD analyses for each applicable parameter.

12.3.4 Laboratory Duplicates

A laboratory duplicate consists of a second aliquot selected by the laboratory from the same project sample. Selection of duplicate samples from a heterogeneous matrix requires homogenization to ensure that representative portions are analyzed. Laboratory duplicates are performed for air analyses, for which matrix spikes are not applicable. Additionally, when sample volume is limited, or for metals and general chemistry methods, a laboratory duplicate may be performed in lieu of the MSD. One sample per batch of 20 samples or fewer per matrix is analyzed as a laboratory duplicate under the above scenarios. The relative percent difference (RPD) between the results in the original and duplicate sample measure the precision of the analytical method on the actual project samples. The RPD is calculated using the same formula as the RPD for the MS/MSD and field duplicates.

12.3.5 Surrogate Spikes

Surrogates are compounds which are unlikely to occur under natural conditions that have properties similar to the analytes of interest. This type of control is primarily used for organic samples analyzed by gas chromatography/mass spectrometry (GC/MS) and GC methods and is added to the samples prior to purging or extraction. The surrogate spike is utilized to provide broader insight into the proficiency and efficiency of an analytical method on a sample-specific basis. This control reflects analytical conditions that may not be attributable to sample matrix.

If surrogate spike recoveries exceed specified quality control limits, the analytical results need to be evaluated thoroughly in conjunction with other control measures. In the absence of other control measures, the integrity of the data may not be verifiable and reanalysis of the samples with additional control may be necessary.

Surrogate spike compounds will be selected utilizing the guidance provided in the analytical methods.

12.3.6 Calibration Standards

Calibration check standards analyzed within a particular analytical series provide insight regarding the instruments' stability. A calibration check standard will be analyzed at the beginning and end of an analytical series, or periodically throughout a series containing a large number of samples.

In general, calibration check standards will be analyzed after every 12 hours, or more frequently, as specified in the applicable analytical method. In analyses where internal standards are used, a calibration check standard will only be analyzed in the beginning of an analytical series. If results of the calibration check standard exceed specified tolerances, then samples analyzed since the last acceptable calibration check standard will be reanalyzed.

Laboratory instrument calibration standards will be selected utilizing the guidance provided in the analytical methods, as summarized in Section 13.

12.3.7 Internal Standards

Internal standard areas and retention times will be monitored for organic analyses performed by GC/MS methods. Method-specified internal standard compounds will be spiked into field samples, calibration standards, and quality control samples after preparation and prior to analysis. If internal standard areas in one or more samples exceed the specified tolerances, the cause will be investigated, the instrument will be recalibrated if necessary, and affected samples will be reanalyzed.

The acceptability of internal standard performance will be determined using the guidance provided within the analytical methods.

12.3.8 Reference Standards/Calibration Verification

Reference standards are standards of known concentration and independent in origin from the calibration standards. The intent of reference standard analysis is to provide insight into the analytical proficiency within an analytical series. This includes preparation of calibration standards, validity of calibration, sample preparation, instrument set-up, and the premises inherent in quantitation. Reference standards will be analyzed at the frequencies specified within the analytical methods.

12.4 Data Precision Assessment Procedures

Field precision is difficult to measure because of temporal variations in field parameters. However, precision will be controlled through the use of experienced field personnel, properly calibrated meters, and duplicate field measurements. Field duplicates will be used to assess precision for the entire measurement system including sampling, handling, shipping, storage, preparation, and analysis.

Laboratory data precision for organic analyses will be monitored through the use of MS/MSD and laboratory duplicates as identified in Table B-2.

The precision of data will be measured by calculation of the RPD by the following equation:

$$RPD = \frac{(A-B)}{(A+B)/2} \times 100$$

Where:

A = Analytical result from one of two duplicate measurements

B = Analytical result from the second measurement

Precision objectives for LCSD, MSDs, and laboratory duplicate analyses are identified in the NYSDEC ASP Revision 2005 and presented in Tables B-4A through B-4E. The precision control limits for air samples are provided in the Air Toxics Limited Quality Manual (Attachment B-5).

12.5 Data Accuracy Assessment Procedures

The accuracy of field measurements will be controlled by experienced field personnel, properly calibrated field meters, and adherence to established protocols. The accuracy of field meters will be assessed by review of calibration and maintenance logs.

Laboratory accuracy will be assessed via the use of MSs, surrogate spikes, internal standards, and reference standards. Accuracy will be calculated in terms of percent recovery as follows:

$$\% \text{ Recovery} = \frac{A-X}{B} \times 100$$

Where:

A = Value measured in spiked sample or standard

X = Value measured in original sample

B = True value of amount added to sample or true value of standard

This formula is derived under the assumption of constant accuracy over the original and spiked measurements. If any accuracy calculated by this formula is outside of the acceptable levels, data will be evaluated to determine whether the deviation represents unacceptable accuracy, or variable, but acceptable accuracy. Accuracy objectives for LCS, LCSD, MS, MSD, and surrogate recovery objectives are identified in the NYSDEC ASP 2005 Revision and presented in Tables B-4A through B-4E. The precision control limits for air samples are provided in the Air Toxics Limited Quality Manual (Attachment B-5).

12.6 Data Completeness Assessment Procedures

Completeness of a field or laboratory data set will be calculated by comparing the number of valid sample results generated to the total number of results generated.

$$\text{Completeness} = \frac{\text{number valid results}}{\text{total number of results generated}} \times 100$$

As a general guideline, overall project completeness is expected to be at least 90%. The assessment of completeness will require professional judgment to determine data usability for intended purposes.

13. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Testing and maintenance schedules have been developed for both field and laboratory instruments. A summary of the testing and maintenance activities to be performed is presented below.

13.1 Field Instruments and Equipment

Prior to field sampling, each piece of field equipment will be inspected to ensure that it is operational. If the equipment is not operational, it will be serviced prior to its use. Meters which require charging or batteries will be fully charged and have fresh batteries. If instrument servicing is required, it is the responsibility of the appropriate Task Manager or field personnel to follow the maintenance schedule and arrange for timely service. Field instruments will be maintained according to the manufacturers' instructions.

Logbooks will be kept for each field instrument. Each logbook will contain records of operation, maintenance, calibration, and any problems and repairs. Logbooks for each piece of equipment shall be maintained in project records. The Task Managers will review calibration and maintenance logs.

13.1.1 Equipment Maintenance

Measuring and testing equipment to be used in support of the SC activities that directly affect the quality of the analytical data shall be subject to preventative maintenance measures that minimize equipment downtime. Equipment will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual to ensure that maintenance requirements are being observed. Field notes from previous sampling events will be reviewed to ensure that any prior equipment problems are not overlooked and that any necessary repairs to equipment have been carried out.

Field equipment returned from a site will be inspected to confirm that it is in working order. The inspection will be recorded in the logbook or field notebooks, as appropriate. It will also be the obligation of the last user to record any equipment problems in the logbook. Non-operational field equipment will either be repaired or replaced. Appropriate spare parts will be made available for field meters.

ARCADIS-owned, subcontractor-owned, or leased equipment maintenance shall be in accordance with the manufacturer's instructions.

13.2 Laboratory Instruments and Equipment

Laboratory instrument and equipment documentation procedures include details of any observed problems, corrective measure(s), routine maintenance, and instrument repair (which will include information regarding the repair and the individual who performed the repair).

Preventive maintenance of laboratory equipment generally will follow the guidelines recommended by the manufacturer. A malfunctioning instrument will be repaired immediately by in-house staff or through a service call from the manufacturer.

13.2.1 Instrument Maintenance

Maintenance schedules for laboratory equipment adhere to the manufacturer's recommendations. Records reflect the complete history of each instrument and specify the time frame for future maintenance. Major repairs or maintenance procedures are performed through service contracts with manufacturer or qualified contractors. Paperwork associated with service calls and preventative maintenance calls will be kept on file by the laboratory.

Laboratory Systems Managers are responsible for the routine maintenance of instruments used in the particular laboratory. Any routine preventative maintenance carried out is logged into the appropriate logbooks. The frequency of routine maintenance is dictated by the nature of samples being analyzed, the requirements of the method used, and/or the judgment of the Laboratory Systems Manager.

Major instruments are backed up by comparable (if not equivalent) instrument systems in the event of unscheduled downtime. An inventory of spare parts is also available to minimize equipment/instrument downtime.

13.2.2 Equipment Monitoring

On a daily basis, the operation of balances, incubators, ovens, refrigerators, and water purification systems will be checked and documented. Any discrepancies will be immediately reported to the appropriate laboratory personnel for resolution.

14. Instrument Calibration and Frequency

This section presents instrument calibration procedures and frequency.

14.1 Field Instruments and Equipment

The calibration of field instruments is governed by specific SOPs documented in the FSP for the applicable field analysis method, and such procedures take precedence over the following discussion.

Field personnel are responsible for ensuring that a master calibration/maintenance log is maintained following the procedures specified for each measuring device. Where applicable, each log will include, at a minimum, the following information:

- Name of device and/or instrument calibrated
- Device/instrument serial/identification numbers
- Calibration method
- Tolerance
- Calibration standard used
- Frequency of calibration
- Date(s) of calibration(s)
- Name of person(s) performing calibration(s)

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated at the intervals specified by the manufacturer or more frequently, and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service. Equipment found to be out of tolerance during the period of use shall be removed from the field and measuring and testing activities performed using the equipment shall be addressed via the corrective action system described in Section 18.3 of this QAPP.

14.2 Laboratory Instrument and Equipment

Instrument calibration will follow the specifications provided by the instrument manufacturer or specific analytical method used. The analytical methods for target constituents are identified separately below.

VOCs

Equipment calibration procedures will follow SW-846 Method 8260 protocols and guidelines presented in NYSDEC ASP Revision 2005, Exhibit E, Part II, Section 2.

SVOCs

Equipment calibration procedures will follow SW-846 Method 8270 protocols and guidelines presented in NYSDEC ASP Revision 2005, Exhibit E, Part II, Section 3.

Pesticides

Equipment calibration procedures will follow SW-846 Method 8081 protocols and guidelines presented in NYSDEC ASP Revision 2005, Exhibit E, Part II, Section 4.

PCBs

Equipment calibration procedures will follow SW-846 Method 8082 protocols and guidelines presented in NYSDEC ASP Revision 2005, Exhibit E, Part II, Section 5.

Metals

Equipment calibration procedures will follow SW-846 Method 6010 and 7470/7471 protocols and guidelines presented in NYSDEC ASP Revision 2005, Exhibit E, Part III, Sections 1 and 3.

Cyanide

Equipment calibration procedures will follow ASTM Method D4282-02 protocols and guidelines presented in NYSDEC ASP Revision 2005, Exhibit E, Part III, Section 5.

Air Samples

Equipment calibration procedures will follow Method TO-15 protocols, the laboratory Standard Operating Procedure, Air Toxics Limited Quality Manual (Attachment B-5), and guidelines presented in NYSDEC ASP Revision 2005, Exhibit D.

15. Inspection/Acceptance Requirements for Supplies and Consumables

Supplies to be used in the field and laboratory will be available as needed. Preservatives and containers or canisters will be free of target chemicals and interferences. Standards will be verified against a second source standard. The laboratory will follow a "first in first out" procedure for the storage and use of consumables to minimize the risk of contamination and degradation. The various supplies and consumables required on site for field operations are noted in the FSP and field SOPs.

16. Data Acquisition Requirements for Non-Direct Measurements

NGRID has not generated any data in connection with the Site. However, historical background and site usage information concerning the activities at the Site will be used as guidance in determining sampling locations for the SC.

17. Data Management

The purpose of data management is to ensure that the generated data are accurate and readily accessible to meet the analytical and reporting objectives of the project. The field investigations require a structured, comprehensive, and efficient program for management of data.

The data management program established for the project includes field documentation, methods for tracking and managing the data, and a system for filing Site-related information. Data management procedures will be employed to efficiently process the information collected such that the data are readily accessible and accurate. These procedures are described in detail in the following section which consists of five elements: 1) sample designation system; 2) field activities; 3) sample tracking and management; 4) data management system; and, 5) document control and inventory.

17.1 Sample Designation System

The sample designation system provides a unique sample numbering scheme that will facilitate both sample tracking and easy re-sampling of select locations to evaluate data gaps, if necessary. The sample designation system to be employed during the sampling activities will be consistent, yet flexible enough to accommodate unforeseen sampling events or conditions. A combination of letters and numbers will be used to yield a unique sample number for each field sample collected, as outlined in Section 7.1.1.

17.2 Field Activities

Field activities designed to gather the information necessary to make decisions during the SC process require consistent documentation and accurate record keeping. During Site activities, standardized procedures will be used for documentation of field activities, data security, and quality assurance. These procedures are described in further detail in the following subsections.

17.2.1 Field Documentation

Complete and accurate record keeping is a critical component of the field investigation activities. When interpreting analytical results and identifying data trends, investigators realize that field notes are an important part of the review and validation process. To ensure that the field investigation is thoroughly documented, several different information records, each with its own specific reporting requirements, will be maintained, including:

- Field and sampling logs
- COC forms
- Instrument calibration records, as appropriate

A description of each of these types of field documentation is provided below.

Field Logs

The personnel performing the field activities will keep field logs that detail observations and measurements made during the SC. Data will be recorded directly into site-dedicated, bound notebooks, with each entry dated and signed. To ensure at any future date that notebook pages are not missing, each page will be sequentially numbered. Erroneous entries will be corrected by crossing out the original entry, initialing it, and then documenting the proper information. In addition, certain media sampling locations will be surveyed to accurately record their locations. The survey crew will use their own field logs and will supply the sampling location coordinates to the Database Administrator.

COC Forms

COC forms document sample possession from time of collection to the time of disposal. A COC form will accompany each field sample collected, and one copy of the form will be filed in the office. Field personnel will be briefed on the proper use of the COC procedure. COC procedures are included in the FSP.

Instrument Calibration Records

As part of data quality assurance procedures, field monitoring and detection equipment will be routinely calibrated. Instrument calibration ensures that equipment used is of the proper type, range, accuracy, and precision to provide data compatible with the specified requirements and desired results. Calibration procedures for the various types of field instrumentation are described in Section 14.1. In order to demonstrate that established calibration procedures have been followed, calibration records will be prepared and maintained to include, as appropriate, the following:

- Calibration date and time
- Type and identification number of equipment
- Calibration frequency and acceptable tolerances
- Identification of individual(s) performing calibration
- Reference standards used
- Calibration data
- Information on calibration success or failure

The calibration record will serve as a written account of monitoring or detection equipment QA. Erratic behavior or failures of field equipment will be subsequently recorded in the calibration log.

17.2.2 Data Security

Measures will be taken during the field investigation to ensure that samples and records are not lost, damaged, or altered. When not in use, field notebooks will be stored at the office or locked in the field vehicle. Access to these files will be limited to the field personnel who utilize them.

17.3 Sample Management and Tracking

A record of field documentation will be maintained to ensure the validity of data used in the Site analysis. To effectively execute such documentation, specific sample tracking and data management procedures will be used throughout the sampling program.

Sample tracking will begin with the completion of COC forms as summarized in Section 10.2.3. The completed COC forms associated with samples collected will be transmitted to the quality assurance officer (QAO). Copies of completed COC forms will be maintained in the office. The laboratory shall verify receipt of the samples electronically (via e-mail) on the following day.

When analytical data are received from the laboratory, the QAO will review the incoming analytical data packages against the information on the COCs to confirm that the correct analyses were performed for each sample and that results for samples submitted for analysis were received. Any discrepancies noted will be promptly followed-up by the QAO.

17.4 Document Control and Inventory

Project files will be maintained by ARCADIS. The types of files to be retained consist of, but are not limited to, the following:

1. Proposals/Agreements
2. Purchase Orders/Change Orders
3. Invoices
4. Project Management
5. Correspondence
6. Notes and Data
7. Regulatory Documents
8. Final Reports/Presentations

18. Assessment and Response Actions

Performance and systems audits may be completed in the field and laboratory during the SC as described below.

18.1 Field Audits

The following field performance and systems audits will be completed during this project.

The appropriate Task Manager will monitor field performance. Field performance review summaries will contain an evaluation of field activities to verify that activities are performed according to established protocols. The QA Officer will review field reports and communicate concerns to ARCADIS' Project Manager and/or Task Managers, as appropriate. ARCADIS' QA Officer or designee will review the equipment blank and trip blank data to identify potential deficiencies in field sampling and cleaning procedures. In addition, systems audits comparing scheduled QA/QC activities from this document with actual QA/QC activities completed will be performed. The appropriate Task Manager and QA Officer will periodically confirm that work is being performed consistent with this QAPP, the SC Work Plan, and the FSP.

18.2 Laboratory Audits

The laboratory will perform internal audits consistent with NYSDEC ASP 2005 Revision, Exhibit E and in accordance with the New York ELAP accreditation requirements.

Internal laboratory audits are conducted by the laboratory QA manager. As part of the audit, the overall performance of the laboratory staff is evaluated and compared to the performance criteria outlined in the laboratory quality assurance manual and SOPs. The results of the audits are summarized and issued to each department supervisor, the Laboratory Manager, and the Laboratory Director. A systems audit of each laboratory is also performed by the QA manager to determine if the procedures implemented by each laboratory are in compliance with the quality assurance manual and SOPs.

In addition to the laboratory's internal audits, as participants in state and federal certification programs, the laboratory is audited by representatives of the regulatory agency issuing certification. Audits are usually conducted on an annual or biennial basis and focus on laboratory conformance to the specific program protocols for which the laboratory is seeking certification. The auditor reviews sample handling and tracking documentation, analytical methodologies, analytical supportive documentation, and final reports. The audit findings are formally documented and submitted to the laboratory for corrective action, if necessary.

ARCADIS reserves the right to conduct an on-site audit of the laboratory prior to the start of analyses for the project. Additional audits may be performed during the course of the project, as deemed necessary.

18.3 Corrective Action

Corrective actions are required when field or analytical data are not within the objectives specified in this QAPP, the FSP, or the SC Work Plan. Corrective actions include procedures to promptly investigate, document, evaluate, and correct data collection and/or analytical procedures. Field and laboratory corrective action procedures for the actions are described below.

18.3.1 Field Procedures

When conducting the field work, if a condition is noted by the field team that would have an adverse affect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause, and corrective action implemented by the Field Manager or a designee, will be documented on a Corrective Action Form and reported to the appropriate ARCADIS Task Manager, QAO, and Project Manager.

Examples of situations that would require corrective actions are provided below:

- Protocols as defined by the QAPP, SC Work Plan, and FSP have not been followed.
- Equipment is not in proper working order or is not properly calibrated.
- QC requirements have not been met.
- Issues resulting from performance or systems audits have not been resolved.
- Air canister valve pressure or gauges not in compliance with project requirements.

Project personnel will continuously monitor ongoing work performance in the normal course of daily responsibilities.

18.3.2 Laboratory Procedures

In the laboratory, when a condition is noted to have an adverse affect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause, and corrective action taken will be documented and reported to the Project Manager and QAO.

Corrective action may be initiated, at a minimum, under the following conditions:

- Specific laboratory analytical protocols have not been followed
- Protocols as defined by this QAPP have not been followed
- Predetermined data acceptance standards are not obtained
- Equipment is not in proper working order or calibrated
- Sample and test results are not completely traceable
- QC requirements have not been met
- Issues resulting from performance or systems audits have not been resolved

Laboratory personnel will continuously monitor ongoing work performance in the normal course of daily responsibilities. Corrective action is initiated at a point where the problem has been identified. At whatever level this occurs (analyst, supervisor, data review, or quality control), it is brought to the attention of the laboratory QAO and, ultimately, the Laboratory Director. Final approval of any action deemed necessary is subject to the approval of the Laboratory Director.

Any corrective action deemed necessary based on system or performance audits or the results of data review will be implemented. The corrective action may include sample re-extraction, re-preparation, re-analysis, cleanup, dilutions, matrix modifications, or other activities.

19. Reporting

This section presents reporting requirements.

19.1 Internal Reporting

The analytical laboratory will submit analytical reports to ARCADIS for review. The reports will then be submitted to the data validator for review. Supporting data (i.e., historic data, related field or laboratory data) will also be reviewed to evaluate data quality, as appropriate. ARCADIS' QA Officer will incorporate results of the data validation reports and assessments of data usability into a summary report (if required) that will be submitted to ARCADIS' Project Manager and appropriate Task Managers. If required, this report will be filed in the project file at ARCADIS' office and will include the following:

1. Assessment of data accuracy, precision, and completeness for both field and laboratory data

2. Results of the performance and systems audits

3. Significant QA/QC problems, solutions, corrections, and potential consequences

4. Analytical data validation report

19.2 SC Reporting

Upon sample transport to the laboratory, a copy of the COC will be forwarded to ARCADIS' Project Manager. Upon receipt of the analytical data package from the laboratory, ARCADIS' QA Officer or designee will determine if the data has met the required data quality objectives. The analytical data package will be submitted to ARCADIS' Project Manager and the analytical data will be incorporated into the SC Report in a tabulated format.

20. Data Reduction and Review

After field and laboratory data are obtained, the data will be subject to the following:

1. Reduction, or manipulation mathematically, or otherwise into meaningful and useful forms

2. Review

3. Data validation

4. Organization, interpretation, and reporting

20.1 Field Data Reduction and Review

20.1.1 Field Data Reduction

Information collected in the field through visual observation, manual measurement, and/or field instrumentation will be recorded in field notebooks or data sheets, and/or on forms. Such data will be reviewed by the appropriate Task Manager for adherence to the SC Work Plan, the FSP, and this QAPP and for consistency. Concerns identified as a result of this review will be discussed with the field personnel, corrected if possible, and, as necessary, incorporated into the data evaluation process.

20.1.2 Field Data Review

Field data calculations, transfers, and interpretations will be conducted by the field personnel and reviewed for accuracy by the appropriate Task Manager and the QAO. Logs and documents will be checked for:

1. General completeness

2. Readability

3. Usage of appropriate procedures

4. Appropriate instrument calibration and maintenance

5. Reasonableness in comparison to present and past data collected

6. Correct sample locations

7. Correct calculations and interpretations

20.2 Laboratory Data Reduction and Review

20.2.1 Laboratory Data Reduction

The calculations used for data reduction will be specified in each of the analytical methods referenced previously. Whenever possible, analytical data will be transferred directly from the instrument to a computerized data system. Raw data not amenable to electronic management will be entered into permanently bound laboratory notebooks. The data entered are sufficient to document factors used to arrive at the reported value.

Concentration calculations for chromatographic analyses will be based on response factors. Quantitation will be performed using either internal or external standards.

Inorganic analyses will be based on regression analysis. Regression analysis is used to fit a curve through the calibration standard data. The sample concentrations will be calculated using the resulting regression equations.

Non-aqueous values will be reported on a dry-weight basis. Values will not be corrected for blank contamination.

20.2.2 Laboratory Data Review

Data will be subject to multi-level review by the laboratory. The group leader will review data reports prior to release for final data report generation. The QA manager will review approximately 10% of the final data reports and the Laboratory Project Manager will review a cross-section of the final data reports prior to shipment to ARCADIS.

If discrepancies or deficiencies exist in the analytical results, then corrective action will be taken, as discussed in Section 18.3. Deficiencies discovered as a result of internal data review, as well as the corrective actions to be used to rectify the situation, will be documented on a Corrective Action Form and summarized in the case narrative.

20.2.3 Data Validation and Verification

Data generated for site investigation purposes will be subjected to the data validation and verification procedures outlined in Section 21. Data generated for waste

characterization and disposal purposes will not be reviewed unless anomalous results are observed.

21. Data Validation and Verification

Data validation entails a review of the quality control data and the raw data to verify that the laboratory was operating within required limits, the analytical results were correctly transcribed from the instrument read outs, and which, if any, environmental samples were related to any out-of-control quality control samples. The objective of data validation is to identify any questionable or invalid laboratory measurements.

ARCADIS will validate data generated and produce a NYSDEC DUSR using this QAPP, analytical method performance criteria, laboratory control limits, NYSDEC ASP Revision 2005 requirements, the USEPA's National Functional Guidelines, and USEPA Region II SOPs for data validation. These procedures and criteria may be modified as necessary to address project-specific and method-specific criteria, control limits, and procedures. Data validation will consist of data screening, checking, reviewing, editing, and interpretation to document analytical data quality and to determine whether the quality is sufficient to meet the DQOs.

The data validator will verify that reduction of laboratory measurements and laboratory reporting of analytical parameters is in accordance with the procedures specified for each analytical method and/or as specified in this QAPP and NYSDEC ASP Revision 2005. Deviations from the analytical method or any special reporting requirements apart from that specified in this QAPP will be detailed in the analytical reports.

Upon receipt of laboratory data, the following procedures will be executed by the data validator:

- Evaluate completeness of data package
- Verify that field COC forms were completed and that samples were handled properly
- Verify that holding times were met for each parameter. Holding time exceedences, should they occur, will be documented. Data for samples exceeding holding time requirements will be flagged as either estimated or rejected. The decision as to which qualifier is more appropriate will be made on a case-by-case basis. In general, if the holding time is exceeded by less

than two times the EPA recommended holding time, the data will be qualified as estimated.

- Verify that parameters were analyzed according to the methods specified.
- Verify compliance with canister pressure requirements and tracking.
- Review QA/QC data (i.e., make sure duplicates, blanks, and spikes were analyzed on the required number of samples, as specified in the method; verify that accuracy and precision of quality control data are acceptable; review calibration information, compound identification, and raw data)
- Investigate anomalies identified during review. When anomalies are identified, they will be discussed with the Project Manager and/or Laboratory Manager, as appropriate.
- If data appears suspect, further data evaluation will be performed to investigate the specific data of concern. This review may include evaluation of instrument calibrations and continuing calibrations, compound identification, verification of calculations, and other reviews of raw data.

Deficiencies discovered as a result of the data review, as well as the corrective actions implemented in response, will be documented and submitted in the form of a written validation report addressing the following topics as applicable to each method:

- Assessment of the data package
- Description of any protocol deviations
- Summary of the QC failures observed
- Assessment of any compromised data
- Summary of the qualified data

It should be noted that qualified results do not necessarily invalidate data. The goal to produce the best possible data does not necessarily mean producing data without quality control qualifiers. Data qualified as estimated will be utilized for site evaluation. Rejected data will not be used.

Resolution of any issues regarding laboratory performance or deliverables will be handled between the laboratory and the data validator. Suggestions for re-sampling or reanalysis may be made by ARCADIS' QA Officer at this point.

Data validation reports will be kept in the project file at ARCADIS' office.

22. Reconciliation with User Requirements

The data results will be examined to determine the performance that was achieved for each data usability criteria. The performance will then be compared with the project objectives and DQOs. Deviations from objectives will be noted. Additional action may be warranted when performance does not meet performance objectives for critical data. Options for corrective action relating to incomplete information, questionable results or inconsistent data, may include any or all of the following:

- Retrieval of missing information
- Request for additional explanation or clarification
- Re-extraction or reanalysis of sample (when appropriate)
- Recalculation or reinterpretation of results by the laboratory

These actions may improve the data quality, reduce uncertainty, and may eliminate the need to qualify or reject data.

If these actions do not improve the data quality to an acceptable level, the following additional actions may be taken:

- Extrapolation of missing data from existing data points
- Use of historical Site use information
- Evaluation of the critical/non-critical nature of the sample

If the data gap cannot be resolved by these actions, an evaluation of the data bias and potential for false negatives and positives can be performed. If the resultant uncertainty level is unacceptable, the following action must be taken:

- Additional sample collection and analysis

23. References

ASTM International Standards. Method D4282-02. Standard Test Method for the Determination of Free Cyanide in Water and Wastewater by Microdiffusion.

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Table B-1. Summary of Sample Containers, Analytical Methods, Preservation, and Holding Times, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

Parameter	Method [1]	Sample Container	Preservation	Holding Time
Soil				
TCL VOCs	8260B	One (1) 2-oz. glass jar with Teflon®-lined septa	Cool 4° C	12 Days VTSR
TCL SVOCs	8270C	One (1) 4-oz. glass jar	Cool 4° C	5 Days VTSR to Extraction, 40 Days to Analysis
TCL Pesticides	8081A	One (1) 4-oz. glass jar	Cool 4° C	5 Days VTSR to Extraction, 40 Days to Analysis
TCL PCBs	8082	One (1) 4-oz. glass jar	Cool 4° C	5 Days VTSR to Extraction, 40 Days to Analysis
TAL Metals	6010B/7471A	One (1) 4-oz. glass jar	Cool 4° C	6 Months VTSR; Mercury 26 days VTSR
Free Cyanide	ASTM D4282-02 [2]	One (1) 4-oz. glass jar	Cool 4° C	12 Days VTSR
Water				
TCL VOCs	8260B	Two (2) 40-mL glass vials with Teflon®-lined septa	Cool 4° C, HCl to pH <2	12 Days VTSR
TCL SVOCs	8270C	Two (2) 1-L amber glass bottles	Cool 4° C	5 Days VTSR to Extraction, 40 Days to Analysis
TCL Pesticides	8081A	Two (2) 1-L amber glass bottles	Cool 4° C	5 Days VTSR to Extraction, 40 Days to Analysis
TCL PCBs	8082	Two (2) 1-L amber glass bottles	Cool 4° C	5 Days VTSR to Extraction, 40 Days to Analysis
TAL Metals	6010B/7470	One (1) 500-mL plastic bottle	Cool 4° C, HNO_3 to pH <2	6 Months VTSR; Mercury 26 days VTSR
Free Cyanide	ASTM D4282-02	One (1) 500-mL plastic bottle	Cool 4° C, NaOH to pH >12	12 Days VTSR
Air				
TO-15 VOCs Expanded	EPA Method TO-15 [3]	One (1) 6-L SUMMA® Canister	---	30 Days

1	USEPA. Office of Solid Waste. *Test Methods for Evaluating Solid Waste (SW-846).*
2	Extraction by EPA Method 9013A; Analysis by ASTM D4282-02 Standard Test Method for Determination of Free Cyanide in Water and Wastewater by Microdiffusion.
3	USEPA. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air - Second Edition.
TCL	Target Compound List OLM04.2.
VOCs	Volatile Organic Compounds.
SVOCs	Semi-Volatile Organic Compounds.
PCBs	Polychlorinated Biphenyls.
TAL	Target Analyte List.
oz.	Ounce.
mL	Milliliter.
L	Liter.
C	Celsius.
HCl	Hydrochloric Acid.
HNO_3	Nitric Acid.
NaOH	Sodium Hydroxide.
VTSR	Validated Time of Sample Receipt at lab.

Table B-2. Quality Assurance/Quality Control Sample Summary, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

Parameter	Estimated Environmental Sample Quantity	Field QC Samples						Laboratory QC Samples				Total
		Equipment Blanks		Trip Blanks		Field Duplicates		Matrix Spike		Matrix Spike Duplicate or Lab Duplicate		
		Frequency	Quantity	Frequency	Quantity	Frequency	Quantity	Frequency	Quantity	Frequency	Quantity	
Soil [1]												
TCL Volatile Organic Compounds (SW-846 8260B)	14	1/Day	5	1/Cooler	5	1/20	1	1/20	1	1/20	1	27
TCL Semi-Volatile Organic Compounds (SW-846 8270C)	14	1/Day	5	NA	NA	1/20	1	1/20	1	1/20	1	22
TCL Pesticides (SW-846 8081A)	14	1/Day	5	NA	NA	1/20	1	1/20	1	1/20	1	22
TCL PCBs (SW-846 8082)	14	1/Day	5	NA	NA	1/20	1	1/20	1	1/20	1	22
TAL Metals (SW-846 6010B/7471A)	14	1/Day	5	NA	NA	1/20	1	1/20	1	1/20	1	22
Free Cyanide (ASTM D4282-02) [2]	14	1/Day	5	NA	NA	1/20	1	1/20	1	1/20	1	22
Water												
TCL Volatile Organic Compounds (SW-846 8260B)	4	1/Day	1	1/Cooler	1	1/20	1	1/20	1	1/20	1	9
TCL Semi-Volatile Organic Compounds (SW-846 8270C)	4	1/Day	1	NA	NA	1/20	1	1/20	1	1/20	1	8
TCL Pesticides (SW-846 8081A)	4	1/Day	1	NA	NA	1/20	1	1/20	1	1/20	1	8
TCL PCBs (SW-846 8082)	4	1/Day	1	NA	NA	1/20	1	1/20	1	1/20	1	8
TAL Metals (SW-846 6010B/7470)	4	1/Day	1	NA	NA	1/20	1	1/20	1	1/20	1	8
Free Cyanide (ASTM D4282-02)	4	1/Day	1	NA	NA	1/20	1	1/20	1	1/20	1	8
Waste Characterization (Soil and Water)												
Full TCLP (SW-846 Methods)	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2
TCL PCBs (SW-846 8082)	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2
Corrosivity, Reactivity, and Ignitability	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2
Air												
TO-15 VOCs Expanded	TBD	NA	NA	NA	NA	1/20	TBD	NA	NA	NA	NA	TBD

1 Sample Quantity is an approximation; the final sample quantity will be determined in the field based on field conditions and observations.
2 Extraction by EPA Method 9013A; Analysis by ASTM D4282-02 Standard Test Method for Determination of Free Cyanide in Water and Wastewater by Microdiffusion.
QC = Quality Control
TCL = Target Compound List OLM04.2
PCBs = Polychlorinated Biphenyls
TAL = Target Analyte List
NA = Not Applicable
TCLP = Toxicity Characteristic Leaching Procedure
TBD = To Be Determined

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Table B-3A. Compound List and RLs for Water and Soil VOC Analysis, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

Compound	Target Reporting Limits	
	Water (ug/L)	Soil (ug/kg)
Dichlorodifluoromethane	5	5
Chloromethane	5	5
Vinyl Chloride	5	5
Bromomethane	5	5
Chloroethane	5	5
Trichlorofluoromethane	5	5
1,1-Dichloroethene	5	5
1,1,2-Trichloro-1,2,2-trifluoroethane	5	5
Acetone	10	20
Carbon Disulfide	5	5
Methyl Acetate	5	5
Methylene Chloride	5	5
trans-1,2-Dichloroethene	5	5
Methyl tert-Butyl Ether	5	5
1,1-Dichloroethane	5	5
cis-1,2-Dichloroethene	5	5
2-Butanone	10	10
Chloroform	5	5
1,1,1-Trichloroethane	5	5
Cyclohexane	5	5
Carbon Tetrachloride	5	5
Benzene	5	5
1,2-Dichloroethane	5	5
Trichloroethene	5	5
Methylcyclohexane	5	5
1,2-Dichloropropane	5	5
Bromodichloromethane	5	5
cis-1,3-Dichloropropene	5	5
4-Methyl-2-pentanone	10	5
Toluene	5	5
trans-1,3-Dichloropropene	5	5
1,1,2-Trichloroethane	5	5
Tetrachloroethene	5	5
2-Hexanone	10	10
Dibromochloromethane	5	5
1,2-Dibromoethane	5	5
Chlorobenzene	5	5
Ethylbenzene	5	5
Xylenes (total)	5	5
Styrene	5	5
Bromoform	5	5
Isopropylbenzene	5	5
1,1,2,2-Tetrachloroethane	5	5
1,3-Dichlorobenzene	5	5
1,4-Dichlorobenzene	5	5
1,2-Dichlorobenzene	5	5
1,2-Dibromo-3-chloropropane	5	10
1,2,4-Trichlorobenzene	5	5

1. Compound list refers to USEPA Contract Laboratory Program Statement of Work OLM04.2 TCL for Volatile Compounds.

RLs	Reporting Limits.
VOC	Volatile Organic Compound.
TCL	Target Compound List.
ug/L	Micrograms per liter.
ug/kg	Micrograms per kilogram.

Table B-3B. Compound List and RLs for Water and Soil SVOC Analysis, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

Compound	Target Reporting Limits	
	Water (ug/L)	Soil (ug/kg)
Benzaldehyde	10	270
Phenol	4	270
bis(2-chloroethyl)ether	4	270
2-Chlorophenol	4	270
2-Methylphenol	4	270
2,2'-oxybis(1-Chloropropane)	4	270
Acetophenone	4	270
4-Methylphenol	4	270
N-Nitroso-di-n-propylamine	4	270
Hexachloroethane	4	270
Nitrobenzene	4	270
Isophorone	4	270
2-Nitrophenol	4	270
2,4-Dimethylphenol	4	270
bis(2-chloroethoxy)methane	4	270
2,4-Dichlorophenol	4	270
Naphthalene	4	270
4-Chloroaniline	4	270
Hexachlorobutadiene	4	270
Caprolactum	4	270
4-Chloro-3-methylphenol	5	270
2-Methylnapthalene	4	270
Hexachlorocyclopentadiene	4	670
2,4,6-Trichlorophenol	4	270
2,4,5-Trichlorophenol	10	1700
1,1'-Biphenyl	4	270
2-Chloronaphthalene	4	270
2-Nitroaniline	4	1700
Dimethylphthalate	4	270
2,6-Dinitrotoluene	4	270
Acenaphthylene	4	270
3-Nitroaniline	4	1700
Acenaphthene	4	270
2,4-Dinitrophenol	25	1700
4-Nitrophenol	10	1700
Dibenzofuran	4	270
2,4-Dinitrotoluene	4	270
Diethylphthalate	4	270
Fluorene	4	270
4-Chlorophenyl-phenyl ether	4	270
4-Nitroaniline	4	270
4,6-Dinitro-2-methylphenol	25	1700
N-Nitrosodiphenylamine	4	270

See last page for footnotes.

Table B-3B. Compound List and RLs for Water and Soil SVOC Analysis, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

Compound	Target Reporting Limits	
	Water (ug/L)	Soil (ug/kg)
4-Bromophenyl-phenylether	4	270
Hexachlorobenzene	4	270
Atrazine	4	330
Pentachlorophenol	25	1700
Phenanthrene	4	270
Anthracene	4	270
Carbazole	4	270
Di-n-butylphthalate	4	270
Fluoranthene	4	270
Pyrene	4	270
Butylbenzylphthalate	4	270
3,3'-Dichlorobenzidine	4	670
Benzo(a)anthracene	4	270
Chrysene	4	270
bis(2-ethylhexyl)phthalate	4	270
Di-n-octylphthalate	4	270
Benzo(b)fluoranthene	4	270
Benzo(k)fluoranthene	4	270
Benzo(a)pyrene	4	270
Indeno(1,2,3-cd)pyrene	4	270
Dibenzo(a,h)anthracene	4	270
Benzo(g,h,i)perylene	4	270

1. Compound list refers to USEPA Contract Laboratory Program Statement of Work OLM04.2 TCL for Semi-Volatile Compounds.

RLs	Reporting Limits.
SVOC	Semi-Volatile Organic Compound.
TCL	Target Compound List.
ug/L	Micrograms per liter.
ug/kg	Micrograms per kilogram.

Table B-3C. Compound List and RLs for Water and Soil Pesticide Analysis, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

Compound	Target Reporting Limits	
	Water (ug/L)	Soil (ug/kg)
alpha-BHC	0.05	1.7
beta-BHC	0.05	1.7
delta-BHC	0.05	1.7
gamma-BHC (Lindane)	0.05	1.7
Heptachlor	0.05	1.7
Aldrin	0.05	1.7
Heptachlor epoxide	0.05	1.7
Endosulfan I	0.05	1.7
Dieldrin	0.1	3.3
4,4'-DDE	0.1	3.3
Endrin	0.1	3.3
Endosulfan II	0.1	3.3
4,4'-DDD	0.1	3.3
Endosulfan sulfate	0.1	3.3
4,4'-DDT	0.1	3.3
Methoxychlor	0.5	17
Endrin ketone	0.1	3.3
Endrin aldehyde	0.1	3.3
alpha-Chlordane	0.05	1.7
gamma-Chlordane	0.05	1.7
Toxaphene	2.5	83

1. Compound list refers to USEPA Contract Laboratory Program Statement of Work OLM04.2 TCL for Pesticides.

RLs Reporting Limits.
TCL Target Compound List.
ug/L Micrograms per liter.
ug/kg Micrograms per kilogram.

Table B-3D. Compound List and RLs for Water and Soil PCB Analysis, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

Compound	Target Reporting Limits	
	Water (ug/L)	Soil (ug/kg)
Aroclor-1016	0.5	17
Aroclor-1221	1	33
Aroclor-1232	0.5	17
Aroclor-1242	0.5	17
Aroclor-1248	0.5	17
Aroclor-1254	0.5	17
Aroclor-1260	0.5	17

1. Compound list refers to USEPA Contract Laboratory Program Statement of Work OLM04.2 TCL for Aroclors.

RLs Reporting Limits.
TCL Target Compound List.
ug/L Micrograms per liter.
ug/kg Micrograms per kilogram.

Table B-3E. Analyte List and RLs for Water and Soil Metals Analysis, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

Analyte	Target Reporting Limits	
	Water (ug/L)	Soil (mg/kg)
Aluminum	500	100
Antimony	40	10
Arsenic	20	5
Barium	10	2
Beryllium	10	2
Cadmium	10	5
Calcium	500	200
Chromium	10	3
Cobalt	10	2
Copper	10	5
Iron	250	60
Lead	10	5
Magnesium	500	35
Manganese	15	6
Mercury	0.2	0.05
Nickel	10	5
Potassium	500	200
Selenium	30	10
Silver	10	3
Sodium	500	200
Thallium	30	7
Vanadium	10	4
Zinc	50	20

1. Analyte list refers to USEPA Contract Laboratory Program Statement of Work ILM04.1 TAL for Metals.

RLs Reporting Limits.
TAL Target Analyte List.
ug/L Micrograms per liter.
mg/kg Milligrams per kilogram.

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Table B-3F. Compound List and RLs for Water and Soil Cyanide Analysis, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

Analyte	Target Reporting Limits	
	Water (ug/L)	Soil (mg/kg)
Free Cyanide	10	0.06

RLs Reporting Limits.
ug/L Micrograms per liter.
mg/kg Milligrams per kilogram.

Table B-3G. Compound List and RLs for Soil Vapor and Indoor Air Analysis, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

	Target Reporting Limits	
Compound	**(ppbv)**	**(ug/m^3)**
Acetone (2-propanone)	5.0	12
Benzene	0.20	0.64
Bromodichloromethane	0.20	1.3
Bromoethene	0.20	0.87
Bromoform	0.20	2.1
Bromomethane (Methyl bromide)	0.20	0.78
1,3-Butadiene	0.20	0.49
2-Butanone (Methyl ethyl ketone)	0.50	1.5
Carbon disulfide	0.50	1.6
Carbon tetrachloride	0.20	1.3
Chlorobenzene	0.20	0.92
Chloroethane	0.20	0.53
Chloroform	0.20	0.98
Chloromethane (Methyl chloride)	0.20	0.41
3-Chloropropene (allyl chloride)	0.20	0.63
2-Chlorotoluene (o-Chlorotoluene)	0.20	1.04
Cyclohexane	0.20	0.69
Dibromochloromethane	0.20	2.0
1,2-Dibromoethane	0.20	1.5
1,2-Dichlorobenzene	0.20	1.2
1,3-Dichlorobenzene	0.20	1.2
1,4-Dichlorobenzene	0.20	1.2
Dichlorodifluoromethane (Freon 12)	0.20	0.99
1,1-Dichloroethane	0.20	0.81
1,2-Dichloroethane	0.20	0.81
1,1-Dichloroethene	0.20	0.79
cis-1,2-Dichloroethene	0.20	0.79
trans-1,2-Dichloroethene	0.20	0.79
1,2-Dichloropropane	0.20	0.92
cis-1,3-Dichloropropene	0.20	0.91
trans-1,3-Dichloropropene	0.20	0.91
1,2-Dichlorotetrafluoroethane (Freon 114)	0.20	1.4
1,4-Dioxane	5.0	18
Ethylbenzene	0.20	0.87
4-Ethyltoluene (p-Etyltoluene)	0.20	0.98
n-Heptane	0.20	0.83
Hexachlorobutadiene	0.20	2.1
n-Hexane	0.20	0.70
Isopropyl Alcohol	5.0	12.5
Methylene chloride	0.50	1.7
Methyl Butyl Ketone (2-Hexanone)	0.50	2.05
4-Methyl-2-pentanone (MIBK)	0.50	2.05
Methyl tert-Butyl Ether (MTBE)	0.50	1.8
Styrene	0.20	0.85
Tertiary butyl alcohol (TBA)	5.0	15
1,1,2,2-Tetrachloroethane	0.20	1.4
Tetrachloroethene (PCE)	0.20	1.4
Toluene	0.20	0.75
1,2,4-Trichlorobenzene	0.50	3.7
1,1,1-Trichloroethane	0.20	1.1
1,1,2-Trichloroethane	0.20	1.1
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	0.20	1.5
Trichloroethene (TCE)	0.20	1.07
Trichlorofluoromethane (Freon 11)	0.20	1.1
1,2,4-Trimethylbenzene	0.20	0.98

See footnotes on last page.

Table B-3G. Compound List and RLs for Soil Vapor and Indoor Air Analysis, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

	Target Reporting Limits	
Compound	**(ppbv)**	**(ug/m^3)**
1,3,5-Trimethylbenzene	0.20	0.98
2,2,4-Trimethylpentane	0.20	1.08
Vinyl Chloride	0.20	0.51
Xylenes (m&p)	0.20	0.87
Xylenes (o)	0.20	0.87
Additional Compounds		
1,2,3-Trimethylbenzene	0.20	0.98
Naphthalene	0.50	2.9
1-Methylnaphthalene	2.5	14.5
2-Methylnaphthalene	2.5	14.5
1,2,4,5-Tetramethylbenzene	2.5	13.7
Indene	2.0	9.5
Indane	2.0	9.7
Thiopene	2.0	6.9

RLs Reporting Limits.
VOC Volatile Organic Compound.
ppbv Parts per billion by volume.
ug/m^3 Micrograms per cubic meter.

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Table B-4A. VOC Analytical QC Limits, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

	% Recovery		RPD	
	Water	Soil/Sediment	Water	Soil/Sediment
VOC Surrogate Recovery Limits				
Compound [1]				
1,2-Dichloroethane-d4	76-114	70-121	----	----
Toluene-d8	88-110	84-138	----	----
4-Bromofluorobenzene	86-115	59-113	----	----
LCS (Blank) and Matrix Spike Recovery and RPD Limits				
Compound				
1,1-Dichloroethene	61-145	59-172	14	22
Trichloroethene 71-120 14	71-120	62-137	14	24
Benzene	76-127	66-142	11	21
Toluene 76-125 13	76-125	59-139	13	21
Chlorobenzene	75-130	60-133	13	21

1 The recovery limits for any of the compounds listed above may be expanded at any time during the period of performance if USEPA determines that the limits are too restrictive.

See NYSDEC Revision 2005 for additional method performance criteria.

VOC Volatile Organic Compound.

QC Quality Control.

LCS Laboratory Control Sample or Blank Spike.

RPD Relative Percent Difference.

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Table B-4B. SVOC Analytical QC Limits, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

	% Recovery		RPD	
	Water	Soil/Sediment	Water	Soil/Sediment
SVOC Surrogate Recovery Limits				
Compound				
Nitrobenzene-d5 (Base/Neutral)	35-114	23-120	----	----
2-Fluorobiphenyl (Base/Neutral)	43-116	30-115	----	----
Terphenyl-d14 (Base/Neutral)	33-141	18-137	----	----
Phenol-d5 (Acid)	10-110	24-113	----	----
2-Fluorophenol (Acid)	21-110	25-121	----	----
2,4,6-Tribromophenol (Acid)	10-123	19-122	----	----
2-Chlorophenol-d4 (Acid)	33-110 (advisory)	20-130 (advisory)	----	----
1,2-Dichlorobenzene-d4 (Base/Neutral)	16-110 (advisory)	20-130 (advisory)	----	----
LCS (Blank) and Matrix Spike Recovery and RPD Limits				
Compound				
Phenol	12-110	26-90	42	35
2-Chlorophenol	27-123	25-102	40	50
N-Nitroso-di-n-propylamine	41-116	41-126	38	38
4-Chloro-3-methylphenol	23-97	26-103	42	33
Acenaphthene	46-118	31-137	31	19
4-Nitrophenol	10-80	11-114	50	50
2,4-Dinitrotoluene	24-96	28-89	38	47
Pentachlorophenol	9-103	17-109	50	47
Pyrene	26-127	35-142	31	36

See NYSDEC Revision 2005 for additional method performance criteria.

SVOC Semi-Volatile Organic Compound.
QC Quality Control.
LCS Laboratory Control Sample or Blank Spike.
RPD Relative Percent Difference.

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Table B-4C. Organochlorine Pesticide Analytical QC Limits, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

	% Recovery		RPD	
	Water	Soil/Sediment	Water	Soil/Sediment
Surrogate Recovery Limits				
Compound				
Tetrachloro-m-xylene (TCMX)	30-150	30-150	----	----
Decachlorobiphenyl (DCB)	30-150	30-150	----	----
LCS Recovery Limits				
Compound [1]				
gamma-BHC	50-120	50-120	----	----
Heptachlor epoxide	50-150	50-150	----	----
Dieldrin	30-130	30-130	----	----
4,4'-DDE	50-150	50-150	----	----
Endrin	50-120	50-120	----	----
Endosulfan sulfate	50-120	50-120	----	----
gamma-Chlordane	30-130	30-130	----	----
Matrix Spike Recovery and RPD Limits				
gamma-BHC (Lindane)	56-123	46-127	15	50
Heptachlor	40-131	35-130	20	31
Aldrin	40-120	34-132	22	43
Dieldrin	52-123	31-134	18	38
Endrin	56-121	42-139	21	45
4,4'-DDT	38-127	23-134	27	50

1 The recovery limits for any of the compounds listed in the LCS may be expanded at any time during the period of performance if USEPA determines that the limits are too restrictive.

See NYSDEC Revision 2005 for additional method performance criteria.

QC Quality Control.

LCS Laboratory Control Sample.

RPD Relative Percent Difference.

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Table B-4D. PCBs as Aroclors Analytical QC Limits, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

	% Recovery		RPD	
	Water	Soil/Sediment	Water	Soil/Sediment
Surrogate Recovery Limits				
Compound				
Tetrachloro-m-xylene (TCMX)	30-150	30-150	----	----
Decachlorobiphenyl (DCB)	30-150	30-150	----	----
LCS Recovery Limits				
Compound				
Aroclor 1016	50-120	50-120	----	----
Aroclor 1260	50-150	50-150	----	----
Matrix Spike Recovery and RPD Limits				
Aroclor 1016	29-135	29-135	15	15
Aroclor 1260	29-135	29-135	20	20

See NYSDEC Revision 2005 for additional method performance criteria.

PCBs Polychlorinated Biphenyls.
QC Quality Control.
LCS Laboratory Control Sample.
RPD Relative Percent Difference.

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Table B-4E. Metals and Cyanide Analytical QC Limits, Quality Assurance Project Plan (QAPP), SC Work Plan, Former Dangman Park Manufactured Gas Plant Site, Brooklyn, New York.

	% Recovery		RPD	
	Water	Soil/Sediment	Water	Soil/Sediment
QC Acceptance Criteria for Mercury				
Initial Precision and Recovery (IPR)	79-121	79-121	----	----
Ongoing Precision and Recovery (OPR)	77-123	77-123	----	----
Matrix Spike/Matrix Spike Duplicate (MS/MSD)				
Mercury	71-125	71-125	24	24
QC Acceptance Criteria for Other Metals				
CRQL Check Standard				
Antimony, Lead, Thallium	50-150	50-150	----	----
All others	70-130	70-130	----	----
LCS				
All metals except Antimony and Silver	80-120	80-120	----	----
Laboratory Duplicate				
All Metals	----	----	20	20
Matrix Spike				
All Metals	75-125	75-125	----	----
Post Digestion Spikes				
All Metals	75-125	75-125	----	----
QC Acceptance Criteria for Cyanide				
CRQL Check Standard				
Cyanide	70-130	70-130	----	----
Continuing Calibration Verification				
Cyanide	85-115	85-115	----	----
LCS				
Cyanide	75-125	75-125	----	----
Laboratory Duplicate				
Cyanide	----	----	20	20
Matrix Spike				
Cyanide	75-125	75-125	----	----

See footnotes on last page.
Above control limits may not apply if the native sample concentration exceeds 4 times the spike concentration.
See NYSDEC Revision 2005 for additional method performance criteria.

QC Quality Control.
CRQL Contract Required Quantitation Limit.
LCS Laboratory Control Sample.
RPD Relative Percent Difference.

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Attachment B-1

Project Organizational Chart

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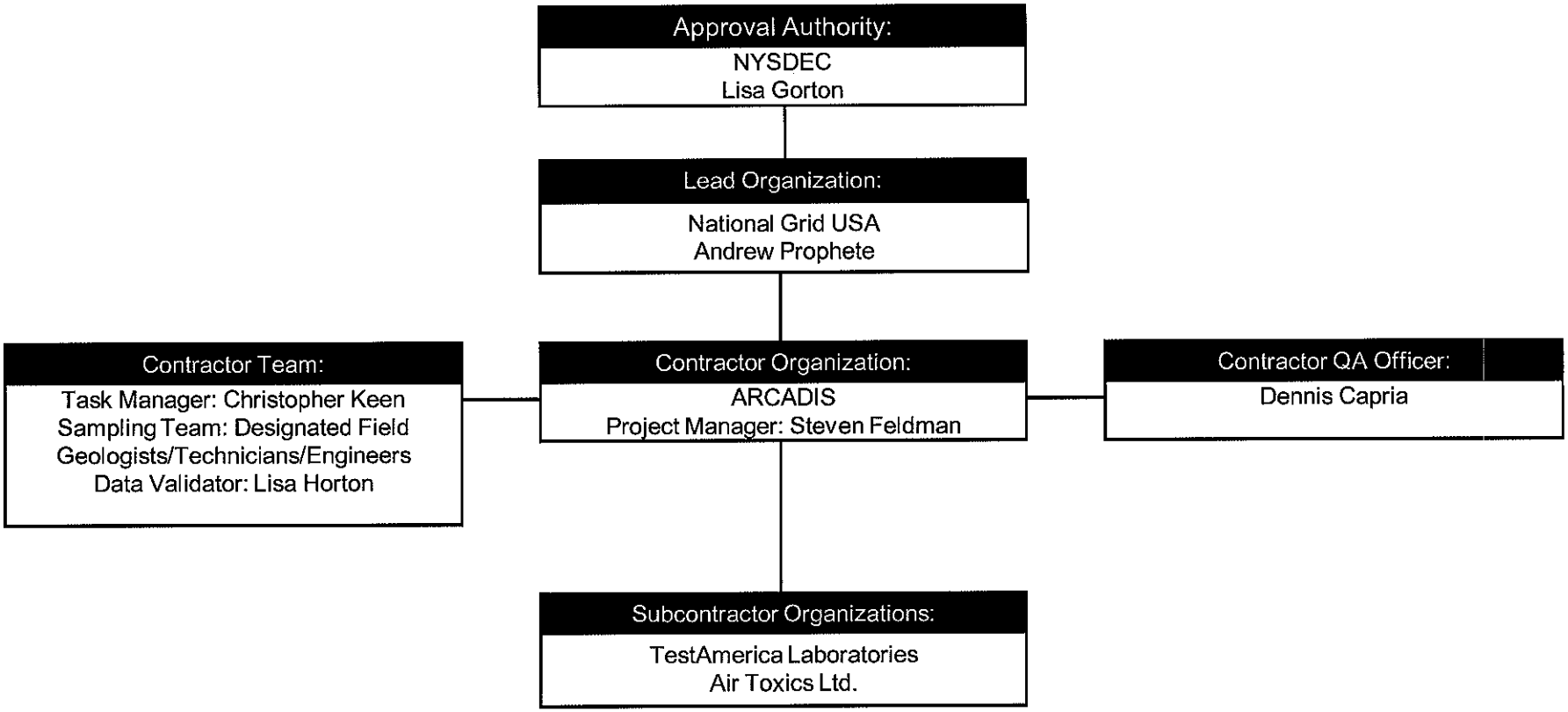
Project Organizational Chart
Former Dangman Park MGP Site
Brooklyn, NY



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Attachment B-2

Field Forms

ARCADIS

Sample/Core Log

Boring/Well _____ Project Name/No. _____ Page ____ of ____

Site Location _____ Drilling Started _____ Drilling Completed _____

Total Depth Drilled _____ feet Hole Diameter _____ inches Type of Sample/ Coring Device _____

Length and Diameter of Coring Device _____ Sampling Interval _____ feet

Land Surface Elev. _____ feet ☐ Surveyed ☐ Estimated Datum _____

Drilling Method _____ Drilling Fluid Used _____

Drilling Contractor _____ Driller _____ Helper _____

Prepared By _____ Hammer Weight _____ pounds Hammer Drop _____ inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description	PID (ppm)

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Sample/Core Log (Cont.d)

Boring/Well ____________________

Prepared by ____________________

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description	PID (ppm)

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Infrastructure, environment, facilities

Low-Flow Groundwater Sampling Log

Project _____

Project Number _____ Site Location _____ Well ID _____

Date _____ Sampled By _____

Sampling Time _____ Recorded By _____

Weather _____ Coded Replicate No. _____

Instrument Identification

Water Quality Meter(s) _____ Serial # _____

Casing Material _____ Purge Method _____

Casing Diameter _____ Screen Interval (ft bmp) Top _____ Bottom _____

Sounded Depth (ft bmp) _____ Pump Intake Depth (ft bmp) _____ _____

Depth to Water (ft bmp) _____ Purge Time Start _____ Finish _____

Field Parameter Measurements During Purging

Time	Minutes Elasped	Flow Rate (mL/min)	Volume Purged	Temp (°C)	pH (s.u.)	Conductivity (umhos or mS/cm) [1]	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Depth to Water (ft bmp)

Collected Sample Condition Color _____ Odor _____ Appearance _____

Parameter	Container	No.	Preservative

PID Reading _____

Comments _____

1) Circle one unit type

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Page ______ of ______

Water Level Record

Project Name/No. ____ Date ______________

Well(s)	Depth to Water (ft bmp)	Time	Remarks

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INSTRUMENT CALIBRATION FORM

Project _____

Project No. _____

Site Location _____

Date _____

Time _____

Prepared by _____

☐ pH/Cond/Temp Meter
Model
Serial No.

☐ Turbidity Meter
Model
Serial No.

☐ DO Meter
Model
Serial No.

☐ ORP Meter
Model
Serial No.

☐ Multi-Parameter Meter
Model
Serial No.

☐ PID
Model
Serial No.

Check appropriate box for equipment calibrated. If two similar items are calibrated, please note two checks under calibration successful

PID (ppm)	Value	Calibration Successful
Zero		
Span		

pH (SU)	Value	Calibration Successful
4.00		
7.00		
10.00		

Conductivity (mS)	Value	Calibration Successful
_____ mS		
_____ mS		
Other		

Turbidity (NTU)	Value	Calibration Successful
1 NTU		
10 NTU		
Other		
Other		

DO	Calibration Successful
100% Saturated Air	
Barometer Adjustment	
Elevation Adjustment	

* ORP (mV)	Calibration Successful
Hydroquinone (240) (Black)	
Zobel Solution (237) (yellow)	
Temperature Based Chart Calibration	
* Adjusted	

*** No adjustment on some meters just a probe check, others are adjustable**

nationalgrid **Sub-slab Vapor (Canister) Sample Collection Field Form**

Project # _____ Consultant _____

Project Name _____ Collector _____

Sample ID _____ Vacuum gauge "zero" ("Hg) _____

Start Date/Time _____ Start Pressure ("Hg) _____

End Date/Time _____ End Pressure ("Hg) _____

Canister ID _____ End pressure > "zero"? _____

Flow controller ID _____ Sampling duration (intended) _____

Associated indoor air sample ID _____ Associated ambient air sample ID _____

Tubing type used _____ Length of tubing _____ cm Tubing volume _____ cc

Volume purged _____ cc @ _____ min 1 to 3 volumes purged @ < 200cc/min? _____

Weather Conditions at Start of Sampling:

Air temperature (°F) _____ Rainfall _____ Wind direction _____

Barometric pressure _____ Wind speed (mph) _____

Substantial changes in weather conditions during sampling or over the past 24 to 48 hrs:

_____

_____

Indoor air temp (°F) _____ Indoor relative humidity (%) _____

Building Survey and Chemical Inventory Form Completed? _____ Photograph IDs _____

Floor Plan showing sample location, HVAC equipment, indoor air sources, preferential pathways

Comments: _____

nationalgrid

Indoor Air (Canister) Sample Collection Field Form

Project # _____ Consultant _____

Project Name _____ Collector _____

Sample ID _____ Vacuum gauge "zero" ("Hg) _____

Start Date/Time _____ Start Pressure ("Hg) _____

End Date/Time _____ End Pressure ("Hg) _____

Canister ID _____ End pressure > "zero"? _____

Flow controller ID _____ Sampling duration (intended) _____

Associated ambient air sample ID _____ Associated sub-slab vapor sample ID _____

Tubing type used _____ Length of tubing _____ cm Tubing volume _____ cc

Volume purged _____ cc @ _____ min 1 to 3 volumes purged @ < 200cc/min? _____

Weather Conditions at Start of Sampling:

Air temperature (°F) _____ Rainfall _____ Wind direction _____

Barometric pressure _____ Relative humidity _____ Wind speed (mph) _____

Substantial changes in weather conditions during sampling or over the past 24 to 48 hrs:

_____

_____

Indoor air temp (°F) _____ Indoor relative humidity (%) _____

Building Survey and Chemical Inventory Form Completed? _____ Photograph IDs _____

Floor Plan showing sample location, HVAC equipment, indoor air sources, preferential pathways

Comments: _____

nationalgrid

Ambient Air (Canister) Sample Collection Field Form

Project # _____ Consultant _____

Project Name _____ Collector _____

Sample ID _____ Vacuum gauge "zero" ("Hg) _____

Start Date/Time _____ Start Pressure ("Hg) _____

End Date/Time _____ End Pressure ("Hg) _____

Canister ID _____ End pressure > "zero"? _____

Flow controller ID _____ Sampling duration (intended) _____

Tubing type used _____ Length of tubing _____ cm Tubing volume _____ cc

Volume purged _____ cc @ _____ min 1 to 3 volumes purged @ < 200cc/min? _____

Weather Conditions at Start of Sampling:

Air temperature (°F) _____ Rainfall _____ Wind direction _____

Barometric pressure _____ Relative humidity _____ Wind speed (mph) _____

Substantial changes in weather conditions during sampling or over the past 24 to 48 hrs:

_____

_____

Site Plan showing sample location, building(s) being sampled, building HVAC inlet, outdoor air sources, wind direction

Comments: _____

_____

_____

_____

_____

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Soil Vapor (Canister) Sample Collection Field Form

Project # _____ Consultant _____

Project Name _____ Collector _____

Sample ID _____

Vacuum gauge "zero" ("Hg) _____

Start Date/Time _____ Start Pressure ("Hg) _____

End Date/Time _____ End Pressure ("Hg) _____

Canister ID _____ End pressure > "zero"? _____

Flow controller ID _____ Sampling duration (intended) _____

Associated ambient air sample ID _____ Depth of sample point below grade _____

Tubing type used _____ Length of tubing _____ cm Tubing volume _____ cc

Volume purged _____ cc @ _____ min 1 to 3 volumes purged @ < 200cc/min? _____

Chamber tracer gas conc. _____ Tracer gas conc. during purging _____

Weather Conditions during Probe Installation:

Air temperature (°F) _____ Rainfall _____ Wind direction _____

Barometric pressure _____ Wind speed (mph) _____

Substantial changes in weather conditions during sampling or over the past 24 to 48 hrs:

Weather Conditions at Start of Sampling:

Air temperature (°F) _____ Rainfall _____ Wind direction _____

Barometric pressure _____ Wind speed (mph) _____

Substantial changes in weather conditions during sampling or over the past 24 to 48 hrs:

Site Plan showing sample location, buildings, landmarks, potential soil vapor and outdoor air sources, preferential pathways

Comments: _____

NEW YORK STATE DEPARTMENT OF HEALTH
INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY
CENTER FOR ENVIRONMENTAL HEALTH

This form must be completed for each residence involved in indoor air testing.

Preparer's Name _____ Date/Time Prepared _____

Preparer's Affiliation _____ Phone No._____

Purpose of Investigation_____

1. OCCUPANT:

Interviewed: Y / N

Last Name: _____ First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

Number of Occupants/persons at this location _____ Age of Occupants _____

2. OWNER OR LANDLORD: (Check if same as occupant ___)

Interviewed: Y / N

Last Name: _____First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

3. BUILDING CHARACTERISTICS

Type of Building: (Circle appropriate response)

Residential	School	Commercial/Multi-use
Industrial	Church	Other: _____

If the property is residential, type? (Circle appropriate response)

Ranch	2-Family	3-Family
Raised Ranch	Split Level	Colonial
Cape Cod	Contemporary	Mobile Home
Duplex	Apartment House	Townhouses/Condos
Modular	Log Home	Other:_____

If multiple units, how many? _____

If the property is commercial, type?

Business Type(s) _____

Does it include residences (i.e., multi-use)? Y / N If yes, how many? _____

Other characteristics:

Number of floors_____ Building age_____

Is the building insulated? Y / N How air tight? Tight / Average / Not Tight

4. AIRFLOW

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow between floors

_____

_____

_____

Airflow near source

_____

_____

_____

Outdoor air infiltration

_____

_____

_____

Infiltration into air ducts

_____

_____

_____

5. **BASEMENT AND CONSTRUCTION CHARACTERISTICS** (Circle all that apply)

a. Above grade construction:	wood frame	concrete	stone	brick
b. Basement type:	full	crawlspace	slab	other _____
c. Basement floor:	concrete	dirt	stone	other _____
d. Basement floor:	uncovered	covered	covered with _____	
e. Concrete floor:	unsealed	sealed	sealed with _____	
f. Foundation walls:	poured	block	stone	other _____
g. Foundation walls:	unsealed	sealed	sealed with _____	
h. The basement is:	wet	damp	dry	moldy
i. The basement is:	finished	unfinished	partially finished	
j. Sump present?	Y / N			
k. Water in sump?	Y / N / not applicable			

Basement/Lowest level depth below grade: _____(feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

_____

_____

6. **HEATING, VENTING and AIR CONDITIONING** (Circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

Hot air circulation	Heat pump	Hot water baseboard	
Space Heaters	Stream radiation	Radiant floor	
Electric baseboard	Wood stove	Outdoor wood boiler	Other _____

The primary type of fuel used is:

Natural Gas	Fuel Oil	Kerosene
Electric	Propane	Solar
Wood	Coal	

Domestic hot water tank fueled by: _____

Boiler/furnace located in:	Basement	Outdoors	Main Floor	Other_____
Air conditioning:	Central Air	Window units	Open Windows	None

Are there air distribution ducts present? Y / N

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

_____

_____

_____

_____

7. OCCUPANCY

Is basement/lowest level occupied? Full-time Occasionally Seldom Almost Never

Level	**General Use of Each Floor (e.g., familyroom, bedroom, laundry, workshop, storage)**
Basement	_____
1st Floor	_____
2nd Floor	_____
3rd Floor	_____
4th Floor	_____

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? Y / N

b. Does the garage have a separate heating unit? Y / N / NA

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, atv, car) Y / N / NA Please specify_____

d. Has the building ever had a fire? Y / N When?_____

e. Is a kerosene or unvented gas space heater present? Y / N Where? _____

f. Is there a workshop or hobby/craft area? Y / N Where & Type? _____

g. Is there smoking in the building? Y / N How frequently? _____

h. Have cleaning products been used recently? Y / N When & Type? _____

i. Have cosmetic products been used recently? Y / N When & Type? _____

j. Has painting/staining been done in the last 6 months? Y / N Where & When? _____

k. Is there new carpet, drapes or other textiles? Y / N Where & When? _____

l. Have air fresheners been used recently? Y / N When & Type? _____

m. Is there a kitchen exhaust fan? Y / N If yes, where vented? _____

n. Is there a bathroom exhaust fan? Y / N If yes, where vented? _____

o. Is there a clothes dryer? Y / N If yes, is it vented outside? Y / N

p. Has there been a pesticide application? Y / N When & Type? _____

Are there odors in the building? Y / N
If yes, please describe: _____

Do any of the building occupants use solvents at work? Y / N
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist

If yes, what types of solvents are used? _____

If yes, are their clothes washed at work? Y / N

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, use dry-cleaning regularly (weekly) No
Yes, use dry-cleaning infrequently (monthly or less) Unknown
Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Y / N Date of Installation: _____
Is the system active or passive? Active/Passive

9. WATER AND SEWAGE

Water Supply:	Public Water	Drilled Well	Driven Well	Dug Well	Other: _____
Sewage Disposal:	Public Sewer	Septic Tank	Leach Field	Dry Well	Other: _____

10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: _____

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel

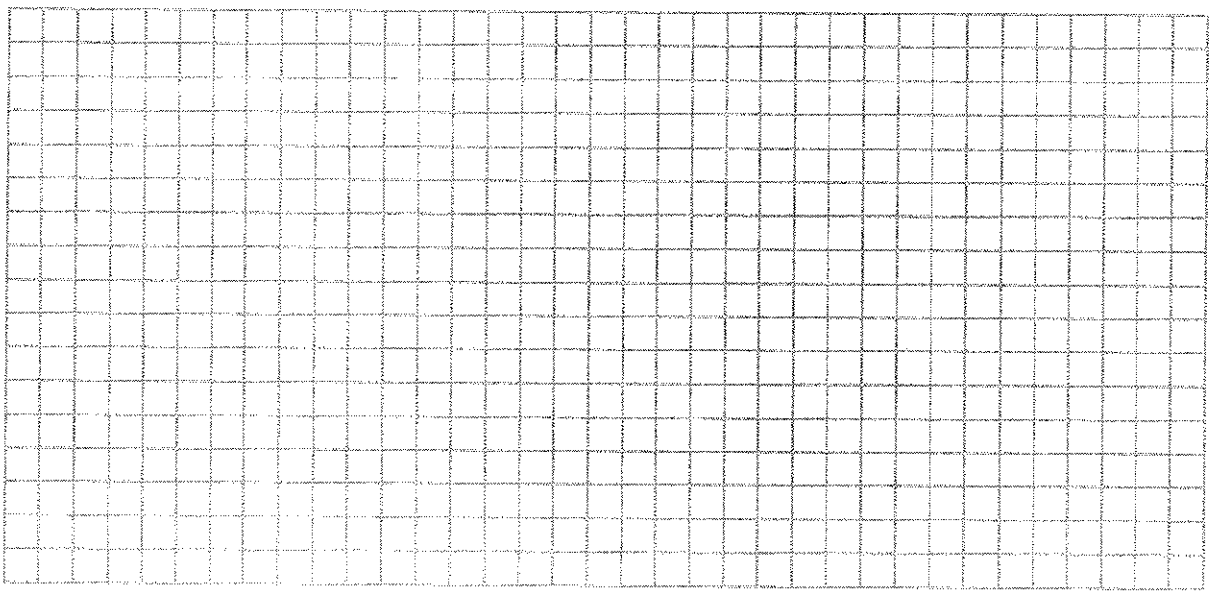
c. Responsibility for costs associated with reimbursement explained? Y / N

d. Relocation package provided and explained to residents? Y / N

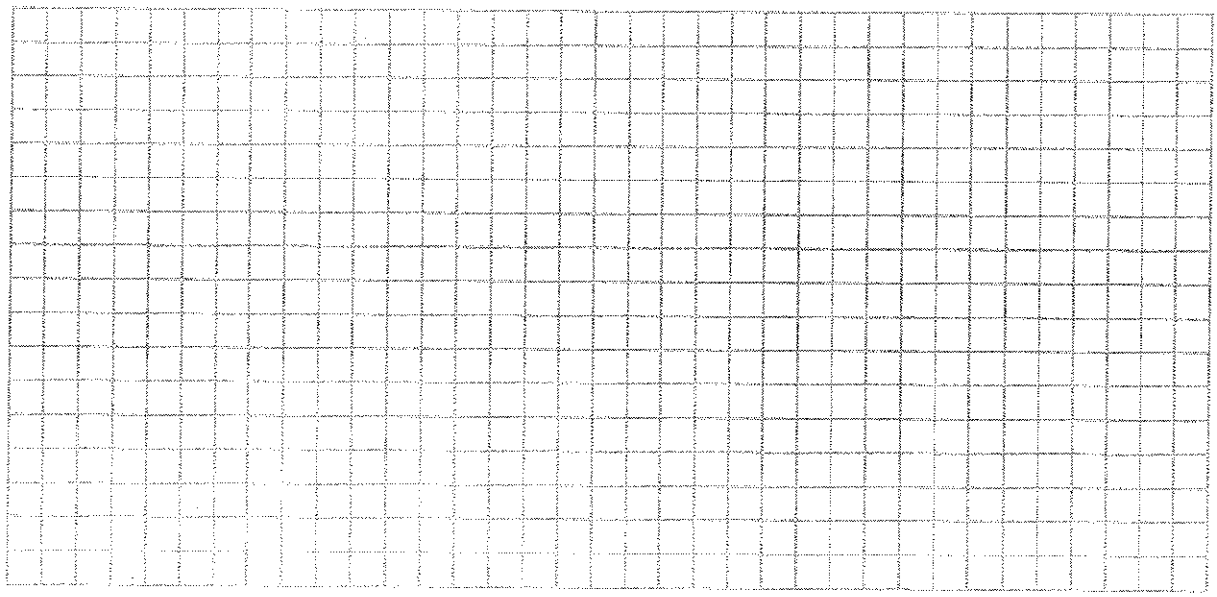
11. FLOOR PLANS

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Basement:



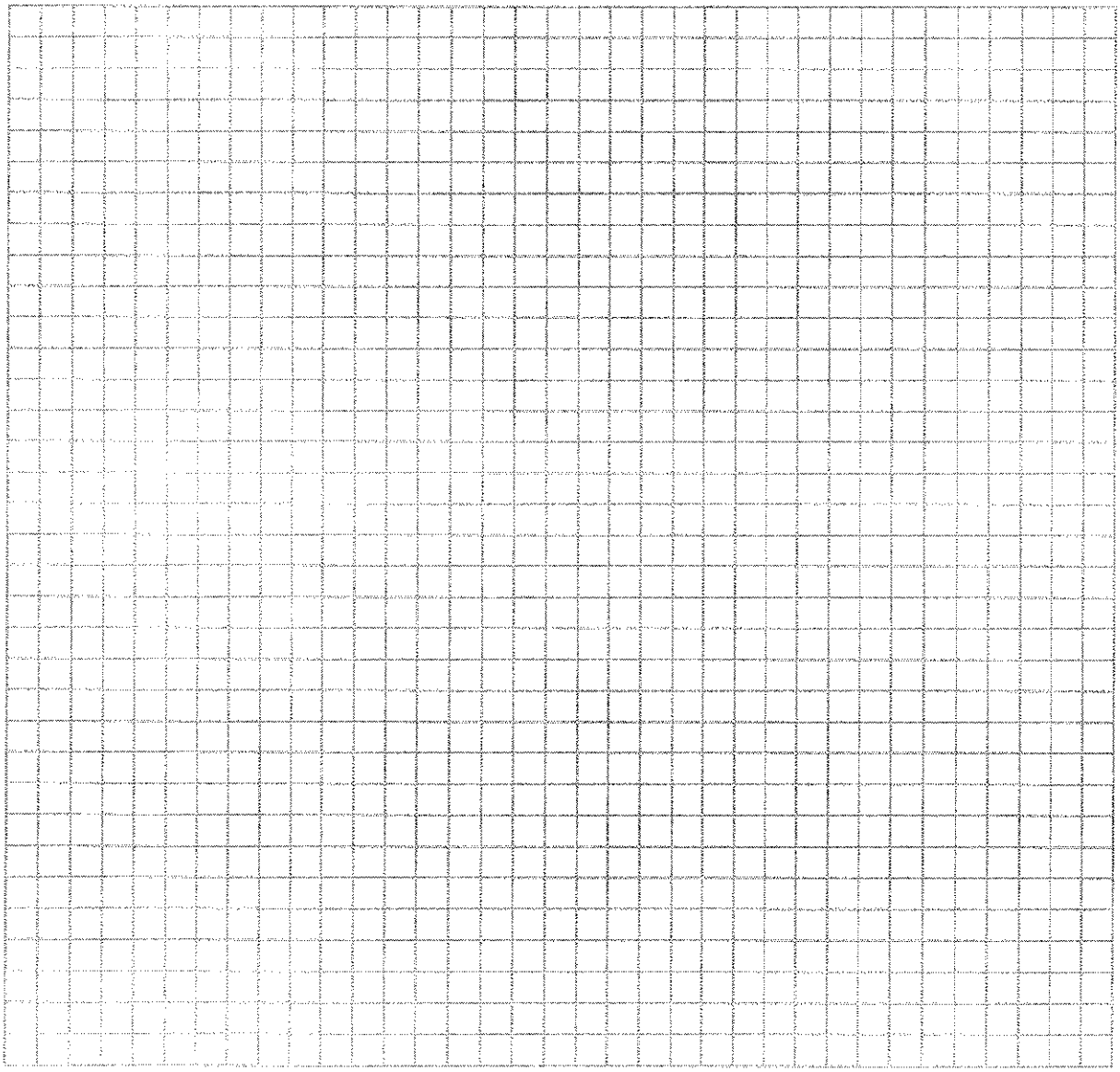
First Floor:



12. OUTDOOR PLOT

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s) and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system, if applicable, and a qualifying statement to help locate the site on a topographic map.



13. PRODUCT INVENTORY FORM

Make & Model of field instrument used: _____

List specific products found in the residence that have the potential to affect indoor air quality.

Location	Product Description	Size (units)	Condition*	Chemical Ingredients	Field Instrument Reading (units)	Photo ** Y / N

* Describe the condition of the product containers as **Unopened (UO), Used (U),** or **Deteriorated (D)**
** Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

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Attachment B-3

Chain-of-Custody Form

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Laboratory Task Order No./P.O. No. _____ **CHAIN-OF-CUSTODY RECORD** Page _____ of _____

Project Number/Name _____

Project Location _____

Laboratory _____

Project Manager _____

Sampler(s)/Affiliation _____

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	ANALYSIS / METHOD / SIZE						Remarks	Total
										Total No. of Bottles/ Containers	

Sample Matrix: L = Liquid; S = Solid; A = Air

Relinquished by: _____	Organization: _____	Date ___/___/___	Time _____	Seal Intact?
Received by: _____	Organization: _____	Date ___/___/___	Time _____	Yes No N/A
Relinquished by: _____	Organization: _____	Date ___/___/___	Time _____	Seal Intact?
Received by: _____	Organization: _____	Date ___/___/___	Time _____	Yes No N/A

Special Instructions/Remarks: _____

Delivery Method: ☐ In Person ☐ Common Carrier _____ (SPECIFY) ☐ Lab Courier ☐ Other _____ (SPECIFY)

AG 05-12/01

Air Toxics LTD.

CHAIN-OF-CUSTODY RECORD

Sample Transportation Notice

Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action, of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Project Manager _____

Collected by: (Print and Sign) _____

Company _____ Email _____

Address _____ City _____ State ____ Zip _____

Phone _____ Fax _____

Project Info:

P.O. # _____

Project # _____

Project Name _____

Turn Around Time:

❑ Normal

❑ Rush

_____ *specify*

Lab Use Only

Pressurized by: _____

Date: _____

Pressurization Gas: N_2 He

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum			
						Initial	Final	Receipt	Final (psi)

Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time
Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time
Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time

Notes:

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
					Yes No None	

Form 1293 rev.11

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Attachment B-4

Laboratory Quality Assurance Manual

Attachment B-5

Air Toxics Limited Quality Manual

ARCADIS

Appendix C

Community Air Monitoring Plan

ARCADIS
Infrastructure, environment, facilities

Imagine the result

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Appendix C
Community Air Monitoring Plan

Former Dangman Park Manufactured Gas Plant
Site
Brooklyn, New York
Site No. 224047
Index # A2-0552-0606

December 31, 2008

ARCADIS

Christopher D. Keen
Task Manager/Senior Scientist

Steven M. Feldman
Project Manager/Principal Scientist

Appendix C
Community Air Monitoring Plan

Former Dangman Park
Manufactured Gas Plant Site
Brooklyn, New York
Site No. 224047
Index # A2-0552-0606

Prepared for:
National Grid USA

Prepared by:
ARCADIS
Two Huntington Quadrangle
Suite 1S10
Melville
New York 11747
Tel 631.249.7600
Fax 631.249.7610

Our Ref.:
B0036704.0000.00001

Date:
December 31, 2008

1. Introduction

On behalf of National Grid USA (NGRID, formerly KeySpan Corporation [KeySpan]), ARCADIS has prepared this Community Air Monitoring Plan (CAMP) as a component of the Site Characterization (SC) Work Plan for the former Dangman Park Manufactured Gas Plant (MGP) site (Site) located at 486 Neptune Avenue, Brooklyn, New York. The CAMP fulfills the general requirements set forth by the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (Attachment C-1 of this CAMP) and the New York State Department of Environmental Conservation (NYSDEC) Technical and Administrative Guidance Memorandum (TAGM) #4031 "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites" (Attachment C-2 of this CAMP). The intent of this CAMP is to provide for a measure of protection of the downwind communities from potential airborne releases of constituents of concern during SC activities. As such, this CAMP specifies the potential air emissions, air monitoring procedures, monitoring schedule, and data collection and reporting for the SC activities to be conducted.

The CAMP should be used in conjunction with the SC Work Plan, the Field Sampling Plan (FSP), the Quality Assurance Project Plan (QAPP), and the Health and Safety Plan (HASP). The SC Work Plan presents the Site background and defines the field sampling program. The FSP describes the methods and procedures to be used for environmental sample collection during implementation of the investigation field activities. The QAPP presents the quality assurance/quality control (QA/QC) procedures to be used during implementation of the SC Work Plan, as well as a description of the general field and laboratory procedures. The FSP, QAPP, and HASP are provided in Appendices A, B, and D, respectively.

1.1 Site Description

The Site is located at 486 Neptune Avenue in the Borough of Brooklyn, New York City, Kings County, New York and is identified by Tax Map Number: Block 7273, Lots 1 and 25. As shown on Figure 1 of the SC Work Plan, the Site is located approximately 1,300 feet southeast of Coney Island Creek and approximately 2,400 feet north of New York Bay. The Site is generally flat with an elevation of approximately 6 feet above mean sea level (amsl). The closest natural surface water body is Coney Island Creek, which is located approximately 0.25 miles to the northwest of the Site.

The Site is located in the Coney Island community district of Brooklyn on approximately 4 acres of land, and is bounded by Neptune Avenue to the north, W. 5th Street to the

east, a residential parcel to the south, and a commercial parcel to the west. Currently, the Site is developed with a strip mall and a parking lot for a high-rise apartment building.

1.2 Summary of Site Investigation Activities

The proposed SC activities for the Site include subsurface soil sampling, monitoring well drilling, installation, and development, and groundwater sampling. A more detailed description of the investigation activities can be found in the SC Work Plan.

1.3 Potential Air Emissions Related to Investigation Activities

Certain intrusive SC activities to be conducted at the Site have the potential to generate localized impacts to air quality including drilling and subsurface soil sampling. Some non-intrusive SC activities to be conducted also have the potential to generate localized impacts to air quality and include the collection of groundwater samples.

1.4 Air/Odor Emissions and Control Measures

Air emissions control and fugitive dust suppression techniques will be used during the SC activities identified above, as necessary, to limit the air/odor emissions from the Site. Air monitoring will be conducted during both intrusive and non-intrusive Site activities.

Odor and dust control measures will be available at the Site and used when necessary. The following dust and odor suppression measures may be used during the SC activities, depending upon specific circumstances and air monitoring results:

- Water spray
- Polyethylene sheeting (for covering drill cuttings, soil stockpiles, etc.)
- Containerize drill cuttings and groundwater in 55-gallon drums with the cover secured

Odor and dust control measures will be implemented based on visual or olfactory observations, and the results of airborne particulate and volatile organic compound (VOC) monitoring.

2. Air Monitoring Procedures

Real-time air monitoring will be implemented at the Site for VOCs and particulate matter. Particulate monitoring will not be performed, however, during non-intrusive activities (i.e., groundwater sampling) and precipitation events. Upwind and downwind monitoring locations will be determined through visual observation (wind vane, windsock, or similar technique). Monitoring at each location will include the use of hand-held direct-reading survey instruments.

2.1 Monitoring Location Selection

Monitoring locations will be determined daily based on visual observation of a wind direction. A single upwind (background) location will be selected daily where both VOC and particulate monitoring will be conducted. This upwind location will be established at the start of each day before commencing investigation activities. Monitoring activities will continue at a downwind location throughout the day. If wind direction shifts radically during the day (greater than approximately +/- 60 degrees from original upwind) new upwind and downwind monitoring locations will be established. Any location changes will be documented in the field logbook.

2.2 VOCs and PAHs Monitoring

As required by the NYSDOH guidance for community air monitoring during intrusive activities, VOCs will be monitored continuously during intrusive Site activities (drilling of soil borings or installation of monitoring wells) with instrumentation that is equipped with electronic data-logging capabilities. Because real-time monitors for polycyclic aromatic hydrocarbons (PAHs) do not exist, the real-time VOC monitoring equipment will also serve as surrogate monitoring equipment for PAH emissions at the Site. A photoionization detector (PID) (MiniRAE 2000 [or equivalent]) will be used to conduct the real-time VOC and PAH monitoring. All 15-minute readings will be recorded in the field logbook, as well as any instantaneous readings collected to facilitate activity decisions.

During non-intrusive Site activities (monitoring well development, collection of groundwater samples from monitoring wells, and specific capacity testing), periodic VOC monitoring will be conducted. Periodic monitoring may include monitoring upon arrival at the sample location, while opening a well cap, during well bailing and/or purging, and/or prior to leaving a sample location. However, if a sampling location is

proximal to potentially exposed individuals, VOCs will be monitored continuously during sampling activities at that location.

2.3 Particulate Matter Monitoring

As required by the NYSDOH guidance, particulate matter will be monitored continuously during intrusive Site activities (drilling of soil borings or installation of monitoring wells) with instrumentation that is equipped with electronic data-logging capabilities. A particulate monitor (MIE DataRAM [or equivalent]) will be used to conduct the real-time monitoring of particulate matter less than 10 microns in size (PM-10). All 15-minute readings will be recorded in the field logbook, as well as any instantaneous readings collected to facilitate activity decisions.

Fugitive dust migration will be visually assessed during all work activities, and reasonable dust suppression techniques will be used during any Site activities that may generate fugitive dust. Fugitive dust control measures are discussed in Section 1.4 of this CAMP.

2.4 Action Levels

The action levels provided below are to be used to initiate response actions, if necessary, based on real-time monitoring.

2.4.1 Action Levels for VOCs and PAHs

As outlined in the NYSDOH CAMP guidance document, if the ambient air concentration of total VOCs exceeds 5 parts per million (ppm) above background (upwind location) for the 15-minute average, intrusive Site activities will be temporarily halted while monitoring continues. If the total VOC concentration readily decreases (through observation of instantaneous readings) below 5 ppm above background, then intrusive Site activities can resume with continuous monitoring.

If the ambient air concentrations of total VOCs persist at levels in excess of 5 ppm above background but are less than 25 ppm above background, intrusive Site activities will be halted, the source of the elevated VOC concentrations will be identified, corrective actions to reduce or abate the emissions will be undertaken, and air monitoring will be continued. Once these actions have been implemented, intrusive Site activities can resume provided that the following two conditions are met:

- The 15-minute average VOC concentrations remain below 5 ppm above background.

- The total VOC concentration 200 feet downwind of the sample location or half the distance to the nearest potential receptor or residential/commercial structure (whichever is less but in no case less than 20 feet) is below 5 ppm above background for the 15-minute average.

If the ambient air concentrations of total VOCs exceed 25 ppm above background, the intrusive Site activities must cease, and emissions control measures must be implemented.

Periodic monitoring for VOCs is required during non-intrusive activities. During these activities, ambient direct-reading (instantaneous) VOC data will be periodically collected at the location of the non-intrusive activity and recorded in the field activity logbooks.

2.4.2 Action Levels for PM-10

As required by the NYSDOH guidance, if the ambient air concentration of PM-10 at any one (or more) of the monitoring locations is noted at levels in excess of 100 micrograms per cubic meter ($\mu g/m^3$) above background (upwind location), or if airborne dust is observed leaving the work area, intrusive Site activities will be temporarily halted. The source of the elevated PM-10 concentration will be identified, corrective actions to reduce or abate the emissions will be undertaken, and air monitoring will be continued. Work may continue following the implementation of dust suppression techniques provided the PM-10 levels do not exceed 150 $\mu g/m^3$ above background.

If, after implementation of dust suppression techniques, PM-10 levels are greater than 150 $\mu g/m^3$ above background, work must be stopped and Site activities must be re-evaluated. Work may only resume provided that the dust suppression measures and other controls are successful in reducing PM-10 levels to less than 150 $\mu g/m^3$ above background and in preventing visible dust from leaving the Site.

If the ambient air concentration of PM-10 is above 150 $\mu g/m^3$ above background, the intrusive Site activities must cease and emissions control measures must be implemented.

2.5 Meteorological Monitoring

Wind direction is the only meteorological information considered relevant for the SC activities and CAMP. Meteorological monitoring will be conducted periodically at the Site using a windsock, wind vane, or other appropriate equipment. Wind direction will be established at the start of each work day and may be re-established at any time during the work day if a significant shift in wind direction is noted.

2.6 Instrument Calibration

Calibration of the VOC (PID) and PM-10 (particulate monitor) monitoring instrumentation will be performed in accordance with each of the equipment manufacturer's calibration and quality assurance requirements. The VOC and PM-10 monitoring instrumentation will be calibrated at least daily, and calibrations will be recorded in the field activity logbook.

3. Monitoring Schedule and Data Collection and Reporting

This section presents the monitoring schedule and data collection and reporting requirements.

3.1 Monitoring Schedule

Real-time VOC and PM-10 monitoring will be performed continuously throughout the intrusive activities. VOC monitoring will be performed periodically during non-intrusive sampling-type activities. Wind direction will be determined at the start of each day and at any other appropriate time during SC activities.

3.2 Data Collection and Reporting

Air monitoring data will be collected continuously by the VOC and PM-10 monitoring equipment during intrusive Site activities by an electronic data-logging system. The data management software will be set up so that instantaneous observed readings are recorded by the electronic data acquisition system and averaged over 15-minute time periods. All readings will be recorded and archived, and will be available for review by NYSDOH and NYSDEC personnel.

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Attachment C-1

NYSDOH Generic Community Air Monitoring Plan

APPENDIX 1A

New York State Department of Health
Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

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Attachment C-2

NYSDEC TAGM #4031 Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites

TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM #4031

FUGITIVE DUST SUPPRESSION AND PARTICULATE MONITORING PROGRAM AT INACTIVE HAZARDOUS WASTE SITES

TO: Regional Hazardous Waste Remediation Engrs., Bur. Directors & Section Chiefs

FROM: Michael J. O'Toole, Jr., Director, Division of Hazardous Waste Remediation

SUBJECT: DIVISION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM -- FUGITIVE DUST SUPRESSION AND PARTICULATE MONITORING PROGRAM AT INACTIVE HAZARDOUS WASTE SITES

DATE: Oct 27, 1989

Michael J. O'Toole, Jr. (signed)

1. Introduction

Fugitive dust suppression, particulate monitoring, and subsequent action levels for such must be used and applied consistently during remedial activities at hazardous waste sites. This guidance provides a basis for developing and implementing a fugitive dust suppression and particulate monitoring program as an element of a hazardous waste site's health and safety program.

2. Background

Fugitive dust is particulate matter--a generic term for a broad class of chemically and physically diverse substances that exist as discrete particles, liquid droplets or solids, over a wide range of sizes--which becomes airborne and contributes to air quality as a nuisance and threat to human health and the environment.

On July 1, 1987, the United States Environmental Protection Agency (USEPA) revised the ambient air quality standard for particulates so as to reflect direct impact on human health by setting the standard for particulate matter less than ten microns in diameter (PM_{10}); this involves fugitive dust whether contaminated or not. Based upon an examination of air quality composition, respiratory tract deposition, and health effects, PM_{10} is considered conservative for the primary standard--that requisite to protect public health with an adequate margin of safety. The primary standards are 150 ug/m^3 over a 24-hour averaging time and 50 ug/m^3 over an annual averaging time. Both of these standards are to be averaged arithmetically.

There exists real-time monitoring equipment available to measure PM_{10} and capable of integrating over a period of six seconds to ten hours. Combined with an adequate fugitive dust suppression program, such equipment will aid in preventing the off-site migration of contaminated soil. It will also protect both on-site personnel from exposure to high levels of dust and the public around the site from any exposure to any dust. While specifically intended for the protection of on-site personnel as well as the public, this program is not meant to replace long-term monitoring which may be required given the contaminants inherent to the site and its air quality.

3. Guidance

A program for suppressing fugitive dust and monitoring particulate matter at hazardous waste sites can be developed without placing an undue burden on remedial activities while still being protective of health and environment. Since the responsibility for implementing this program ultimately will fall on the party performing the work, these procedures must be incorporated into appropriate work plans. The following fugitive dust suppression and particulate monitoring program will be employed at hazardous waste sites during construction and other activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Such activities shall also include the excavation, grading, or placement of clean fill, and control measures therefore should be considered.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM_{10}) with the following minimum performance standards:

   Object to be measured: Dust, Mists, Aerosols
   Size range: <0.1 to 10 microns
   Sensitivity: 0.001 mg/m^3
   Range: 0.001 to 10 mg/m^3
   Overall Accuracy: ±10% as compared to gravimetric analysis of stearic acid or reference dust

   Operating Conditions:
   Temperature: 0 to 40°C
   Humidity: 10 to 99% Relative Humidity

   Power: Battery operated with a minimum capacity of eight hours continuous operation

   Automatic alarms are suggested.

   Particulate levels will be monitored immediately downwind at the working site and integrated over a period not to exceed 15 minutes. Consequently, instrumentation

shall require necessary averaging hardware to accomplish this task; the P-5 Digital Dust Indicator as manufactured by MDA Scientific, Inc. or similar is appropriate.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the entity operating the equipment to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m^3 over the integrated period not to exceed 15 minutes. While conservative, this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m^3, the upwind background level must be measured immediately using the same portable monitor. If the working site particulate measurement is greater than 100 ug/m^3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see Paragraph 7). Should the action level of 150 ug/m^3 be exceeded, the Division of Air Resources must be notified in writing within five working days; the notification shall include a description of the control measures implemented to prevent further exceedences.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM_{10} at or above the action level. Since this situation has the potential to migrate contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

    1. Applying water on haul roads.
    2. Wetting equipment and excavation faces.
    3. Spraying water on buckets during excavation and dumping.
    4. Hauling materials in properly tarped or watertight containers.
    5. Restricting vehicle speeds to 10 mph.
    6. Covering excavated areas and material after excavation activity ceases.
    7. Reducing the excavation size and/or number of excavations.

    Experience has shown that utilizing the above-mentioned dust suppression techniques, within reason as not to create excess water which would result in

unacceptable wet conditions, the chance of exceeding the 150 ug/m^3 action level at hazardous waste site remediations is remote. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. If the dust suppression techniques being utilized at the site do not lower particulates to an acceptable level (that is, below 150 ug/m^3 and no visible dust), work must be suspended until appropriate corrective measures are approved to remedy the situation. Also, the evaluation of weather conditions will be necessary for proper fugitive dust control--when extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended.

There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require appropriate toxics monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

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Appendix D

Health and Safety Plan

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Appendix D
Environmental Health and Safety Plan (E-HASP)

Former Dangman Park Manufactured Gas Plant Site
Brooklyn, New York
Site No. 224047
Index # A2-0552-0606

December 31, 2008

ARCADIS

Christopher D. Keen
Designated H&S Plan Writer

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Project Manager

Appendix D
Environmental Health and Safety Plan (E-HASP)

Former Dangman Park
Manufactured Gas Plant Site
Brooklyn, New York
Site No. 224047
Index # A2-0552-0606

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Tables

Figures

Appendices

1. Introduction

All work on this project will be carried out in compliance with ARCADIS' Health and Safety policies and procedures, and the Occupational Safety and Health Administration's Hazardous Waste Operations and Emergency Response regulation 29 CFR 1910.120. The design of this health and safety plan (HASP) conforms to the requirements of the ARC HSFS010 (HASP H&S Procedure). Specific health and safety information for the project is contained in this HASP. All personnel working on hazardous operations or in the area of hazardous operations shall read and be familiar with this HASP before doing any work. All project personnel shall sign the certification page acknowledging that they have read and understand this HASP.

Changes in the scope of the project or introduction of new hazards to the project shall require revision of the HASP by the HASP writer and reviewer, and approval by the Project Manager. The HASP Addendum Form and log table are included as Appendix A.

2. Project Site History and Requirements

On behalf of National Grid USA (NGRID, formerly KeySpan Corporation [KeySpan]), ARCADIS has prepared this Health and Safety Plan (HASP) as a component of the Site Characterization (SC) Work Plan for the former Dangman Park Manufactured Gas Plant (MGP) site (Site) located at 486 Neptune Avenue, Brooklyn, New York.

The HASP should be used in conjunction with the SC Work Plan, the Field Safety Plan (FSP), the Quality Assurance Project Plan (QAPP), and the Community Air Monitoring Plan (CAMP). The SC Work Plan presents the Site background and defines the field sampling program. The FSP describes the methods and procedures to be used for environmental sample collection during implementation of the investigation field activities. The QAPP presents the quality assurance/quality control (QA/QC) procedures to be used during implementation of the SC Work Plan, as well as a description of the general field and laboratory procedures. The FSP, QAPP, and CAMP are provided in Appendices A, B, and C, respectively.

2.1 Site Description

Site Type: (Check as many as applicable)

X	Active	X	Secure		Industrial		Landfill		Service station
	Inactive		Unsecured	X	Commercial		Well field		Water work
			Uncontrolled	X	Residential		Railroad		Undeveloped
Other specify:									

The Site is located at 486 Neptune Avenue in the Borough of Brooklyn, New York City, Kings County, New York and is identified by Tax Map Number: Block 7273, Lots 1 and 25. As shown on Figure 1 of the SC Work Plan, the Site is located approximately 1,300 feet southeast of Coney Island Creek and approximately 2,400 feet north of New York Bay. The Site is generally flat with an elevation of approximately 6 feet above mean sea level (amsl). The closest natural surface water body is Coney Island Creek, which is located approximately 0.25 miles to the northwest of the Site.

The Site is located in the Coney Island community district of Brooklyn on approximately 4 acres of land, and is bounded by Neptune Avenue to the north, W. 5th Street to the east, a residential parcel to the south, and a commercial parcel to the west. Currently, the Site is developed with a strip mall and a parking lot for a high-rise apartment building.

2.2 List of Project Tasks and Scope of Work

- Task 1 – Drilling of Soil Borings and Monitoring Well Installation

Task 1 involves the following activities: ground penetrating radar (GPR) survey (i.e., surface geophysics), utility clearance, advancing soil borings/collecting soil cores for the purpose of lithologic characterization and laboratory analysis, installation of monitoring wells to determine if MGP-related and/or non-MGP-related chemical constituents are present in groundwater, equipment decontamination, surveying of monitoring wells, and management of investigation-derived waste (IDW). The soil borings and monitoring wells will be drilled using hollow-stem auger (HSA) drilling techniques. It is planned that IDW (drill cuttings, development water, and decontamination water) will be containerized in Department of Transportation (DOT)-approved 55-gallon steel drums.

- Task 2 – Monitoring Well Sampling and Hydraulic Monitoring

Task 2 involves the sampling of monitoring wells for the purpose of laboratory analysis and characterization and the collection of water-level measurements. The monitoring wells will be sampled using low-flow (minimal drawdown) groundwater sampling techniques. The water-level measurements will be collected using an electronic water-level indicator. It is planned that IDW (monitoring well purge water) will be containerized in DOT-approved 55-gallon steel drums.

3. ARCADIS Organization and Responsibilities

3.1 Project Manager/Task Manager

In planning and preparation of this project, the project manager and/or task manager has completed the project-specific H&S Stewardship Checklist & Project Hazard Analysis Worksheet. The Project Hazard Analysis Worksheet was completed using the Hazard Analysis Risk Control (HARC) ranking process (ARCADIS H&S Procedure ARC HSMS002) (see Section 4 of this HASP). Additional responsibilities of the project manager and task manager are as follows:

- Review all applicable H&S Procedures, and ensure that project activities conform to all requirements.
- Obtain client-specific health and safety information and communicate with the client on health and safety issues.
- Communicate with the Site Safety Officer (SSO) on health and safety issues.
- Allocate resources for correction of identified unsafe work conditions.
- Ensure ARCADIS site workers have all training necessary for the project.
- Report all injuries, illnesses and near-misses to the Client H&S Resource (CHSR) or Project H&S Manager (PHSM), lead incident investigations, and ensure that any recommendations made are implemented.

3.2 Other Project Team Responsibilities

Additional personnel designated to carry out H&S job functions for the project, and their responsibilities are listed below. The same person may fill more than one role:

ARCADIS Project Team	Responsibility and Tasks
On-Site Scientist, Technician, or Engineer	**SSO** • Reviews and works in accordance with the components of this HASP. • Ensures that this HASP is available to and reviewed by all site personnel including subcontractors. • Ensures that necessary site-specific training is performed (both initial and "tailgate" safety briefings. • Ensures site visitors have been informed of the hazards related to ARCADIS work, and have signed the Site Visitors Log. • Ensures that work is performed in a safe manner and has authority to stop work when necessary to protect workers and/or the public. • Coordinates activities during emergency situations. • Ensures that all necessary permits and safety information provided by the client is disseminated to other site personnel and is maintained in an organized manner. • Communicates with the PM, Client H&S Resource and/or the PHSM on health and safety issues. • Reports all injuries, illnesses and near-misses to the PM, Client H&S Resource and PHSM. • Ensures that necessary safety equipment is maintained and used at the site. • Contacts a health and safety professional for assistance in establishing the respiratory cartridge change schedule as required.
On-Site Scientists, Technicians, and Engineers	**Site Workers** • Reads and works in accordance with the components of this HASP. • Reports all unsafe working conditions to the SSO. • Reports all injuries, no matter how minor, to the SSO. • Works in a safe manner. • Signs the HASP acceptance log in Appendix E.

ARCADIS Project Team	Responsibility and Tasks
Charles Webster	**Project Health and Safety Manager (PHSM)** The PHSM oversees all aspects of the site safety program, and prepares site-specific health and safety guidance documents or addenda to this plan. The PHSM does not report to the Project Manager, and is separately accountable to the ARCADIS project team for site health and safety. The PHSM acts as the sole contact to regulatory agencies on matters of safety and health. Other responsibilities include: • Overall authority for health and safety compliance and HASP conformance for the project. • General health and safety program administration. • Conducts project health and safety audits as warranted. • Determines the level of personal protection required. • Updates equipment or procedures based on information obtained during site operations. • Establishes air-monitoring parameters based on expected contaminants. • Assists in injury, illness and near-miss investigations and follow-up.
Charles Webster	**Client Health and Safety Resource (CHSR)** The designated Client H&S Resource is responsible for : • Assisting the SSO in issues as they arise. • Performing site audits and assessments. • Assisting with near-miss/incident investigations. • Serves as the liaison with corporate during H&S regulatory issues as they may arise.

4. Hazard Control

Figure 1. HARC - Risk Assessment Matrix (H&S Procedure ARC HSMS002)

Risk Assessment Matrix

Consequences Ratings*		Likelihood Ratings**				
		A	B	C	D	E
People	Property	Never heard of in the world	Heard of incident in industry	Incident has occurred in ARCADIS Group	Happens several times a year in ARCADIS OpCo	Happens several times a year at ARCADIS Worksite
0 - No health effect	0 - No damage	Low	Low	Low	Low	Low
1 - Slight health effect	1 - Slight damage	Low	Low	Low	Low	Low
2 - Minor health effect	2 - Minor damage	Low	Low	Low	Medium	Medium
3 - Major health effect	3 - Local damage	Low	Low	Medium	Medium	
4 - PTD or 1 fatality	4 - Major damage	Low	Medium	Medium		
5 - Multiple fatalities	5 - Extensive damage	Medium	Medium			

The Hazard Analysis Worksheet is provided in Appendix B of this HASP.

4.1 Job Safety Analyses (JSAs), H&S Procedures and PPE

A JSA has been completed for each safety critical task, and are included in Appendix C. Hazards identified on the Project Hazard Analysis Worksheet are addressed in the JSAs as well as control methods to protect employees and property from hazards. The JSA also lists the type of personal protective equipment (PPE) required for the completion of the project. A detailed list of PPE for the project is located in Appendix D.

ARCADIS H&S Procedures applicable to this project are listed below. These procedures should be reviewed by the project manager, task manager and Site personnel. The Client H&S Resource should be contacted with any questions concerning the procedures.

The following health and safety management and general health and safety procedures apply to this project and are available on APEX:

- ARC HSMS002 – Hazard Identification, Risk Assessment and Risk Control
- ARC HSMS010 – Incident Reporting and Investigation

- ARC HSMS011 – Root Cause Analysis and Solutions Development
- ARC HSGE002 – Hazardous Materials (Dangerous Goods) Shipping and Transportation
- ARC HSGE004 – First Aid/CPR
- ARC HSGE024 – Defensive Driving Policy and Procedure

The following specific procedures apply to this project and are located in Appendix G of this HASP:

- ARC HSFS019 – Utility Location Policy and Procedure
- ARC HSIH003 – Benzene
- ARC HSIH006 – Cadmium
- ARC HSIH008 – Hearing Conservation Health & Safety Procedure
- ARC HSIH010 – Lead – Health and Safety Policy and Procedures

4.2 Field Health & Safety Handbook

The Field H&S Handbook is an ARCADIS document containing information about topic-specific health and safety requirements for the field. This handbook contains relevant general topics and is used as part of the overall HASP process. To aid in the consistency of the HASP process the handbook will be used as an informational source in conjunction with this HASP. Section III of the Field H&S Handbook is minimally required reading for this project.

The following handbook sections are additional required reading for this project:

- Section IV-E. Heavy Equipment
- Section IV-F. Hoisting and Rigging, Cranes and Derricks

5. Hazard Communication (HazCom)

All project required chemicals must be handled in accordance with OSHA 29 CFR 1910.1200, ARCADIS-HazCom Procedure (ARC HSGE007), and the requirements outlined in the Field H&S Handbook. Table 1 lists all chemicals that will be brought and stored on the Site. Material Safety Data Sheets (MSDS) for chemicals brought on site are included in Appendix F. MSDS for other chemicals brought on site will be kept in the ARCADIS vehicle which transports the chemicals.

Table 1. Master Chemical and Storage List

Chemical Name	Estimated Quantity	Chemical Storage Location
Conductivity Standard Solution	500 mL	Sampling/Field Vehicle
YSI 3161 Conductivity Calibrator	1,000 mL	Sampling/Field Vehicle
ORP Calibration Solution	500 mL	Sampling/Field Vehicle
pH 4.00 Calibration Solution	500 mL	Sampling/Field Vehicle
pH 7.00 Calibration Solution	500 mL	Sampling/Field Vehicle
pH 10.00 Calibration Solution	500 mL	Sampling/Field Vehicle
Amco Clear: Turbidity Standard	500 mL	Sampling/Field Vehicle
Eye Saline Solution	500 mL	Sampling/Field Vehicle
ABC Fire Extinguisher Powder	10 lbs	Sampling/Field Vehicle
Gasoline, All Grades	150 L	Sampling/Field Vehicle
Motor Oil	1 Qt	Sampling/Field Vehicle
Hydrochloric Acid	<100 mL	Sampling/Field Vehicle
Nitric Acid 50-70%	<500 mL	Sampling/Field Vehicle
Micro-90 Cleaning Solution	1 Qt	Sampling/Field Vehicle
Isobutylene Gas	17 L	Sampling/Field Vehicle

5.1 Chemical Hazards

Air monitoring will be conducted as outlined in this HASP to collect exposure data for chemicals of concern (COC) or for chemicals brought onsite for use. Table 2 lists the properties of chemicals that will be encountered at the Site.

Table 2. Chemical Hazard Information

Chemical Name	IP (eV)	Odor Threshold (ppm)	Routes of Entry/ Exposure Symptoms	8-hr TWA[1] (ppm)	IDLH (NIOSH) (ppm)	STEL (ppm)	Source TLV/PEL
Arsenic and soluble inorganic compounds (as As)	NA	NA	Routes of Entry: Inhalation, Absorption, Ingestion, Contact Exposure Symptoms: Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, [potential occupational carcinogen]	0.01 mg/m^3	5 mg/m^3	NA	TLV
Benzene	9.24	34-119	Routes of Entry: Inhalation, Absorption, Ingestion, Contact Exposure Symptoms: Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]	0.5	500	2.5	TLV

Chemical Name	IP (eV)	Odor Threshold (ppm)	Routes of Entry/ Exposure Symptoms	8-hr TWA[1] (ppm)	IDLH (NIOSH) (ppm)	STEL (ppm)	Source TLV/PEL
Benzo[a]pyrene (Coal tar pitch volatiles)			Routes of Entry: Inhalation, Ingestion, Contact Exposure Symptoms: Eye and skin irritation, respiratory tract irritation. Potential cancer causing chemical	0.2 mg/m^3	80 mg/m^3	NA	(as benzene soluble aerosol) ACGIH
Cadmium dust (as Cd)	NA	NA	Routes of Entry: Inhalation, Ingestion Exposure Symptoms: Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	0.01 mg/m^3	9 mg/m^3	NA	TLV
Chromium metal (as Cr)	NA	NA	Routes of Entry: Inhalation, Ingestion, Contact Exposure Symptoms: Irritation eyes, skin; lung fibrosis (histologic)	0.5 mg/m^3	250 mg/m^3	NA	TLV
Cyanides: calcium, potassium, and sodium	NA	NA	Routes of Entry: Inhalation, Absorption, Ingestion, Contact Exposure Symptoms: Asphyxiation and death can occur; weakness, headache, and confusion; nausea and vomiting; increased respiratory rate; slow respiratory gasping; irritated eyes and skin	5 mg/m^3 (skin)	25 mg/m^3	NA	TLV

Chemical Name	IP (eV)	Odor Threshold (ppm)	Routes of Entry/ Exposure Symptoms	8-hr TWA[1] (ppm)	IDLH (NIOSH) (ppm)	STEL (ppm)	Source TLV/PEL
Fluorene			Routes of Entry: Inhalation, Contact Exposure Symptoms: It is irritating to the skin, eyes, and respiratory tract.	NE			
Ethylbenzene	8.76	0.09-0.6	Routes of Entry: Inhalation, Ingestion, Contact Exposure Symptoms: Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	100	800	125	TLV
Lead, inorganic dusts and fumes (as Pb)	NA	NA	Routes of Entry: Inhalation, Ingestion, Contact Exposure Symptoms: Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension	0.05 mg/m^3	100 mg/m^3	NA	PEL

Chemical Name	IP (eV)	Odor Threshold (ppm)	Routes of Entry/ Exposure Symptoms	8-hr TWA[1] (ppm)	IDLH (NIOSH) (ppm)	STEL (ppm)	Source TLV/PEL
Naphthalene	8.12	0.0095-0.64	Routes of Entry: Inhalation, Absorption, Ingestion, Contact Exposure Symptoms: Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	10	250	15	TLV
Toluene	8.82	0.16-37	Routes of Entry: Inhalation, Absorption, Ingestion, Contact Exposure Symptoms: Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage	50	500	NA	TLV

Chemical Name	IP (eV)	Odor Threshold (ppm)	Routes of Entry/ Exposure Symptoms	8-hr TWA[1] (ppm)	IDLH (NIOSH) (ppm)	STEL (ppm)	Source TLV/PEL
Xylene (o-, m-, and p- isomers)	8.44-8.56	0.08-40	Routes of Entry: Inhalation, Absorption, Ingestion, Contact Exposure Symptoms: Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	100	900	150	TLV

[1]The TLV (Threshold Limit Value) from the American Conference of Governmental Industrial Hygienists (ACGIH) is listed unless the PEL (Permissible Exposure Limit), designated by OSHA, is lower.

See Section 7 for information on air monitoring requirements.

6. Tailgate Meetings

Tailgate safety briefings will be conducted at least twice daily. Tailgate safety briefings will be conducted at the beginning of the work day, after lunch, or again as tasks/hazards change. Each tailgate safety briefing will be documented on the form included in Appendix E.

7. Personal Exposure Monitoring and Respiratory Protection

Personal and area exposure monitoring will be documented on the Real Time Exposure Monitoring Data Form provided in Appendix E. All monitoring equipment will be maintained and calibrated in accordance with manufacturer's recommendations. All pertinent monitoring data will be logged on the form and maintained on site for the duration of project activities. Calibration of all monitoring equipment will be conducted daily and logged on the same form.

Table 3 lists exposure monitoring requirements and associated action levels for Site exposure hazards (e.g. chemical, noise, radiation, etc).

Table 3. Exposure Monitoring Requirements

TASK 1 – Drilling of Soil Borings and Monitoring Well Installation – Is exposure monitoring required for the completion of this project?

☒ YES ☐ NO If yes, complete the following:

Exposure Hazard	Monitoring Equipment	Monitoring Frequency	Action Level	Required Action
VOCs	PID (11.7 eV lamp)	Periodic (15 minute intervals)	0.5 ppm	Stop work if readings in breathing zone are above the action level for a sustained period of 15 minutes; Perimeter monitoring; Contact PM and PHSM to discuss; Initiate controls if feasible; Work may resume after work area readings are below the action level
Particulates	Particulate Monitor	Periodic (15 minute intervals)	150 $\mu g/m^3$	Stop work; Employ dust suppression; Perimeter monitoring; Contact PM and PHSM to discuss; Work may resume after work area readings are below the action level

Flammable Vapors LEL O_2 CO H_2S	LEL/ O_2/CO/H_2S Multi-Gas Meter	Periodic (15 minute intervals)	LEL = >10% of the LEL; O_2 = Below 19.5% or above 23.5%; CO = 25 ppm; H_2S = 10 ppm	Stop work; Evacuate work area; Perimeter monitoring; Contact PM and PHSM to discuss; Ventilate work area; Work may resume after work area readings are below the action level
TASK 2 – Monitoring Well Sampling and Hydraulic Monitoring – Is exposure monitoring required for the completion of this project? ☒ YES ☐ NO If yes, complete the following:				
Exposure Hazard	**Monitoring Equipment**	**Monitoring Frequency**	**Action Level**	**Required Action**
VOCs	PID (11.7 eV lamp)	When initially accessing well; Periodic, if necessary, based on initial reading	0.5 ppm	Stop work if readings in breathing zone are above the action level for a sustained period of 15 minutes; Let well vent until reading is below the action level; Contact PM and PHSM to discuss

*Note – Use of respiratory protection is not anticipated or planned. If exposure monitoring readings in the **breathing zone** are above action levels, work is to stop and the PM and CHSR informed. Engineering controls such as modifying work and ventilation may be considered. PM and CHSR must concur before respirators will be utilized and respirators will be considered a last resort.*

8. Medical Surveillance

Medical surveillance requirements for the project are provided on the Project Manager/Task Manager H&S Stewardship Checklist & Project Hazard Analysis Worksheet (Appendix B). All medical surveillance requirements as indicated on the worksheet must be completed and Site personnel medically cleared before being permitted on the project Site.

9. General Site Access and Control

The SSO will coordinate access and control security at the work site. As the work dictates, the SSO will establish a work area perimeter. The size of the perimeter will be based on the daily task activities and will be discussed with all project personnel during the tailgate meeting and then documented on the tailgate meeting form. Control zones will be demarcated by either visual or physical devices and will be monitored for effectiveness by the SSO.

Only authorized personnel will be allowed beyond the perimeter. Other Site workers and visitors to the Site should be kept out of the work Site. If visitors need access to the Site, the SSO will escort the visitor at all times. All visitors will log in and out with the SSO. The visitor log sheet is included in Appendix E.

10. Decontamination Control Zones and Procedures

Part of required reading for this HASP includes reviewing the Field H&S Handbook, Section III-G Site Security, Work Zones and Decontamination for HAZWOPER site zones. The decontamination procedures outlined in the Field H&S Handbook are provided for typical Level D and Level C ensembles.

The zones will be designated by traffic cones, barricades, signs, caution tape, or other means effective in identifying the different areas. The SSO will establish control boundaries for the exclusion zone, contamination reduction zone, and the support zone. The zones will be identified by the SSO during tailgate meetings and documented on the meeting form. Entrance and exit to the exclusion zone will only be through controlled access points established for each work area.

11. Emergency Action Plan (EAP)

In the event that an injury, over-exposure or spill has occurred, an EAP will be implemented. Appendix H provides the EAP and notifications for the project. All employees working on this project must be shown the location and proper use of all emergency equipment prior to beginning work on the project.

12. Department of Transportation (DOT) Dangerous Goods Shipping Requirements

ARCADIS has policies in place for transporting small quantities of hazardous materials and for offering for shipping via ground or air. These policies are designed to meet the applicable requirements. As such, only ARCADIS staff that have been trained in the proper methods to prepare and ship hazardous materials are authorized to do so. Tasks associated with the packaging, labeling, marking, and preparation of hazardous materials for shipping or transport must have all appropriate and applicable training.

12.1 Materials of Trade (MOT)

DOT allows for a small amount of hazardous materials that are used in or an inherent part of our work to be transported in company vehicles. This includes things like gasoline, paint, small compressed gas cylinders, calibration gas, etc. To transport these:

- Staff will complete Materials of Trade training.
- Vehicles used in transportation to and from off-site work locations will be in conformance with ARCADIS vehicle safety procedures.

Hazardous materials will be transported as described above as a result of the activities covered in this HASP. Site personnel who transport materials mentioned above will complete the Hazardous Materials Transportation Form included in Appendix E.

12.2 Department of Transportation

Staff who collect, prepare, package, mark, label, complete shipping declarations, offer shipments to a transporter, directly transport or are engaged in other activities associated with the transportation of Hazardous Materials (referred to as Dangerous Goods in Canada and by the International Air Transport Association [IATA]) will have appropriate and applicable training. DOT requires all individuals who participate in hazmat shipping including activities such as completing the paperwork (but not signing it), filling a container with a hazardous material (including filling a drum with drill cuttings or purge water), marking, labeling, and packaging the hazardous material, etc., have awareness level training on the DOT requirements. DOT requires additional job function training for those who conduct specific activities including:

- Staff who have to sign shipping papers or manifests, are listed as the 24-hour emergency contacts on shipping and have the responsibility for identifying, classifying, packaging, marking, and labeling HazMat packages, and/or are directing or overseeing others who do these tasks will become certified through the completion of additional training.

- The above training allows the offering employee to ship only by ground. If the shipment is to be offered for air transport, additional training is required.

Shipments as described above will be made as a result of the activities covered in this HASP. Site personnel shipping hazardous materials will complete the Hazardous Materials Shipment Form included in Appendix E.

13. Loss Prevention System™ (LPS™) and Loss Prevention Observations (LPOs)

As part of any project, no matter how simple or complex, LPOs should be conducted when practical and when able to integrate into normal business activities. LPOs should be scheduled based on the risk of the tasks being performed, and should be conducted for different tasks and at different times. Completion of LPOs should be documented on the tailgate meeting form.

The following table outlines the LPO plan for the project:

Identified Task for LPO	Schedule Date	Observer Name	Observee Name	Feedback Supervisor Name
Drilling	TBD	TBD	TBD	TBD

14. Subcontractors

A copy of this HASP is to be provided to all subcontractors prior to the start of work so that the subcontractor is informed of the hazards at the site. While the ARCADIS HASP will be the minimum health and safety requirements for the work completed by ARCADIS and its subcontractors, each subcontractor, in coordination with ARCADIS health and safety personnel, is expected to perform its operations in accordance with its own HASP, policies and procedures unique to the subcontractor's work to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to ARCADIS for review prior to the start of on-site activities.

In the event that the subcontractor's procedures/requirements conflict with requirements specified in this HASP, the more stringent guidance will be adopted after discussion and agreement between the subcontractor and ARCADIS project health and safety personnel. Hazards not listed in this HASP, but known to the subcontractor or known to be associated with the subcontractor's services, must be identified and addressed to the ARCADIS project or task manager and SSO prior to beginning work operations.

If the subcontractor prefers to adopt this HASP, the **"Subcontractor Acknowledgement Memo" must be signed and dated by the subcontractor's management and placed in the project file.** Once the signed memo is received by the project manager, an electronic version of our HASP can be submitted to the subcontractor to use as their own. Subcontractors working at the site will need to have this plan with them, and will also need to sign the Subcontractor HASP receipt signature page of the ARCADIS HASP (Appendix E). Subcontractors are responsible for the H&S of their employees at all times, and have the authority to halt work if unsafe conditions arise.

The Project/Task Manager and SSO (or authorized representative) has the authority to halt the subcontractor's operations and to remove the subcontractor or subcontractor's employee(s) from the site for failure to comply with established health and safety procedures or for operating in an unsafe manner.

15. Project Personnel HASP Certification

All Site project personnel will sign the certification signature page provided in Appendix E of this HASP.

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Appendix A

HASP Addendum Pages and Log Table

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Addendum Page

This form should be completed for new tasks associated with the project. The project manager and/or task manager should revise the Project Hazard Analysis Worksheet with the new task information and attach to this addendum sheet. JSAs should be developed for any new tasks and attached as well.

Review the addendum with all site staff, including subcontractors, during the daily tailgate briefing, and complete the tailgate briefing form as required. Attach a copy of the addendum to all copies of the HASP including the site copy, and log in the Addendum Log Table A-1 on the next page.

Addendum Number: _____ Project Number: _____

Date of Changed Conditions: _____ Date of Addendum: _____

Description of Change that Results in Modifications to HASP:

Signed: _____
Project Manager

Signed: _____
Site Safety Officer

Signed: _____
H&S Plan Writer

Signed: _____
H&S Plan Reviewer

Addendum Log Table

Addendums are to be added to every copy of the HASP, and logged on Table A-1 to verify that all copies of the HASP are current:

Table A-1 Addendum Log Table

Addendum Number	Date of Addendum	Reason for Addendum	Person Completing Addendum
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Make additional copies of this form as necessary.

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Appendix B

Project Hazard Analysis Worksheet

ARCADIS US Project Manager and Task Manager/Principal-In-Charge H&S Stewardship Checklist

Project Hazard Analysis Page

Project Name:	Former Dangman Park MGP Site		**Project Number:**	B0036704.0000	
Client:	National Grid		**Principal-In Charge:**	James Nuss	
Project / Task Manager:	Steven Feldman	**Completed By:**	Christopher Keen	**Date:**	11/23/08

ARCADIS Project Hazard Analysis Worksheet TRACK

Recognize and Assess the Hazards for the Project

For each potential hazard, determine the worst case conditions for the entire project and all of the tasks and assess them using High (H), Medium (M), Low (L). Use the drop down list in each "Assess" cell. If a hazard is not expected on the site, leave the "Assess" box blank.

	Recognize the Hazards	[illegible]	[illegible]	[illegible]	[illegible]
Physical Hazards	Heat	[illegible]	Holes/Pits		
	Cold	[illegible]	Ionizing Radiation		
	Noise	[illegible]	Non-ionizing Radiation		
	Walking/Working surfaces (includes slip/trip/fall & floor/wall openings)	Medium	Electricity	[illegible]	Generator
	Visible Dust	Low	Poor lighting	[illegible]	
	LASER		Severe Weather	[illegible]	
	Underground Utilities	[illegible]	Overhead Hazards	[illegible]	
	Other:		None: Mark with an "X"		

Control the Hazard: (Briefly describe how the identified hazards will be controlled)

Appropriate personal protective equipment (PPE) as outlined in the Job Safety Analysis (JSA) will be used by all on-site employees for each task. ARCADIS H&S procedures will be reviewed prior to beginning work and will be followed during work. In addition, administrative and engineering controls will also be used (e.g., employees will keep hydrated and take breaks as needed to avoid heat exhaustion), the One Call center will be contacted before starting intrusive activities, and awareness of site hazards will be discussed during daily safety briefings.

Chemical Hazards	Flammable/ Combustible	[illegible]	Corrosive	[illegible]	[illegible]
	Compressed gas		Toxic	[illegible]	Arsenic, Benzene, B(a)P, Cd, Cr, Pb, Naphthalene, Toluene, Xylene
	Explosive		Highly toxic		
	Organic peroxide		Irritant	[illegible]	Arsenic, Benzene, B(a)P, Cd, Cr, Fluorene, Ethylbenzene, Pb, Naphthalene, Toluene, Xylene
	Oxidizer		Sensitizer		
	Water reactive		Carcinogen	[illegible]	Arsenic, Benzene, B(a)P, Cd
	Unstable reactive		Mutagen		
	Dust/Fumes/ Particulates	[illegible]	None: Mark with an "X"		

Control the Hazard: (Briefly describe how the identified hazards will be controlled)

Appropriate PPE as outlined in the JSA will be used by all on-site employees for each task. In addition, chemical hazards will be discussed daily during daily safety briefings before starting work to create awareness to chemical hazards.

Environmental/ Equipment Hazards	Heavy machinery	Medium	Cranes/Hoists/Rigging	Medium	[illegible]
	Trenching/excavation		Ladders		
	Docks – marine operations		Scaffolding		
	Construction activities		Manlifts		
	Diving operations		Welding		
	Drilling	Medium	Gas cylinders	[illegible]	
	Forklifts		Roadway work	Medium	
	Water operations work		Railroad work		
	Heights (fall protection)		Mining work		
	Overhead/ Underground utilities	[illegible]	Energized / Pressurized equip (LO/TO)		
	Confined spaces		Drums and containers	[illegible]	
	Power tools	[illegible]	Other		
	Other		None: Mark with an "X"		

Control the Hazard: (Briefly describe how the identified hazards will be controlled)

Appropriate PPE as outlined in the JSA will be used by all on-site employees for each task. In addition, engineering and administrative controls will also be implemented such as set-up of exclusion zones, etc.

Biological Hazards	Animal/Human fluids or blood		Contaminated Needles		
	Animal/Human tissue(s)		Live Bacterial Cultures		
	Poisonous/irritating plants		Insects/rodents/snakes		
	Other:		None: Mark with an "X"	X	

Control the Hazard: (Briefly describe how the identified hazards will be controlled)

Ergonomic Hazards	Repetitive motion		Limited movement		
	Awkward position		Forceful exertions		
	Heavy lifting	**Medium**	Vibration		
	Frequent lifting		Other:		
	Other:		None: Mark with an "X"		

Control the Hazard: (Briefly describe how the identified hazards will be controlled)

Use buddy system during hand digging activities to minimize back strain. Take breaks as needed. Use two people to lift objects greater than 50 pounds.

Personal Safety/Security	Personal safety		Employees working early/late		
	Security issue		Potentially dangerous wildlife		
	Project site in isolated area		Guard or stray dogs in area		
	Employees working alone		No/limited cell phone service		
	Fatigue		Other:		
	Other		None: Mark with an "X"		

Control the Hazard: (Briefly describe how the identified hazards will be controlled)

Employees will take breaks as needed to avoid fatigue. In addition, personal safety/security hazards will be discussed during daily safety briefings.

Driving Safety	Driving early/late		City driving	**Medium**	
	Driving long trips		Pulling a trailer		
	Driving off-road		ATV driving:		
	Bad weather driving	**Medium**	Other		
	Other		None: Mark with an "X"		

Control the Hazard: (Briefly describe how the identified hazards will be controlled)

Use Smith System defensive driving techniques while driving.

Training Required	40 hour HAZWOPER		Bloodborne pathogens		
	24 hour HAZWOPER		Confined space		
	HAZWOPER site supervisor		Lockout/tagout		
	OSHA 30 hour Construction		Electrical Safety		
	OSHA 10 hour Construction		Fire Extinguishers		
	PPE		Fall Protection		
	Respiratory protection		Noise exposure		
	Chemical hygiene		Forklifts		
	Hazard communication		Asbestos		
	Hazardous waste		Lead		
	First-aid/CPR		Cadmium		
	DOT/IATA hazmat transportation		SPCC		
	MSHA		Radiation safety		
	Diving		Client specific		
	FRA		None: Mark with an "X"		
Medical Screening	Medical Surveillance Exam (HAZWOPER)		Other hazardous substance		
	Pulmonary Function Test if wearing respirator and employee not part of HAZWOPER		Audiometric test if noise is a hazard and employee not part of HAZWOPER		
	Client required drug and/or alcohol testing		Blood and/or urine screening		
	Hepatitis B Immunization (or declination on file)		None: Mark with an "X"		

Keep Safety First In All Things

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Appendix C

JSAs

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JOB SAFETY ANALYSIS

SECTION 1	
JSA Type:	Environmental Operations
JSA No:	JSA002165
Date:	11/26/2008
Work Type:	Environmental - Monitoring Well Sampling/Gauging
Work Activity:	Groundwater Sampling
Project No.:	B00367040000 - DANGMAN PARK FORMER MGP (DANGMAN PARK FORMER MGP)

SECTION 2

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Keen, Christopher .	Senior Scientist	☑	Webster, Charles P.	H&S	12/3/2008

SECTION 3

Job Steps	Potential Hazard(s)	Critical Action(s)	SOP Reference
Load required sampling equipment and supplies into vehicle	Lifting hazards and back strain. Appropriate PPE or equipment not on-site.	Review HASP for proper PPE and Work Plan for necessary equipment. Also refer to the HASP for required traffic control and emergency procedures. Use proper lifting technique. Request assistance when lifting heavy equipment. Use dolly to transport equipment.	
Working outdoors	Heat/cold stress, sunburn, severe weather, lightning.	Avoid/stop work in extreme weather conditions or if extreme weather is imminent, seek shelter as needed; take breaks and consume fluids as needed; use sunscreen and wear clothing to cover body for protection.	
Travel to site	Vehicle accident	Smith Defensive Course. Follow safe driving procedures (following distances, speed, headlights, safety belts, 'give the other driver a break'). Do not use cell phone when driving.	ARCADIS H&S Procedure ARCHSGE024
Property access	Vehicle traffic. Trip and fall.	Wear safety vest and face oncoming traffic. Be aware of vehicle traffic on-site. Be aware of surroundings.	
Set up necessary traffic control at well	Struck by vehicle during placement. Vehicle accident as result of improper vehicle control placement.	Wear Class II traffic vest if wells are located proximal to vehicular traffic. Use appropriate traffic control measures (barricades and cones) to direct traffic around work area. Use a vehicle as a barrier between sampler and on-coming traffic. To the extent possible, stay out of the way of	

		other traffic.	
Gauge water levels in wells	Pinchpoints on well vault can pinch fingers. Scraped knuckles (flush-mount wells), back strain, exposure to chemical hazards, repetitive motion, knee strain from kneeling, biological hazards. Pressure can build up inside wells causing well caps to project into the air.	Don appropriate PPE. Bend at the knees, not the waist. Be careful opening flush-mount wells. Watch for biological hazards. Wear leather gloves when removing well vault lids, and chemical protective gloves while gauging. Keep head away from well cap when opening.	
Low-flow sampling, purge well(s), collect water quality parameters, contain purge water.	Lacerations to hand/fingers can occur when cutting tubing. Muscle strain can occur when lifting equipment, pinch point between tubing and well casing while lowering pump or bailers. Cross-contamination. Back strain. Inhalation or dermal exposure to chemical hazards. Slip and fall. Spilling/splashing contaminated water.	Wear protective gloves and lower pump/bailer slowly. Cut tubing with tube cutting device (do not use pocket knife). Decontaminate purge equipment between each sampling location or use disposable equipment/tubing. Use proper lifting techniques. Use appropriate PPE and air monitoring equipment in accordance with HASP. Keep work area clear of tripping or slipping hazards. Store purge water in appropriate containers. Make sure all tubing joints are secure.	
Collect samples in accordance with sampling plan	Cross-contamination. Back strain from lifting full coolers. Inhalation or dermal exposure to chemical hazards. Slip and fall. Improper labelling or storage. Injury from broken or leaking sampling bottles (cuts and/or acid burns).	Decontaminate sampling equipment between each well or use disposable equipment/tubing. Use proper lifting techniques. Use PPE in accordance with HASP. Label samples in accordance with sampling plan. Keep samples stored in proper containers, at proper temperature, and away from work areas. Make sure glass sample containers are not cracked or broken. Handle bottles carefully and with gloves.	
Management of purge water	Back strain. Splashing. Exposure to chemical hazards. Improper disposal.	Wear PPE in accordance with HASP. Lift with legs. To minimize splashing and to keep the load at a reasonable weight, do not overfill buckets. Properly containerize water in drums.	
Clean site/demobilize	Vehicle traffic. Lifting hazards and back strain.	Use buddy system, as necessary, when removing traffic control. Leave site clean of refuse and debris. Use proper lifting techniques.	
Package and ship samples to lab	Bottle breakage. Injury from broken/leaking sample bottle (cuts and/or acid burn)/dermal exposure to chemical hazards. Back strain when lifting samples. Leaking coolers.	Handle and package bottle carefully (bubble wrap bags, if available). Use proper lifting techniques. Double-bag ice. Wrap potential leak points on coolers with duct/clear tape.	

SECTION 4

Personal Protective Equipment (PPE):

Level D
Long Sleeves
Orange Traffic Safety Vest
Protective Gloves - Nitrile or Latex
Safety Glasses
Safety Shoes
Required and/or Recommended Equipment and Supplies: Water-level indicator, submersible pump, decon supplies, sample containers, ice, drinking water, and air monitoring equipment per HASP.

JSA002165 - Closed - Current - 12/30/2008 07:58 PM EST

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JOB SAFETY ANALYSIS

SECTION 1	
JSA Type:	Environmental Operations
JSA No:	JSA002168
Date:	11/26/2008
Work Type:	Environmental - Monitoring Well/Piezometer Installation
Work Activity:	Drilling, Soil Sampling, Monitoring Well Installation
Project No.:	B00367040000 - DANGMAN PARK FORMER MGP (DANGMAN PARK FORMER MGP)

SECTION 2

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Keen, Christopher .	Senior Scientist	☑	Webster, Charles P.	H&S	12/3/2008

SECTION 3

Job Steps	Potential Hazard(s)	Critical Action(s)	SOP Reference
Load required sampling equipment and supplies into vehicle	Lifting hazards and back strain. Appropriate PPE or equipment not on-site.	Review HASP for proper PPE and Work Plan for necessary equipment. Also refer to the HASP for required traffic control and emergency procedures. Use proper lifting technique. Request assistance when lifting heavy equipment. Use dolly to transport equipment.	
Working outdoors	Heat/cold stress, sunburn, severe weather, lightning.	Avoid/stop work in extreme weather conditions or if extreme weather is imminent, seek shelter as needed; take breaks and consume fluids as needed; use sunscreen and wear clothing to cover body for protection.	
Travel to site	Vehicle accident	Smith Defensive Course. Follow safe driving procedures (following distances, speed, headlights, safety belts, 'give the other driver a break'). Do not use cell phone when driving.	ARCADIS H&S Procedure ARCHSGE024
Property access	Vehicle traffic. Trip and fall.	Wear safety vest and face oncoming traffic. Be aware of vehicle traffic on-site. Be aware of surroundings.	
Locate drilling area. Set up necessary traffic control at drilling location.	Struck by vehicle during locating and traffic control placement. Vehicle accident as result of improper vehicle control placement. Slips from	Wear Class II traffic vest if drilling location is located proximal to vehicular traffic. Use appropriate traffic control measures (barricades and cones) to direct traffic around work area. To the extent possible, stay out of the way of other traffic. Scan the ground	

	uneven terrain, or wet ground.	ahead of the walking path for obstacles or wet/treacherous conditions. Use alternate route when conditions appear to be hazardous.	
Set up drill rig	Contact with overhead power lines. Pinches from moving hydraulics. Contact with hydraulic fluid from hose rupture. Uneven ground that could cause rig to roll over.	Minimum distance is 10 ft from overhead power lines. Visually inspect hydraulic/air hoses for signs of wear or deterioration. Ensure whip checks in place on air lines. Visually inspect hoisting cables for wear, replace as needed. Have driller check kill switch at beginning of job. Keep hands, feet, and clothing a minimum of 5 ft from moving parts (e.g., leveling jacks, rotating augers, drill rods, etc.). Set parking brake, chock wheels, level drill rig. Visually scan the location to identify areas that may be soft or where the drill rig could get stuck. Set up cones around perimeter of work area.	ARCADIS H&S Procedure ARCHSFS019
Utility Clearance	Potential to encounter underground or aboveground utilities while drilling. Back strain, repetitive motion strain, exhaustion, muscle sprains/strains.	Complete utility clearance in accordance with the ARCADIS H&S procedure. Hand auger/post-hole dig no more than 15 minutes per person before taking break and switching diggers.	ARCADIS H&S Procedure ARCHSFS019
Drilling/borehole advancement	Moving parts of the drilling rig can pull you in, causing injury. Pinch points on the rig and auger connections can cause pinching or crushing of body parts. Soil cuttings and/or water could contain chemicals of concern. Dust and debris can cause eye injury. Drilling equipment laying on the ground (i.e. augers, split spoons, decon equipment, coolers, etc.) could create a tripping hazard. Water from decon buckets generate mud and cause a slipping hazard. Excessive noise is generated by rig operation. Injuries (e.g., sprains, strains, cuts, bruises) from handling augers/drill rods and soil cuttings.	Conduct tailgate safety briefing. The drill rig should only be moved with the derrick down. Set-up rig on level surface where possible, and ensure that the stabilizers are located on a competent surface. Stay at least 5 feet away from moving parts of the drill rig. Know where the kill switch is, and have the drillers test it to verify that it is working. Do not wear loose clothing, and tie long hair back. Avoid wearing jewelry while drilling. Wear appropriate gloves to protect from COCs and safety glasses and hard hat to protect from flying dust, water and debris. Keep equipment neatly stored and pick up trash, and store away from the primary work area. Wear ear plugs, steel-toe boots with good tread, and maintain proper footing in muddy areas. Inspect the integrity of drill rig hoses and cables/lines before operation. Stay clear of any material being hoisted from the rig or support truck. Implement air monitoring and action levels per HASP.	ARCADIS H&S Procedure ARCHSIH008
Sample	Injuries can result from pinch points on split spoon sampler, and from sample container breakage.	Care should be taken when opening split spoon. Look at empty containers before picking them up, and do not over-tighten container caps. Use dividers to store containers in	

Collection and Processing	Workers can be exposed to COCs. Lifting heavy objects (e.g., coolers) can cause back injuries.	the cooler so they do not break. Wear appropriate gloves as designated by the HASP. Lift with knees and minimize bending and twisting while lifting. Use two people to lift heavy objects.	
Monitoring well installation	Same hazards as Step 8 with respect to drill rig operation. Additionally, monitoring well construction materials can clutter the work area causing tripping hazards. Well finishing material (i.e., sand, grout, bentonite) can become airborne and get in your eyes. Cutting the top of the well can cause jagged/sharp edges on the top of the well casing. Silicosis from mixing Portland cement. Strains from handling sand, bentonite, and Portland cement bags.	Same critical actions as Step 8 with respect to drill rig operation. Wear safety glasses for protection from airborne sand and dust. Well construction materials should be picked up during the well installation process. Wear gloves when working with the top of the well casing, and file any sharp jagged edges that resulted from cutting the well. If visible dust is present, wear dust masks when mixing Portland cement. Use rig cable to lift heavy loads, when possible. Two man lift for bagged materials > 50 lbs.	
Decontamination	Injuries from pressure washer. Strains/sprains. Electrical shock hazard from generator/water use.	Wear PPE in accordance with HASP during decon activities. Maintain a clear area at least 10 ft around decon pad. Use two people to lift augers/drill rods. Use GFCI at all times on generator.	
Soil cutting and purge water management	Exposure to COCs in both soil and groundwater. Moving full drums can cause back injury, or pinching/crushing injury. Purge water can splash and cause eye injury. Improper storage or disposal.	Wear PPE in accordance with HASP. Have the drilling contractor move full drums with their equipment. If this is not practicable, use lift assist devices such as drum dollys, lift gates, etc. Employ proper lifting techniques, and perform SPSA to identify pinch/crush points. Wear leather work gloves, and clear all walking and work areas of debris prior to moving a drum. Have proper containment and labeling available on site. Stage drums in isolated and/or secure location away from public interference. Coordinate proper off-site disposal as needed.	
Break down exclusion zone and work area	Struck by vehicle due to improper traffic controls	Use a buddy system for removing site control cones. Wear Class II traffic vest.	

SECTION 4
Personal Protective Equipment (PPE):
Ear plugs
Hard Hat
Level D
Long Sleeves
Orange Traffic Safety Vest

Protective Gloves - Nitrile or Latex
Safety Glasses
Safety Shoes
Required and/or Recommended Equipment and Supplies:

JSA002168 - Closed - Current - 12/30/2008 07:58 PM EST

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Appendix D

PPE Checklist

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PPE CHECKLIST

R = Equipment required to be present on the site. **O** = Optional equipment. Subcontractors must have the same equipment listed here as a minimum.

Description (Put Specific Material or Type in Box)	Level Of Protection		
	D	C	B
Body			
Coveralls	O	NA	
Chemical Protective Suit	NA	R	
Splash Apron	O	NA	
Rain Suit	O	NA	
Traffic Safety Vest (reflective)	R	R	
Head			
Hard Hat (if does not create other hazard)	R	R	
Head Warmer (depends on temperature and weather conditions)	O	O	
Eyes & Face			
Safety Glasses (incorporate sun protection as necessary)	R	NA	
Goggles (based on hazard)	O	NA	
Splash Guard (based on hazard)	O	NA	
Ears			
Ear Plugs (when drilling)	R	R	
Ear Muffs	O	O	
Hands and Arms			
Outer Chemical Resistant Gloves	R (Nitrile)	R (Nitrile)	
Inner Chemical Resistant Gloves	NA	R (Nitrile)	
Kevlar Cut-Proof Gloves (when handling sharps or amber glass sample bottles)	R	R	
Work Gloves	O	O	
Foot			
Safety Boots (steel toe and shank)	R	R	
Rubber, Chemical Resistant Boots	NA	R	
Rubber Boots	O	O	
Disposable Boot Covers	O	O	
Respiratory Protection			
1/2 Mask APR	NA	NA	
Full Face APR	NA	R	
Dust Protection	O	NA	
Powered APR	NA	NA	
SCBA	NA	NA	
Air Line	NA	NA	

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Appendix E

Forms

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SITE ACTIVITIES TAILGATE HEALTH & SAFETY BRIEFING FORM

This briefing form documents the tailgate briefing conducted in accordance with the HASP. Personnel who perform work operations on site are required to attend each briefing and to acknowledge receipt of each briefing, at least daily.

Project Number:		**Project Name:**	
Date:	**Time:**	**Briefing Conducted by:**	
Company:		**Signature/Title:**	

TRACKing the Tailgate Briefing

Think through the Tasks (list the tasks for the day):

1 _____ 3 _____ 5 _____

2 _____ 4 _____ 6 _____

Recognize the hazards (check all those that are discussed) and **Assess** the Risks (Low, Medium, High-circle risk level)

☐ Confined Space	(L M H)	☐ Buried/Overhead Utilities	(L M H)	☐ Excavation	(L M H)
☐ Walking/Working surfaces	(L M H)	☐ Chemical Exposure	(L M H)	☐ Noise	(L M H)
☐ Thermal Stress (Hot/Cold)	(L M H)	☐ Overhead Hazards	(L M H)	☐ Traffic/Roadway/Railway	(L M H)
☐ Severe Weather	(L M H)	☐ Chemical Usage	(L M H)	☐ Elevated work	(L M H)
☐ Hazardous Energy	(L M H)	☐ Heavy Machinery	(L M H)	☐ Biological/Animals	(L M H)
☐ Ergonomic	(L M H)	☐ Personal Safety/Security	(L M H)	☐ Mining	(L M H)
☐ Client/Other Site Activities	*List*	☐ Chemical Exposure	*List*	☐ Other	*Specify*
_____	(L M H)	_____	(L M H)	_____	(L M H)
_____	(L M H)	_____	(L M H)	_____	(L M H)
_____	(L M H)	_____	(L M H)	_____	(L M H)

Control the hazards (Check all those methods to control the hazards that apply):

☒ **STOP WORK AUTHORITY** (Must be addressed in every Tailgate meeting-*See H&S Handbook for definition*)

☐ General PPE Usage	☐ Hearing Conservation	☐ Respiratory Protection
☐ Personal Hygiene	☐ Exposure Guidelines	☐ Decon Procedures
☐ Emergency Action Plan	☐ Fall Protection	☐ Work Zones/Site Control
☐ JSA to be developed/used *(specify)*	☐ LPO conducted *(specify job/JSA)*	☐ Other *(specify)*
_____	_____	_____
_____	_____	_____
_____	_____	_____

Personnel Sign-in List

Printed Name	Signature

Keep H&S 1st in all things

Use the back to add comments such as recent near misses, injuries or property damage, visitors to the site, etc

SITE ACTIVITIES TAILGATE HEALTH & SAFETY BRIEFING FORM

Additional Comments:

Discussion of recent results of LPOs conducted on the project:

Discussion of recent Near-miss, injuries, and/or property damage on the project:

List Visitors to Site Today:

Real Time Exposure Monitoring Data Collection Form

Document all air monitoring conducted on the Site below. Keep this form with the project file.

Site Name: _____ Date: _____

Instrument: _____ Model: _____ Serial #: _____

Calibration Method: (Material used settings, etc.)	
Calibration Results:	
Calibrated By:	

Activity Being Monitored	Compounds/Hazards Monitored	Time	Reading	Action Required? Y/N

Describe Any Actions Taken as a Result of this Air Monitoring and Why (does it match Table 5-1):

_____

_____

Employee Signature Form

I certify that I have read, understand, and will abide by the safety requirements outlined in this HASP.

Printed Name	Signature	Date

Subcontractor Acknowledgement: Receipt of HASP Signature Form

ARCADIS claims no responsibility for the use of this HASP by others although subcontractors working at the site may use this HASP as a guidance document. In any event, ARCADIS does not guarantee the health and/or safety of any person entering this site. Strict adherence to the health and safety guidelines provided herein will reduce, but not eliminate, the potential for injury at this site. To this end, health and safety becomes the inherent responsibility of personnel working at the site.

Printed Name	Company	Signature	Date

Visitor Acknowledgement and Acceptance of HASP Signature Form

By signing below, I waive, release and discharge the owner of the site and ARCADIS and their employees from any future claims for bodily and personal injuries which may result from my presence at, entering, or leaving the site and in any way arising from or related to any and all known and unknown conditions on the site.

Name	Company	Reason for Visit	Date/Time On Site	Date/Time Off Site

Hazardous Materials Transportation Form

	Vehicle (place X in box)	Type (pick-up, car, box truck, etc.)
Personal		
Rental		
ARCADIS owned/leased		
Government owned		
Trailer		

Materials Transported	Quantity	Storage/Transport Container

List Trained Drivers:

_____

_____

Hazardous Materials Shipment Form

Material Description and Proper Shipping Name (per DOT or IATA)	Shipment Quantity	DOT Hazard Classification	Shipment Method (air/ground)

List Shipper (i.e., who we are offering the shipment to):

_____

_____

List Trained Employee(s):

_____

_____

ARCADIS

Appendix F

MSDSs

OAKTON® ***MATERIAL SAFETY DATA SHEET***

Section 1. Chemical Product and Company Identification

Catalog Number(s)

00606-10, 00653-15, 00653-16, 00653-18, 00653-20, 00653-23, 00653-27, 00653-32, 00653-47, 00653-50, 00653-89, 35653-09, 35653-10, 35653-11, 35653-12, 35653-13, 35656-18, 35656-47

Product Identity

CONDUCTIVITY STANDARD SOLUTIONS, < 90 mS

Manufacturer's Name	Emergency Telephone Number (24 hr)
RICCA CHEMICAL COMPANY	CHEMTREC®: 800-424-9300
Address (Number, Street, City, State, and ZIP Code)	Telephone Number For Information
P.O. Box 13090	817-461-5601
	Date Prepared
Arlington, Texas 76094	3-17-2000

Section 2. Composition / Information on Ingredients

Component	CAS Registry #	Percent Concentration	Exposure Limits ACGIH TLV	Exposure Limits OSHA PEL
Potassium Chloride	7447-40-7	< 6	N/A	N/A
Water, Deionized	7732-18-5	Balance	N/A	N/A

Section 3. Hazards Identification

☆☆☆

EMERGENCY OVERVIEW

Clear, colorless liquid. Non-flammable, non-toxic, non-corrosive. Does not present any significant health hazards.

☆☆☆

POTENTIAL HEALTH EFFECTS:

TARGET ORGANS: eyes, skin.

EYE CONTACT: May cause irritation.

INHALATION: Not likely to be hazardous by inhalation.

SKIN CONTACT: May cause slight irritation.

INGESTION: Large doses may cause stomach upset.

CHRONIC EFFECTS / CARCINOGENICITY:

IARC – No

NTP – No

OSHA – No

TERATOLOGY (BIRTH DEFECT) INFORMATION:

Mutation data cited in 'Registry of Toxic Effects of Chemical Substances' for Potassium Chloride.

REPRODUCTION INFORMATION:

No information found in "Registry of Toxic Effects of Chemical Substances" or other information sources.

Section 4. First Aid Measures – In all cases, seek qualified evaluation.

EYE CONTACT: Irrigate immediately with large quantity of water for at least 15 minutes.

INHALATION: Remove to fresh air. Give artificial respiration if necessary.

SKIN CONTACT: Flush with plenty of water for at least 15 minutes.

INGESTION: Dilute with water or milk. Call a physician if necessary.

Section 5. Fire Fighting Measures

FLAMMABLE PROPERTIES:

FLASH POINT: N/A METHOD USED: N/A

FLAMMABLE LIMITS

LFL: N/A UFL: N/A

EXTINGUISHING MEDIA: Use any means suitable for extinguishing surrounding fire.

FIRE & EXPLOSION HAZARDS: Not considered to be a fire or explosion hazard.

FIRE FIGHTING INSTRUCTIONS: Use normal procedures/instructions.

FIRE FIGHTING EQUIPMENT: Use protective clothing and breathing equipment appropriate for the surrounding fire.

Section 6. Accidental Release Measures

Absorb with suitable material (paper towels, etc.) and dispose of in accordance with local regulations. Small amounts may be flushed to the sewer with plenty of water.

Section 7. Handling and Storage

As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes and skin. Protect from freezing and physical damage. SAFETY STORAGE CODE: GENERAL

Section 8. Exposure Controls / Personal Protection

ENGINEERING CONTROLS: No specific controls are needed. Normal room ventilation is adequate.

RESPIRATORY PROTECTION: Normal room ventilation is adequate.

SKIN PROTECTION: Chemical resistant gloves are recommended.

EYE PROTECTION: Safety glasses or goggles.

Section 9. Physical and chemical Properties

APPEARANCE:	Clear, colorless liquid	**pH:**	approximately 7
ODOR:	Odorless	**BOILING POINT (°C):**	approximately 100
SOLUBILITY IN WATER:	Infinite	**MELTING POINT (°C):**	approximately 0
SPECIFIC GRAVITY:	approximately 1.0 – 1.04	**VAPOR PRESSURE:**	N/A

Section 10. Stability and Reactivity

CHEMICAL STABILITY: Stable under normal conditions of use and storage.

INCOMPATIBILITY: Bromine Trifluoride, Potassium Permanganate plus Sulfuric Acid.

HAZARDOUS DECOMPOSITION PRODUCTS: Oxides of Potassium.

HAZARDOUS POLYMERIZATION: Will not occur.

Section 11. Toxicological Information

LD_{50}, Oral, Rat: 2600 mg/kg (Potassium Chloride), details of toxic effects not reported other than lethal dose value.
Irritation: eye, rabbit (500mg/24 hr mild).

Section 12. Ecological Information

ECOTOXICOLOGICAL INFORMATION: No information found.

CHEMICAL FATE INFORMATION: No information found.

Section 13. Disposal Considerations

Dilute with water and flush to sewer if local regulations allow. If not allowed, save for recovery or recycling in an approved waste disposal facility. Always dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information (Not meant to be all inclusive)

D.O.T. SHIPPING NAME:	Not regulated
D.O.T. HAZARD CLASS:	None
U.N. / N.A. NUMBER:	None
PACKING GROUP:	None
D.O.T. LABEL:	None

Section 15. Regulatory Information (Not meant to be all inclusive - selected regulation represented)

OSHA STATUS: The above items either do not contain any specifically hazardous material or the potentially hazardous material is present in such low concentration that the items do not present any immediate threat to health and safety. These items do not meet the OSHA Hazard Communication Standard (29 CFR 1910.1200) definition of a hazardous material.

TSCA STATUS: All components of this solution are listed on the TSCA Inventory.
CERCLA REPORTABLE QUANTITY: Not reportable
SARA TITLE III:
SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES: No
SECTION 311/312 HAZARDOUS CATEGORIES: No
SECTION 313 TOXIC CHEMICALS: No
RCRA STATUS: No

CALIFORNIA PROPOSITION 65: Not listed

Section 16. Other Information

NFPA® Ratings:	**Health: 0**	**Flammability: 0**	**Reactivity: 0**	**Special Notice Key: None**
HMIS® Ratings:	**Health: 0**	**Flammability: 0**	**Reactivity: 0**	**Protective Equipment: B (Protective eyewear, gloves)**

Rev 1, 10-16-2000: (Section 1) added catalog numbers 35653-10, 35653-11, 35653-12, and 35653-13.
Rev 2, 12-06-2001: (Section 1) added catalog number 35653-09; revised description from 23µ - 80 mS.
Rev 3, 03-25-2003: Reviewed and approved, (Section 3) added mutation statement, (Section 11) added irritation data.
Rev 4, 03-20-2006: Reviewed and approved.

When handled properly by qualified personnel, the product described herein does not present a significant health or safety hazard. Alteration of its characteristics by concentration, evaporation, addition of other substances, or other means may present hazards not specifically addressed herein and which must be evaluated by the user. The information furnished herein is believed to be accurate and represents the best data currently available to us. No warranty, expressed or implied, is made and RICCA CHEMICAL COMPANY assumes no legal responsibility or liability whatsoever resulting from its use.

OAKTON® MATERIAL SAFETY DATA SHEET

Section 1. Chemical Product and Company Identification

Catalog Number(s)

00654-00, 05942-21, 05942-22, 05942-24, 05942-25, 05942-26, 05942-27, 35653-01, 35654-00

Product Identity

BUFFER, Standard, pH 4.01; BUFFER, High Accuracy, pH 4.000 (Color Coded Red)

Manufacturer's Name	Emergency Telephone Number (24 hr)
RICCA CHEMICAL COMPANY	CHEMTREC®: 800-424-9300
Address (Number, Street, City, State, and ZIP Code)	Telephone Number For Information
P.O. Box 13090	817-461-5601
	Date Prepared
Arlington, Texas 76094	3-7-2000

Section 2. Composition / Information on Ingredients

Component	CAS Registry #	Percent Concentration	Exposure Limits ACGIH TLV	OSHA PEL
Potassium Acid Phthalate	877-24-7	0.95 – 1.05	N/A	N/A
Preservative* *(No Mercury compounds or Formaldehyde)	proprietary	<0.5	N/A	N/A
Inert Dye	proprietary	<0.1	N/A	N/A
Water, Deionized	7732-18-5	Balance	N/A	N/A

Section 3. Hazards Identification

☆☆☆

EMERGENCY OVERVIEW

Non-flammable, non-toxic, non-corrosive. Does not present any significant health hazards. Wash areas of contact with water.

☆☆☆

POTENTIAL HEALTH EFFECTS:

TARGET ORGANS: eyes, skin.

EYE CONTACT: May cause slight irritation.

INHALATION: Not likely to be hazardous by inhalation.

SKIN CONTACT: May cause slight irritation.

INGESTION: Large doses may cause nausea, vomiting, diarrhea and cramps.

CHRONIC EFFECTS / CARCINOGENICITY:

IARC – No
NTP – No
OSHA – No

TERATOLOGY (BIRTH DEFECT) INFORMATION:

No information found in "Registry of Toxic Effects of Chemical Substances" or other information sources.

REPRODUCTION INFORMATION:

No information found in "Registry of Toxic Effects of Chemical Substances" or other information sources.

Section 4. First Aid Measures – In all cases, seek qualified evaluation.

EYE CONTACT: Irrigate immediately with large quantity of water for at least 15 minutes. Call a physician if irritation develops.

INHALATION: Remove to fresh air. Give artificial respiration if necessary. If breathing is difficult, give oxygen.

SKIN CONTACT: Flush with plenty of water for at least 15 minutes. Call a physician if irritation develops.

INGESTION: Dilute with water or milk. Call a physician if necessary.

Section 5. Fire Fighting Measures

FLAMMABLE PROPERTIES:

FLASH POINT:	N/A	METHOD USED:	N/A

FLAMMABLE LIMITS

LFL:	N/A	UFL:	N/A

EXTINGUISHING MEDIA: Use any means suitable for extinguishing surrounding fire.

FIRE & EXPLOSION HAZARDS: Not considered to be a fire or explosion hazard.

FIRE FIGHTING INSTRUCTIONS: Use normal procedures/instructions.

FIRE FIGHTING EQUIPMENT: Use protective clothing and breathing equipment appropriate for the surrounding fire.

Section 6. Accidental Release Measures

Absorb with suitable material and dispose of in accordance with local regulations.

Section 7. Handling and Storage

As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes and skin. Protect from freezing and physical damage. SAFETY STORAGE CODE: GENERAL

Section 8. Exposure Controls / Personal Protection

ENGINEERING CONTROLS: No specific controls are needed. Normal room ventilation is adequate.

RESPIRATORY PROTECTION: Normal room ventilation is adequate.

SKIN PROTECTION: Chemical resistant gloves.

EYE PROTECTION: Safety glasses or goggles.

Section 9. Physical and chemical Properties

APPEARANCE:	Clear, red colored liquid	pH:	4
ODOR:	odorless	BOILING POINT (°C):	approximately 100
SOLUBILITY IN WATER:	infinite	MELTING POINT (°C):	approximately 0
SPECIFIC GRAVITY:	approximately 1	VAPOR PRESSURE:	N/A

Section 10. Stability and Reactivity

CHEMICAL STABILITY: Stable under normal conditions of use and storage.

INCOMPATIBILITY: Nitric Acid

HAZARDOUS DECOMPOSITION PRODUCTS: Oxides of Carbon and Potassium.

HAZARDOUS POLYMERIZATION: Will not occur.

Section 11. Toxicological Information

LD50, Oral, Rat: >3200 mg/kg (Potassium Acid Phthalate), details of toxic effects not reported other than lethal dose value.

Section 12. Ecological Information

ECOTOXICOLOGICAL INFORMATION: No information found.

CHEMICAL FATE INFORMATION: No information found.

Section 13. Disposal Considerations

Dilute with water, neutralize with weak sodium hydroxide solution, and then flush to sewer if local regulations allow. If not allowed, save for recovery or recycling in an approved waste disposal facility. Always dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information (Not meant to be all inclusive)

D.O.T. SHIPPING NAME:	Not regulated
D.O.T. HAZARD CLASS:	None
U.N. / N.A. NUMBER:	None
PACKING GROUP:	None
D.O.T. LABEL:	None

Section 15. Regulatory Information (Not meant to be all inclusive - selected regulation represented)

OSHA STATUS: The above items either do not contain any specifically hazardous material or the potentially hazardous material is present in such low concentration that the items do not present any immediate threat to health and safety. These items do not meet the OSHA Hazard Communication Standard (29 CFR 1910.1200) definition of a hazardous material.

TSCA STATUS: All components of this solution are listed on the TSCA Inventory.
CERCLA REPORTABLE QUANTITY: Not reportable
SARA TITLE III:

SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES: No
SECTION 311/312 HAZARDOUS CATEGORIES: No
SECTION 313 TOXIC CHEMICALS: No

RCRA STATUS: No

CALIFORNIA PROPOSITION 65: Not listed

Section 16. Other Information

NFPA® Ratings:	**Health: 1**	**Flammability: 0**	**Reactivity: 0**	**Special Notice Key: None**
HMIS® Ratings:	**Health: 1**	**Flammability: 0**	**Reactivity: 0**	**Protective Equipment: B (Protective eyewear, gloves)**

Rev 1, 10-16-2000: (Section 1) added catalog number 35653-01.
Rev 2, 03-25-2003: Reviewed and approved.
Rev 3, 03-20-2006: Reviewed and approved.

When handled properly by qualified personnel, the product described herein does not present a significant health or safety hazard. Alteration of its characteristics by concentration, evaporation, addition of other substances, or other means may present hazards not specifically addressed herein and which must be evaluated by the user. The information furnished herein is believed to be accurate and represents the best data currently available to us. No warranty, expressed or implied, is made and RICCA CHEMICAL COMPANY assumes no legal responsibility or liability whatsoever resulting from its use.

OAKTON® MATERIAL SAFETY DATA SHEET

Section 1. Chemical Product and Company Identification

Catalog Number(s)

00654-04, 35654-04, 05942-41, 05942-42, 05942-44, 05942-45, 35653-02

Product Identity

BUFFER, Standard, pH 7.00 (Color Coded Green)

Manufacturer's Name	Emergency Telephone Number (24 hr)
RICCA CHEMICAL COMPANY	CHEMTREC®: 800-424-9300
Address (Number, Street, City, State, and ZIP Code)	Telephone Number For Information
P.O. Box 13090	817-461-5601
	Date Prepared
Arlington, Texas 76094	3-8-2000

Section 2. Composition / Information on Ingredients

Component	CAS Registry #	Percent Concentration	Exposure Limits ACGIH TLV	OSHA PEL
Sodium Phosphate, Dibasic	7558-79-4	< 1	N/A	N/A
Potassium Phosphate, Monobasic	7778-77-0	< 1	N/A	N/A
Preservative* *(No Mercury Compounds or Formaldehyde)	Proprietary	< 0.1	N/A	N/A
Inert Dye	Proprietary	< 0.1	N/A	N/A
Water, Deionized	7732-18-5	Balance	N/A	N/A

Section 3. Hazards Identification

☆☆

EMERGENCY OVERVIEW

Non-flammable, non-toxic, non-corrosive. Does not present any significant health hazards. May cause irritation. Wash areas of contact with water

☆☆

POTENTIAL HEALTH EFFECTS:

TARGET ORGANS: eyes, skin.

EYE CONTACT: May cause slight irritation.

INHALATION: May cause allergic respiratory reaction to those allergic to phosphates.

SKIN CONTACT: May cause slight irritation to those allergic to phosphates.

INGESTION: Large doses may cause stomach upset.

CHRONIC EFFECTS / CARCINOGENICITY:

IARC – No
NTP – No
OSHA – No

TERATOLOGY (BIRTH DEFECT) INFORMATION:

No information found in "Registry of Toxic Effects of Chemical Substances" or other information sources.

REPRODUCTION INFORMATION:

No information found in "Registry of Toxic Effects of Chemical Substances" or other information sources.

Section 4. First Aid Measures – In all cases, seek qualified evaluation.

EYE CONTACT: Irrigate immediately with large quantity of water for at least 15 minutes. Call a physician if irritation develops.

INHALATION: Remove to fresh air. Give artificial respiration if necessary. If breathing is difficult, give oxygen.

SKIN CONTACT: Flush with plenty of water for at least 15 minutes. Call a physician if irritation develops.

INGESTION: Dilute with water or milk. Call a physician if necessary.

Section 5. Fire Fighting Measures

FLAMMABLE PROPERTIES:

FLASH POINT:	N/A	METHOD USED:	N/A

FLAMMABLE LIMITS

LFL:	N/A	UFL:	N/A

EXTINGUISHING MEDIA: Use any means suitable for extinguishing surrounding fire.

FIRE & EXPLOSION HAZARDS: Not considered to be a fire or explosion hazard.

FIRE FIGHTING INSTRUCTIONS: Use normal procedures/instructions.

FIRE FIGHTING EQUIPMENT: Use protective clothing and breathing equipment appropriate for the surrounding fire.

Section 6. Accidental Release Measures

Absorb with suitable material (vermiculite, clay, etc.) and dispose of in accordance with local regulations. Check with local agencies for the proper disposal of phosphate containing solutions.

Section 7. Handling and Storage

As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes and skin. Protect from freezing and physical damage. SAFETY STORAGE CODE: GENERAL

Section 8. Exposure Controls / Personal Protection

ENGINEERING CONTROLS: No specific controls are needed. Normal room ventilation is adequate.

RESPIRATORY PROTECTION: Normal room ventilation is adequate.

SKIN PROTECTION: Chemical resistant gloves.

EYE PROTECTION: Safety glasses or goggles.

Section 9. Physical and chemical Properties

APPEARANCE:	Clear, green liquid	pH:	7
ODOR:	Odorless	BOILING POINT (°C):	approximately 100
SOLUBILITY IN WATER:	Infinite	MELTING POINT (°C):	approximately 0
SPECIFIC GRAVITY:	approximately 1	VAPOR PRESSURE:	N/A

Section 10. Stability and Reactivity

CHEMICAL STABILITY: Stable under normal conditions of use and storage.

INCOMPATIBILITY: None identified.

HAZARDOUS DECOMPOSITION PRODUCTS: Phosphorus oxides may form when heated to decomposition.

HAZARDOUS POLYMERIZATION: Will not occur.

Section 11. Toxicological Information

LD50, Oral, Rat: (Sodium Phosphate Dibasic) 17 gm/kg; LD50, Dermal, Rabbit: (Potassium Phosphate Monobasic) >4640 mg/kg; details of toxic effects not reported other than lethal dose value.

Section 12. Ecological Information

ECOTOXICOLOGICAL INFORMATION: No information found.

CHEMICAL FATE INFORMATION: No information found.

Section 13. Disposal Considerations

Dilute with water, then flush to sewer if local regulations allow for the flushing of phosphate containing solutions. If not allowed, save for recovery or recycling in an approved waste disposal facility. Always dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information (Not meant to be all inclusive)

D.O.T. SHIPPING NAME:	Not regulated
D.O.T. HAZARD CLASS:	None
U.N. / N.A. NUMBER:	None
PACKING GROUP:	None
D.O.T. LABEL:	None

Section 15. Regulatory Information (Not meant to be all inclusive - selected regulation represented)

OSHA STATUS: The above items either do not contain any specifically hazardous material or the potentially hazardous material is present in such low concentration that the items do not present any immediate threat to health and safety. These items do not meet the OSHA Hazard Communication Standard (29 CFR 1910.1200) definition of a hazardous material.

TSCA STATUS: All components of this solution are listed on the TSCA Inventory or are mixtures (hydrates) of items listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITY: Sodium Phosphate, Dibasic - 5,000 pounds.

SARA TITLE III:

SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES: No

SECTION 311/312 HAZARDOUS CATEGORIES: No

SECTION 313 TOXIC CHEMICALS: No

RCRA STATUS: No

CALIFORNIA PROPOSITION 65: Not listed.

PENNSYLVANIA: Sodium Phosphate Dibasic is listed as an environmental hazard on the state Hazardous Substance list.

Section 16. Other Information

NFPA Ratings:	**Health: 1**	**Flammability: 0**	**Reactivity: 0**	**Special Notice Key: None**
HMIS® Ratings:	**Health: 1**	**Flammability: 0**	**Reactivity: 0**	**Protective Equipment: B (Protective eyewear, gloves)**

Rev 1, 8-25-2000: (Section 2) corrected concentration of preservative from 1 – 2 to < 0.1%.
Rev 2, 03-25-2003: Reviewed and approved, (Section 15) added CERCLA reportable quantity.
Rev 3, 03-20-2006: Reviewed and approved.

When handled properly by qualified personnel, the product described herein does not present a significant health or safety hazard. Alteration of its characteristics by concentration, evaporation, addition of other substances, or other means may present hazards not specifically addressed herein and which must be evaluated by the user. The information furnished herein is believed to be accurate and represents the best data currently available to us. No warranty, expressed or implied, is made and RICCA CHEMICAL COMPANY assumes no legal responsibility or liability whatsoever resulting from its use.

OAKTON® MATERIAL SAFETY DATA SHEET

Section 1. Chemical Product and Company Identification

Catalog Number(s)	
00654-08, 35654-08, 05942-61, 05942-62, 05942-64, 05942-65, 05942-66, 05942-67, 35653-03	
Product Identity	
BUFFER, Standard, pH 10.00; BUFFER, High Accuracy, pH 10.000 (Color Coded Blue)	
Manufacturer's Name	**Emergency Telephone Number (24 hr)**
RICCA CHEMICAL COMPANY	CHEMTREC®: 800-424-9300
Address (Number, Street, City, State, and ZIP Code)	**Telephone Number For Information**
P.O. Box 13090	817-461-5601
	Date Prepared
Arlington, Texas 76094	3-8-2000

Section 2. Composition / Information on Ingredients

Component	CAS Registry #	Percent Concentration	Exposure Limits ACGIH TLV	OSHA PEL
Sodium Carbonate	497-19-8	< 1	N/A	N/A
Sodium Bicarbonate	144-55-8	< 1	N/A	N/A
Preservative* *(No Mercury compounds or Formaldehyde)	proprietary	< 0.1	N/A	N/A
Inert Dye	proprietary	< 0.1	N/A	N/A
Water, Deionized	7732-18-5	Balance	N/A	N/A

Section 3. Hazards Identification

☆☆

EMERGENCY OVERVIEW

Non-flammable, non-toxic, non-corrosive. Does not present any significant health hazards. Wash areas of contact with water.

☆☆

POTENTIAL HEALTH EFFECTS:

TARGET ORGANS: eyes, skin.

EYE CONTACT: May cause slight irritation.

INHALATION: Not likely to be hazardous by inhalation.

SKIN CONTACT: May cause slight irritation.

INGESTION: Large doses may cause nausea, vomiting, diarrhea and cramps.

CHRONIC EFFECTS / CARCINOGENICITY:

IARC – No
NTP – No
OSHA – No

TERATOLOGY (BIRTH DEFECT) INFORMATION:

Mutation data cited in "Registry of Toxic Effects of Chemical Substances" for Sodium Bicarbonate in rats.

REPRODUCTION INFORMATION:

Reproductive data cited in "Registry of Toxic Effects of Chemical Substances" for Sodium Bicarbonate and Sodium Carbonate in mice.

Section 4. First Aid Measures – In all cases, seek qualified evaluation.

EYE CONTACT: Irrigate immediately with large quantity of water for at least 15 minutes. Call a physician if irritation develops.

INHALATION: Remove to fresh air. Give artificial respiration if necessary. If breathing is difficult, give oxygen.

SKIN CONTACT: Flush with plenty of water for at least 15 minutes. Call a physician if irritation develops.

INGESTION: Dilute with water or milk. Call a physician if necessary.

Section 5. Fire Fighting Measures

FLAMMABLE PROPERTIES:

FLASH POINT: N/A METHOD USED: N/A

FLAMMABLE LIMITS

LFL: N/A UFL: N/A

EXTINGUISHING MEDIA: Use any means suitable for extinguishing surrounding fire.

FIRE & EXPLOSION HAZARDS: Not considered to be a fire or explosion hazard.

FIRE FIGHTING INSTRUCTIONS: Use normal procedures/instructions.

FIRE FIGHTING EQUIPMENT: Use protective clothing and breathing equipment appropriate for the surrounding fire.

Section 6. Accidental Release Measures

Absorb with suitable material and treat as normal refuse. Small amounts of the liquid may be flushed to the drain with excess water. Always dispose of in accordance with local regulations.

Section 7. Handling and Storage

As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes and skin. Protect from freezing and physical damage. SAFETY STORAGE CODE: GENERAL

Section 8. Exposure Controls / Personal Protection

ENGINEERING CONTROLS: No specific controls are needed. Normal room ventilation is adequate.

RESPIRATORY PROTECTION: Normal room ventilation is adequate.

SKIN PROTECTION: Chemical resistant gloves.

EYE PROTECTION: Safety glasses or goggles.

Section 9. Physical and chemical Properties

APPEARANCE:	Clear, blue colored liquid	pH:	10
ODOR:	Odorless	BOILING POINT (°C):	approximately 100
SOLUBILITY IN WATER:	Infinite	MELTING POINT (°C):	approximately 0
SPECIFIC GRAVITY:	approximately 1	VAPOR PRESSURE:	N/A

Section 10. Stability and Reactivity

CHEMICAL STABILITY: Stable under normal conditions of use and storage.

INCOMPATIBILITY: Acids

HAZARDOUS DECOMPOSITION PRODUCTS: Oxides of Sodium.

HAZARDOUS POLYMERIZATION: Will not occur.

Section 11. Toxicological Information

LD50, Oral, Rat: 4090 mg/kg (Sodium Carbonate), 4220 mg/kg (Sodium Bicarbonate), details of toxic effects not reported other than lethal dose value.

Section 12. Ecological Information

ECOTOXICOLOGICAL INFORMATION: No information found.

CHEMICAL FATE INFORMATION: No information found.

Section 13. Disposal Considerations

Dilute with water, then flush to sewer if local regulations allow. If not allowed, save for recovery or recycling in an approved waste disposal facility. Always dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information (Not meant to be all inclusive)

D.O.T. SHIPPING NAME:	Not regulated
D.O.T. HAZARD CLASS:	None
U.N. / N.A. NUMBER:	None
PACKING GROUP:	None
D.O.T. LABEL:	None

Section 15. Regulatory Information (Not meant to be all inclusive - selected regulation represented)

OSHA STATUS: The above items either do not contain any specifically hazardous material or the potentially hazardous material is present in such low concentration that the items do not present any immediate threat to health and safety. These items do not meet the OSHA Hazard Communication Standard (29 CFR 1910.1200) definition of a hazardous material.

TSCA STATUS: All components of this solution are listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITY: Not reportable

SARA TITLE III:

SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES: No

SECTION 311/312 HAZARDOUS CATEGORIES: No

SECTION 313 TOXIC CHEMICALS: No

RCRA STATUS: No

CALIFORNIA PROPOSITION 65: Not listed.

Section 16. Other Information

NFPA® Ratings:	Health: 1	Flammability: 0	Reactivity: 0	Special Notice Key: None
HMIS® Ratings:	Health: 1	Flammability: 0	Reactivity: 0	Protective Equipment: B (Protective eyewear, gloves)

Rev 1, 01-15-2003: added catalog number 35653-03.
Rev 2, 03-25-2003: Reviewed and approved.
Rev 3, 03-20-2006: Reviewed and approved.

When handled properly by qualified personnel, the product described herein does not present a significant health or safety hazard. Alteration of its characteristics by concentration, evaporation, addition of other substances, or other means may present hazards not specifically addressed herein and

which must be evaluated by the user. The information furnished herein is believed to be accurate and represents the best data currently available to us. No warranty, expressed or implied, is made and RICCA CHEMICAL COMPANY assumes no legal responsibility or liability whatsoever resulting from its use.

HANNA Instruments **HI 93703-0**
Primary Standard –0 FTU

Health & Safety data sheet
According to EC Directive 91/155/EC and following amendments

Date of issue: 03 January 2008.

SECTION 1 - IDENTIFICATION OF THE PRODUCT AND OF THE COMPANY

Product name:
- HI 93703-0 Primary Standard – 0 FTU.

Application:
- Calibration Solution for turbidity measurements.

Manufacturer identification: Hanna Instruments Italia s.r.l.
viale delle Industrie, 12/A
35010 Villafranca Padovana, Italy
tel. n°.:+39-049-9070211

Emergency Telephone n.°: No hazardous product

SECTION 2 – COMPOSITION/INFORMATION ON INGREDIENTS

Aqueous solution.

SECTION 3 - HAZARD IDENTIFICATION

No hazardous product as specified in Directive 67/548/EEC.

SECTION 4 - FIRST AID MEASURES

- **After inhalation** : NA
- **After skin contact** : NA
- **After eye contact** : NA
- **After swallowing** : NA

SECTION 5 – FIRE-FIGHTING MEASURES

- **Suitable extinguishing media**
  - In adaptation to materials stored in the neighborhood.
- **Special risks:**
  - None.
- **Additional information:**
  - No special fire precautions are required.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

- **Personal precautions:**
  - None
- **Environmental precautions:**
  - None

SECTION 7 - HANDLING AND STORAGE

- **Handling:**
  - No restrictions
- **Storage:**
  - Keep container closed and protected from direct sunlight.
  - Store at room temperature (+15°C to +25°C).

SECTION 8 - EXPOSURE CONTROL/PERSONAL PROTECTION

- **Personal protective equipment:**
  - Not required.

Health & Safety data sheet
According to EC Directive 91/155/EC and following amendments

SECTION 9 - PHYSICAL/CHEMICAL PROPERTIES

- **Appearance and odor** : clear liquid.
- **Odor** : odorless.
- **Solubility in water** : soluble
- **Melting point** : ~ 0 °C
- **Boiling point** : ~ 100 °C
- **pH value at 20°C** : ~ 6.5
- **density at 20°C** : ~ 1 g/cm^3
- **flash point** : NA
- **explosive properties** : NA
- **explosion limits** : NA
- **ignition temperature** : NA

SECTION 10 - STABILITY AND REACTIVITY

- **Conditions to be avoided:**
  - Strong heating (above boiling point).
  - Stable in the recommended storage conditions.
- **Substances to be avoided:**
  - None.
- **Hazardous decomposition products:**
  - In the event of fire: see section 5.
- **Hazardous Polymerization:**
  - Will not occur.

SECTION 11 - TOXICOLOGICAL INFORMATION

No toxic effects are to be expected when the product is handled appropriately.

SECTION 12 - ECOLOGICAL INFORMATION

No environmental hazard.

SECTION 13 - DISPOSAL CONSIDERATIONS

- **Waste disposal:**
  - Can be safely disposed off as an ordinary refuse.

SECTION 14 - TRANSPORT INFORMATION

Not subject to transport regulations.

SECTION 15 - REGULATORY INFORMATION

Labeling according to EC Directives:

Symbol:	-
R-phrases:	-
S-phrases:	-
Contains :	-

SECTION 16 - OTHER INFORMATION

- **Supersedes edition of** : June 2002
- **Reason for revision** : general update
- **Legend** : NA Not Applicable
  ND Not Determined

THE INFORMATION CONTAINED HEREIN IS BASED ON THE PRESENT STATE OF OUR KNOWLEDGE. IT CHARACTERIZES THE PRODUCT WITH REGARD TO THE APPROPRIATE SAFETY PRECAUTIONS. IT DOES NOT REPRESENT A GUARANTEE OF THE PROPERTIES OF THE PRODUCT.

HANNA instruments **HI 93703-10**
Primary Standard – 10 FTU

Health & Safety data sheet
According to EC Directive 91/155/EC

Date of issue: 03 January 2008

SECTION 1 - IDENTIFICATION OF THE PRODUCT AND OF THE COMPANY

Product name:
- HI 93703-10 AMCO-AEPA Primary Standard – 10FTU

Application:
- Calibration Solution for turbidity measurements

Manufacturer identification: Hanna Instruments Italia s.r.l.
viale delle Industrie, 12/A
35010 Villafranca Padovana, Italy
tel. n°.:+39-049-9070211

Emergency Telephone n.°: No hazardous product

SECTION 2 – COMPOSITION/INFORMATION ON INGREDIENTS

Aqueous solution.

SECTION 3 - HAZARD IDENTIFICATION

No hazardous product as specified in Directive 67/548/EEC.

SECTION 4 - FIRST AID MEASURES

- **After inhalation** : NA
- **After skin contact** : NA
- **After eye contact** : NA
- **After swallowing** : NA

SECTION 5 – FIRE-FIGHTING MEASURES

- **Suitable extinguishing media**
  - In adaptation to materials stored in the neighborhood.
- **Special risks:**
  - Specific Hazard(s): emits toxic fumes under fire conditions. The following may develop in event of fire: carbon monoxide, carbon dioxide, alkylbenzene, vinylbenzene, naphthalene, benzaldehydes and phenol.
- **Additional information:**
  - No special fire precautions are required.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

- **Personal precautions:**
  - None
- **Environmental precautions:**
  - None

SECTION 7 - HANDLING AND STORAGE

- **Handling:**
  - No restrictions
- **Storage:**
  - Keep container closed and protected from direct sunlight.
  - Store at room temperature (+15°C to +25°C).

SECTION 8 - EXPOSURE CONTROL/PERSONAL PROTECTION

- **Personal protective equipment:**
  - Not required.

Health & Safety data sheet
According to EC Directive 91/155/EC

SECTION 9 - PHYSICAL/CHEMICAL PROPERTIES

- **Appearance and odor** : clear to opaque liquid.
- **Odor** : odorless.
- **Solubility in water** : soluble
- **Melting point** : ~ 0 °C
- **Boiling point** : ~ 100 °C
- **pH value at 20°C** : ~ 6.5
- **density at 20°C** : ~ 1 g/cm^3
- **flash point** : NA
- **explosive properties** : NA
- **explosion limits** : NA
- **ignition temperature** : NA

SECTION 10 - STABILITY AND REACTIVITY

- **Conditions to be avoided:**
  - Strong heating (above boiling point).
  - Stable in the recommended storage conditions.
- **Substances to be avoided:**
  - Organic compounds.
- **Hazardous decomposition products:**
  - In the event of fire: see section 5.
- **Hazardous Polymerization:**
  - Will not occur.

SECTION 11 - TOXICOLOGICAL INFORMATION

- **In case of inhalation** : NA.
- **In case of skin contact** : irritant effects, danger of skin absorption.
- **In case of skin absorption** : wash hands / use moisturizer if dryness develops.
- **In case of eye contact** : flush with water several times.
- **In case of ingestion** : not hazardous.
- **Further data** : no toxic effects are to be expected when the product is handled appropriately.

SECTION 12 - ECOLOGICAL INFORMATION

No environmental hazard.

SECTION 13 - DISPOSAL CONSIDERATIONS

- **Waste disposal:**
  - Can be safely disposed off as an ordinary refuse.

SECTION 14 - TRANSPORT INFORMATION

Not subject to transport regulations.

SECTION 15 - REGULATORY INFORMATION

Labeling according to EC Directives:

Symbol: -
R-phrases : -
S-phrases : -
Contains : -

SECTION 16 - OTHER INFORMATION

- **Supersedes edition of** : / (1st edition)
- **Legend** : NA Not Applicable
  ND Not Determined

THE INFORMATION CONTAINED HEREIN IS BASED ON THE PRESENT STATE OF OUR KNOWLEDGE. IT CHARACTERIZES THE PRODUCT WITH REGARD TO THE APPROPRIATE SAFETY PRECAUTIONS. IT DOES NOT REPRESENT A GUARANTEE OF THE PROPERTIES OF THE PRODUCT.

MATERIAL DATA SAFETY SHEET

HMIS Ratings Health: 0
Flammability: 0
Reactivity: 0

Identity: Eyesaline® solution - Product #s 32-000400, 32-000401, 32-000502, 32-001050, 32-001052

Section I

Manufacturer: Fendall, Inc.	**Emergency Telephone:** 1-401-232-1200
Address: 825 East Highway 151	**Information Telephone:** 800-543-4842
Platteville, WI 53818 USA	**Date Prepared: 11/30/06**

Section II - Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other limits recommended	% (optional)
BENZALKONIUM CHLORIDE CAS #8001-54-5	NONE	NONE	N/A	<0.1%

Section III - Physical/Chemical Characteristics

Boiling Point: 200°F (93.3°C)	**Specific Gravity (H2O)=1:** NOT DETERMINED
Vapor Pressure (mm Hg.): 760	**Melting Point:** N/A
Vapor Density (Air = 1): NOT DETERMINED.	**Evaporation Rate (Butyl Acetate = 1):** NOT DETERMINED

Solubility in Water: 100%

Appearance and Odor: COLORLESS LIQUID WITH NO DISCERNABLE ODOR.

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used): N/A	**Flammable Limits:**	**LEL:** N/A	**UEL:** N/A

Extinguishing Media: THIS IS A NONFLAMMABLE AQUEOUS SOLUTION.

Special Fire Fighting Procedures: N/A

Unusual Fire and Explosion Hazards: N/A

Section V - Reactivity Data

Stability	**Unstable:** NO **Stable:** YES	**Conditions to Avoid:** THIS PRODUCT IS STABLE AND CONSIDERED NON-REACTIVE UNDER NORMAL CONDITIONS OF STORAGE AND USAGE.

Incompatibility (Materials to Avoid): NONE KNOWN

Hazardous Decomposition or Byproducts: NONE

Hazardous Polymerization	**May Occur:** NO **Will Not Occur:** YES	**Conditions to Avoid:** NONE

Section VI - Health Hazard Data

Route(s) of Entry: **Inhalation?** NO **Skin?** NO **Ingestion?** YES

Health Hazards (Acute and Chronic): INGESTION OF VOLUMES IN EXCESS OF 20 LITERS MAY CAUSE GASTRIC IRRITATION.

Carcinogenicity: **NTP?** NO **IARC Monographs?** NO **OSHA Regulated?** NO

Signs and Symptoms of Exposure: N/A

Medical Conditions Generally Aggravated by Exposure: N/A

Emergency First Aid Procedures: NOTES TO PHYSICIAN: IN THE UNLIKELY EVENT OF RAPID INGESTION OF LARGE VOLUMES OF THE SOLUTION, INDUCE VOMITING AND OBSERVE THE PATIENT FOR GASTRIC IRRITATION.

Section VII - Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled: FLUSH AREA WITH WATER. THE SOLUTION IS NOT RCRA HAZARDOUS WASTE.

Waste Disposal Method: N/A

Precautions to Be Taken in Handling and Storing: DO NOT FREEZE OR EXPOSE TO TEMPERATURES IN EXCESS OF 110°F (43°C) FOR EXTENDED PERIODS.

Other Precautions: N/A

Section VIII - Control Measures

Respiratory Protection: N/A

Ventilation	**Local Exhaust:** N/A **Mechanical:** N/A	**Special:** N/A **Other:** N/A

Protective Gloves: N/A **Eye Protection:** N/A

Other Protective Clothing: N/A

Work Hygienic Practices: N/A

Material Safety Data Sheet

June 1, 1999

YSI Incorporated
1725 Brannum Lane
Yellow Springs, OH 45387
USA

C-P# 05478-60

Information and Emergency Phone: (937) 767-7241

SECTION 1 - MATERIAL IDENTIFICATION

PRODUCT NAME: **YSI 3682 Zobell Solution** FORMULA: n/ap
Chemical Type: Inorganic chloride / cyanide
CAS No. n/app

SECTION 2 - HAZARDOUS / IMPORTANT INGREDIENTS

Chemical	CAS No.	PERCENT	PEL/TLV	CARCINOGEN (OSHA, NTP, IARC)
Potassium chloride	7447-40-7	72 - 78%	none	no
Potassium ferrocyanide, trihydrate	14459-95-1	10 - 15%	none	no
Potassium ferricyanide	13746-66-2	10 - 15%	none	no

SECTION 3 - CHEMICAL AND PHYSICAL PROPERTIES

Appearance: white powder
Odor: none
pH: neutral
Water Solubility: infinite
Evaporation Rate: n/av
Boiling Point: n/av
Melting Point: n/av
Specific Gravity: n/av
Vapor Pressure: n/ap
Vapor Density: n/ap

SECTION 4 - FIRE AND EXPLOSION HAZARDS

Flash Point: none Explosive Limits: none
Extinguishing Media: n/ap
Special Firefighting Procedures and Hazards: Material is not combustible. May emit toxic fumes when heated, such as NOx, HCN. HCl. Wear protection as described in Section 6.

SECTION 5 - REACTIVITY INFORMATION

Stable: X Unstable: Precautions: none known
Hazardous Polymerization: Occurs: Does Not Occur: X
Incompatibility: strong acids and oxcidizing agents.
Hazardous Decomposition Products: When heated, possibly NOx, HCN, HCl.

SECTION 6 - HEALTH HAZARDS / PROTECTIVE MEASURES / FIRST AID

Inhalation:
Possible irritation from dusts. (see CHRONIC below)
Use a NIOSH approved respirator for dusts. Get supplier recommendations. Provide adequate ventilation.
Minimize dusty conditions.
Remove to fresh air and provide artificial respiration if needed.

Skin:
Possible irritation from dusts. (see CHRONIC below)
Wear dust-proof gloves and other body protection as needed. Minimize dusty conditions.
Wash exposed areas with soap and water for 15 minutes. Remove contaminated clothing, and wash before re-using.

Eyes:
Possible irritation from dust.
Wear dust barrier goggles. Eliminate dusty conditions.
Flush with water for 15 minutes.

Ingestion
No effects expected from normal use and minor amounts ingested. Large amounts, over 1 tablespoon, can cause digestive system upset s. (see CHRONIC below)
Reduce dusting. Avoid mouth breathing. Use facemask. Provide adequate ventilation.
Avoid swallowing. Spit out. Drink large amounts of water. Induce vomiting if person is conscious. Otherwise, and if effects persist, get medical attention.

CHRONIC EFFECTS: None reported for this material. "Cyanides" in general are often reported as toxic to humans. Therefore, it is recommended that exposure via skin, inhalation, and ingestion be limited.

IN ALL CASES: GET MEDICAL ATTENTION IF EFFECTS PERSIST.

Most likely routes of entry: skin, eyes, ingestion.

SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE

Spills and Leaks: Take up powder in any container and hold for disposal. Flush residual to sewer or ground. Provide personal protection as described in Section 6.

Storage and Handling: Keep containers closed. Discard any material that may be contaminated. Minimize dusting.

Waste Disposal: Is not listed as RCRA hazardous waste at this date. Cyanides are restricted in water disposed to streams and to sewers. Therefore, landfill disposal is indicated; check with local disposal companies.

Empty Containers: Rinse well. Dispose as appropriate for glass and plastic containers.

SECTION 8 - REGULATORY INFORMATION

DOT: Not regulated.
SARA Title III, S.313, Form R: Nothing reportable.

MATERIAL SAFETY DATA SHEET
MASTER NON HAZARDOUS

Revision Number A96002D,
3/30/06

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

Product name	3161 Conductivivty Calibrator 1,000 micromho/cm
Synonyms	None
Chemical characterization	Liquid.
Manufacturer, importer, supplier	YSI, Inc. 1700/1725 Brannum Lane Yellow Springs, OH 45387 USA
EMERGENCY TELEPHONE NUMBER	CHEMTREC: 1-800-424-9300

2. COMPOSITION/INFORMATION ON INGREDIENTS

CAS	Chemical Name	% Weight	ACGIH TWA	Acute toxicity	IARC*	NTP*	OSHA*
7447-40-7	Potassium chloride	0-1	None	NA	N/A	N/A	N/A
7732-18-5	Water	99-100	None	NA	N/A	N/A	N/A

* IARC - Group 1 (Carcinogenic to humans)
* NTP - Report on Carcinogens - Known Carcinogens
* OSHA - Regulated Carcinogens

3. HAZARDS IDENTIFICATION

Emergency Overview:

- The product contains no substances which at their given concentration, are considered to be hazardous to health

Eye contact	Can cause severe irritation.
Skin contact	Exposure can cause skin irritation.
Inhalation:	Inhalation of dust may cause irritation of respiratory tissue.
Ingestion:	May be harmful if swallowed.
General advice	No information available.
Properties affecting health	No information available
Principle Routes of Exposure	eyes, absorption, ingestion

4. FIRST AID MEASURES

General advice	• If exposure symptoms persist, seek medical attention.
Skin contact	• Wash exposed areas with soap and water for 15 minutes. • If skin irritation persists, seek medical attention.
Eye contact	• Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes • If eye irritation persists, seek medical attention
Inhalation:	• Move to fresh air • If exposure symptoms persist, seek medical attention.
Ingestion:	• Do not swallow. Rinse mouth with water and afterwards drink plenty of water. • If effects persist, seek medical attention.
Notes to physician	• Treat symptomatically
Protection of first-aiders	• Use necessary personal protective equipment
Aggravated Medical Conditions	• Users with skin conditions (eczema, psoriasis, etc.,) respiratory conditions (asthma, bronchitis, emphysema, etc.,) or with chemical sensitivities should take protective precautions.

5. FIRE FIGHTING MEASURES

Flash point	NA
Suitable extinguishing media	• Not applicable to this product
Extinguishing media which must not be used for safety reasons	• None
Specific hazabrds	• None
Special exposure hazards arising from the substance or preparation itself, its combustion products, or released gases	• None
Special protective equipment for firefighters	• None • As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear
Specific methods	• No special protective measures against fire required
NFPA (National Fire Protection Association)	Health=1 (slight); Reactivity=0, fire=0, & Special = 0 (none)
HMIS (Hazardous Material Information System)	Health=1(slight); Reactivity=0, fire=0, & Special = 0 (none)

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	• Ensure adequate ventilation
Environmental precautions	• No information available
Methods for cleaning up	• Soak up with inert absorbent material • After cleaning, flush away traces with water

7. HANDLING AND STORAGE

Handling

Technical measures/Precautions	• As a rule, at least 10 air changes per hour are recommended at the workplace
Safe handling advice	• Avoid contact with eyes. Wash hands immediately after contact to avoid hand-eye transfer.

Storage

Technical measures/Precautions	• Keep in properly labelled containers • Keep containers tightly closed; discard any material that may be contaminated or, which may have changed composition. • The product is not flammable
Incompatible products	• Avoid strong acids, oxidizing agents.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures	• Ensure eyewash station is readily available • Ensure adequate ventilation, especially in confined areas
Personal protective equipment	
Hand protection	• Wear appropriate protective gloves
Eye protection	• Avoid contact with eyes • Safety glasses with side-shields or full face shield.
Respiratory protection	• No information available
Skin and body protection	• lightweight protective clothing • boots • apron
Hygiene measures	• Handle in accordance with good industrial hygiene and safety practice • Keep away from food, drink and animal feeding stuffs

Environmental exposure controls	• No information available

9. PHYSICAL AND CHEMICAL PROPERTIES

General Information

Form	Liquid.
Appearance	Clear colorless liquid.
Odour	None.

Important Health Safety and Environmental Information

pH	6.50 to 7.50
Boiling point/range	100°C
Flash point	Not applicable
Vapour pressure	equivalent to water.
Vapour density	equivalent to water vapor.
Water solubility	Infinitely soluable.
Specific Gravity	1.00.

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Materials to avoid	None. Incompatible with strong acids and oxidizing agents.
Hazardous decomposition products	None.
Polymerization	Polymerization does not occur.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Component Information

Product Information

Local effects	
Skin irritation	May cause skin irritation in susceptible persons.
Eye irritation	Dust may cause eye irritation.
Inhalation:	Inhalation of dust may cause irritation of respiratory tissue.
Ingestion:	No effects expected from normal use and minor amounts ingested. Ingestion of large amounts (over 1 tablespoon) may cause digestive system upset.
Sensitization	Not a sensitizer.
Chronic toxicity	No information available.
Specific effects	
carcinogenic effects	No information available.
mutagenic effects	No information available.
Reproductive toxicity	No information available.
Target Organ Effects	No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Component Information

CAS	Chemical Name	% Weight	ACGIH*
7447-40-7	Potassium chloride	0-1	N/A

7732-18-5	Water	99-100	N/A

* ACGIH - Occupational Exposure Limits - TWA's

Product Information

Aquatic toxicity No information available.

Other information:

Ozone depletion potential; ODP; (R-11 = 1)	No information available.
Global warming potential (GWP)	No information available.
Additional ecological information	No information available.
Mobility	No information available
Bioaccumulative potential	No information available
Ecotoxicity effects	No information available
Aquatic toxicity	No information available

13 DISPOSAL CONSIDERATIONS

Waste from residues / unused products	In accordance with local and national regulations.
Contaminated packaging	Empty containers should be rinsed and disposed of as appropriate for glass and plastic containers. .

14 TRANSPORT INFORMATION

DOT Not regulated.
UN-No
Proper shipping name
Packing group
Subsidiary Risk
Description

15 REGULATORY INFORMATION

U.S. Inventories

CAS	Chemical Name	% Weight	ACGIH*
7447-40-7	Potassium chloride	0-1	N/A
7732-18-5	Water	99-100	N/A

* ACGIH - Occupational Exposure Limits - TWA's

International Inventories

CAS	Chemical Name	% Weight	EUOED*
7447-40-7	Potassium chloride	0-1	N/A
7732-18-5	Water	99-100	N/A

* EUOED - EU Occupational Exposure Directive (98/24/EC) Indicative Occupational Exposure Limit Values (IOELV)

16 OTHER INFORMATION

Literary reference None.
Prepared By YSI, Inc. .

End of Safety Data Sheet

Scott Specialty Gases

AIR LIQUIDE

Material Safety Data Sheets
MSDS No: M-704
Date: 04/15/2008

SUPPLIER ADDRESS: 6141 Easton Road, Bldg. 1
PO Box 310
Plumsteadville, PA 18949-0310

EMERGENCY PHONE NUMBER: (215) 766-8861

1. CHEMICAL PRODUCT

PRODUCT NAME: ISOBUTYLENE IN AIR SYNONYMS: None

2. COMPOSITION, INFORMATION ON INGREDIENTS

					Exposure Limits (PPM)		
Ingredient Name	Formula	CAS #	Concentration	ACGIH TLV	OSHA PEL	MAC	Other STEL
ISOBUTYLENE	C4H8	115-11-7	1-1500 PPM	NE	NE	NE	NE
AIR	O2	132259-10-0	BALANCE	NE	NE	NE	NE

Note: NE = NONE ESTABLISHED S/A = SIMPLE ASPHYXIANT

3. HAZARD INDENTIFICATION

* * * EMERGENCY OVERVIEW * * *
High pressure gas.
May accelerate combustion.

POTENTIAL HEALTH EFFECTS

ROUTES OF ENTRY: Inhalation

ACUTE EFFECTS: None

CHRONIC EFFECTS: None known

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None known

OTHER EFFECTS OF OVEREXPORSURE: None

CARCINOGENICITY (US ONLY):

NTP - No
IARC MONOGRAPHS - No
OSHA REGULATED - No

4. FIRST AID MEASURES

INHALATION: Immediately remove victim to fresh air.If breathing has stopped, give artificial respiration.If breathing is difficult, give oxygen.

EYE CONTACT: None

SKIN CONTACT: None

INGESTION: None

IN EVENT OF EXPOSURE, CONSULT A PHYSICIAN

NOTE TO PHYSICIAN: None

5. FIRE FIGHTING MEASURES

FLASH POINT: Nonflammable

AUTOIGNITION TEMPERATURE: N/Ap

FLAMMABLE LIMITS: Nonflammable

LOWER:
UPPER:

EXTINGUISHING MEDIA: Use what is appropriate for surrounding fire.

SPECIAL FIRE FIGHTING INSTRUCTION AND EQUIPMENT: Wear self-contained breathing apparatus and full protective clothing.Keep fire exposed cylinders cool with water spray.If possible, stop the product flow.

HAZARDOUS COMBUSTION PRODUCTS: None

UNUSUAL FIRE AND EXPLOSION HAZARDS: Cylinder rupture may occur under fire conditions.Compressed air at high pressure will accelerate the combustion of flammable materials.

6. ACCIDENTAL RELEASE MEASURES

CLEAN UP PROCEDURES: Evacuate and ventilate area.Remove leaking cylinder to exhaust hood or safe outdoor area.Shut off source if possible and remove source of heat.

SPECIALIZED EQUIPMENT: None

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING: Secure cylinder when using to protect from falling.Use suitable hand truck to move cylinders.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store in well ventilated areas.Keep valve protection cap on cylinders when not in use.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide adequate general and local exhaust ventilation.

EYE / FACE PROTECTION: Safety glasses

SKIN PROTECTION: None

RESPIRATORY PROTECTION: In case of leakage, use self-contained breathing apparatus.

OTHER PROTECTIVE EQUIPMENT: Safety shoes when handling cylinders.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless

ODOR: Odorless

PHYSICAL PRESSURE: Gas

VAPOR PRESSURE: N/Ap

VAPOR DENSITY (AIR=1): 0.991

BOILING POINT (C): N/Ap

SOLUBILITY IN WATER: @20deg.celsius: 18.68cm3/l

SPECIFIC GRAVITY (H2O=1): Gas

EVAPORATION RATE: Gas

ODOR THRESHOLD: N/Ap

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal storage conditions.

CONDITIONS TO AVOID: Storage in poorly ventilated areas.Storage near a heat source.

MATERIALS TO AVOID: Oxidizing agents.

HAZARDOUS POLYMERIZATION: Will not occur.

HAZARDOUS DECOMPOSITION: None

11. TOXICOLOGICAL INFORMATION

LETHAL CONCENTRATION (LC50): NONE ESTABLISHED

LETHAL DOSE 50 (LD50): N/Ap

TERATOGENICITY: N/Ap

REPRODUCTIVE EFFECTS: N/Ap

MUTAGENICITY: N/Ap

12. ECOLOGICAL INFORMATION

No adverse ecological effects are expected.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Dispose of non-refillable cylinders in accordance with federal, state and local regulations. Allow gas to vent slowly to atmosphere in an unconfined area or exhaust hood. If the cylinders are the refillable type, return cylinders to supplier with any valve outlet plugs or caps secured and valve protection caps in place.

14. TRANSPORT INFORMATION

CONCENTRATION: 1-1500 ppm

DOT DESCRIPTION (US ONLY):

PROPER SHIPPING NAME: Compressed gases, n.o.s.
HAZARD CLASS: 2.2 (nonflammable)
INDENTIFICATION NUMBER: UN1956
REPORTABLE QUANTITIES: None
LABELING: NONFLAMMABLE GAS

ADR / RID (EU Only): Class 2, 1A

SPECIAL PRECAUTIONS: Cylinders should be transported in a secure upright position in a well ventilated truck.

15. REGULATORY INFORMATION

OSHA: Process Safety Management: Minor component is not listed in appendix A of 29 CFR 1910.119 as a highly hazardous chemical.

TSCA: Mixture is not listed in TSCA inventory.

SARA: The threshold planning quantity for this mixture is 10,000 lbs.

EU NUMBER: N/Ap

NUMBER IN ANNEX 1 OF DIR 67/548: Mixture is not listed in annex 1.

EU CLASSIFICATION: N/Ap

R: 20

S: 9

16. OTHER INFORMATION

OTHER PRECAUTIONS: Protect containers from physical damage. Do not deface cylinders or labels. Cylinders should be refilled by qualified producers of compressed gas. Shipment of a compressed gas cylinder which has not been filled by the owner or with his written consent is a violation of federal law (49 CFR).

ABBREVIATIONS: N/Ap - Not Applicable N/Av - Not Available SA - Simple Asphyxiant NE - None Established

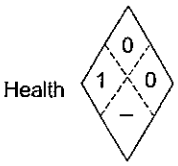
Approved August 1, 2005

*MICRO-90 is a registered trademark of International Products Corp. Burlington, NJ USA

**ANSI Z400.1 - 1998 format

NFPA

Flammability



0 = Minimal Hazard
4 = Severe Hazard

MATERIAL SAFETY DATA SHEET* (MSDS)

International Products Corporation

MICRO-90*

CONCENTRATED CLEANING SOLUTION

DISTRIBUTED BY: COLE-PARMER INSTRUMENT COMPANY
625 E. Bunker Court, Vernon Hills, IL 60061
Toll-Free: 800/323-4340 Chicago Area 847/549-7600
Fax: 847/247-2929

HMIS

Health – 1
Flammability – 0
Reactivity – 0
Personal Protection – B

0 = Minimal Hazard
4 = Severe Hazard
B = Safety Glasses & Gloves

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME MICRO-90*
CHEMICAL FAMILY ..... Mixture
CHEMICAL USE ..... Concentrated Cleaning Solution
ISSUE DATE of MSDS ..... August 1, 2005

MANUFACTURER:

International Products Corporation
201 Connecticut Drive
P.O. Box 70
Burlington, NJ 08016-0070 USA

Tel: (609) 386-8770
Fax: (609) 386-8438
E-mail: mkt@ipcol.com

EMERGENCY TELEPHONES:

Transportation:
CHEMTREC (800) 424-9300
(Calls within USA & Canada)

(703) 527-3887
(Calls outside the USA)

Nontransportation:
Tel: (609) 386-8770
Fax: (609) 386-8438

2. COMPOSITION / INFORMATION ON INGREDIENTS

Ingredients	CAS Number	EEC Hazard Identity	EEC Concentration Range (w/w)
Water	7732-18-5	———	———
Glycine, N,N'-1,2-ethanediylbis-(N-(carboxymethyl)-,tetra-sodium salt	64-02-8	Xi, R-36 R-38	less than 20%
Benzenesulfonic acid, dimethyl-, ammonium salt	26447-10-9	Xi, R-36 R-38	less than 20%
Benzenesulfonic acid, dodecyl-, cpd. with 2,2', 2"-nitrilotris (ethanol)	27323-41-7	Xi, R-36 R-38	less than 20%
Poly(oxy-1,2-ethanediyl), alpha-(undecyl)-omega-hydroxy	34398-01-1	Xi, R-36	less than 20%

3. HAZARDS IDENTIFICATION

* *

EMERGENCY OVERVIEW

Pale yellow aqueous solution with a slight ammonia odor. Nonflammable aqueous solution. NFPA rating of zero. No immediate hazards associated with the product.

* *

POTENTIAL HEALTH EFFECTS

EYE CONTACT ..... Prolonged or repeated contact may cause irritation.

SKIN CONTACT ..... Prolonged or repeated contact may cause irritation.

INHALATION ..... Prolonged or repeated contact may cause irritation.

INGESTION ..... No hazard in normal industrial use.

CARCINOGENICITY:
NTP ..... No ingredients are listed.
IARC ..... No ingredients are listed.
OSHA ..... No ingredients are listed.

CHRONIC EFFECTS ..... Not determined.

TARGET ORGANS ..... Not determined.

SIGNS AND SYMPTOMS ..... Eye and skin irritation (redness or swelling)

* *

POTENTIAL ENVIRONMENTAL EFFECTS

None known.

4. FIRST AID MEASURES

EYE CONTACT ..... Immediately flush eyes with plenty of water. Get medical attention if irritation develops or persists.

SKIN CONTACT ..... Remove contaminated clothing. Wash skin with soap and water. Get medical attention if irritation develops or persists.

INHALATION ..... If exposed to excessive levels of fumes, remove to fresh air. Get medical attention if cough or other symptoms develop.

INGESTION ..... No specific treatment is necessary since this material is not likely to be hazardous by ingestion.

5. FIRE FIGHTING MEASURES

Nonflammable aqueous cleaner.

FLASH POINT ..... None.

LFL ..... Not applicable.

UFL ..... Not applicable.

EXTINGUISHING MEDIA ..... Use alcohol foam, carbon dioxide, or water spray to extinguish flames.

FIRE FIGHTING INSTRUCTION ..... As in any fire, wear self-contained breathing apparatus, pressure-demand MSHA/NIOSH (approved or equivalent) and full protective gear. Water runoff may cause environmental damage. Dike and collect water used to fight fire.

6. ACCIDENTAL RELEASE MEASURES

Clean up spills immediately, observing precautions in Section 8 Personal Protection. Absorb spill with inert material (e.g., dry sand or earth), then place in a chemical waste container.

7. HANDLING AND STORAGE

HANDLING ..... Avoid contact with eyes, skin and clothing. Use in a well-ventilated area.

STORAGE ..... Store in a cool place in original container and protect from sunlight. Keep container closed when not in use. Use only stainless steel, polyethylene or plastic-lined containers for handling. Do not store in contact with aluminum, zinc, copper or their alloys.

SHELF LIFE ..... One year from date of manufacture when stored in original sealed container at recommended storage temperature range.

STORAGE TEMPERATURE ..... 5–43°C (41–110°F)

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS ..... Good general ventilation should be sufficient to control airborne levels.

RESPIRATORY PROTECTION ..... For most situations, no respiratory protection should be needed.

SKIN PROTECTION ..... Wear chemical-resistant gloves.

EYE PROTECTION ..... Wear safety glasses with sideshields (or goggles). Contact lenses should not be worn.

GENERAL HYGIENE CONSIDERATIONS ..... There are no known health hazards associated with this material when used as recommended. The following general hygiene considerations are recognized as common, good industrial hygiene practices:

- Wash hands after use and before eating.
- Avoid breathing vapors.
- Wear safety glasses and gloves.

* *

EXPOSURE LIMITS ..... Not established for product as whole.

Ingredients	CAS #	ACGIH
None established for individual components.		

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE ..... Yellow Liquid.

ODOR ..... Ammonia Odor.

pH (neat) ..... ca. 9.5

BOILING POINT ..... ca. 100°C (212°F)

FREEZING POINT ..... ca. -8°C (18°F)

SOLUBILITY IN WATER ..... Complete

SPECIFIC GRAVITY (water = 1) ..... 1.135@25°C

10. STABILITY AND REACTIVITY

STABILITY ..... Stable Liquid.

HAZARDOUS POLYMERIZATION ..... Will not occur.

INCOMPATIBILITIES ..... May etch aluminum and zinc. Do not mix with other cleaners. Mixing with chlorine-based cleaners may produce toxic gasses.

DECOMPOSITION PRODUCTS ..... Not determined.

11. TOXICOLOGICAL INFORMATION

Eye: Irritant per USA-FHSA criteria.
Not an irritant per OECD Guideline No. 405.

Skin: Not an irritant per USA-FHSA criteria.
Not an irritant per OECD Guideline No. 404.

Oral: LD_{50} is greater than 5g/kg (rats).

12. ECOLOGICAL INFORMATION

Contains no CFCs, ODCs, phosphates, silicates, borates, halogens, or phenols.

13. DISPOSAL CONSIDERATIONS

MICRO-90* is not considered a hazardous waste under Federal Hazardous Waste Regulations 40 CFR 261. Please be advised, however, that state and local requirements for waste disposal may be more restrictive or otherwise different from federal regulations. Consult state and local regulations regarding the proper disposal of this material.

(Note: Chemical additions, processing or otherwise altering this material may make the waste management information presented in this MSDS incomplete, inaccurate or otherwise inappropriate.)

14. TRANSPORTATION INFORMATION

A. USA

D.O.T. SHIPPING ..... Not regulated.

TECHNICAL SHIPPING NAME . Liquid Detergent

D.O.T. LABEL ..... None

D.O.T. PLACARD (non-bulk) ... None

FREIGHT CLASS PACKAGE .... Class 55 - Liquid Detergent

PRODUCT LABEL ..... Concentrated Cleaning Solution

B. CANADA: TDG ..... Not regulated.

C. ENGLAND: APPROVED CARRIAGE LIST ..... Not regulated.

15. REGULATORY INFORMATION

A. USA

TSCA STATUS ..... All ingredients are listed on the TSCA inventory.

SARA TITLE III, 302/303 EHS ... None.

SARA TITLE III, 304, HS ..... None.

SARA TITLE III, 313 ..... None.

B. CANADA

DSL ..... All ingredients are listed on the Domestic Substance List.

WHMIS Classification ..... Not controlled.

C. EC

EINECS ..... All ingredients are listed.

D. CHIPS ..... Not a significant eye irritant. Not a skin irritant.

16. STATE REGULATORY INFORMATION

For details on specific requirements, you should contact the appropriate agency in your state.

17. OTHER INFORMATION

PREPARED BY ..... K. Wyrofsky, Vice President of Marketing

APPROVED BY ..... T. McGuckin, Vice President of Quality & Safety

APPROVAL DATE ..... August 1, 2005

NOTE: All data presented here are for the full-strength product, unless otherwise noted. However, recommended usage is as a 1-2% w/w solution in water.

While International Products Corporation believes the information contained herein to be true and accurate, it has relied on information provided by others. International Products Corporation makes no warranties, express or implied, as to the accuracy or adequacy of the information contained herein or with respect to the results to be obtained from the use of the product. International Products Corporation disclaims all liability with respect to the use of this product, including without limitation, liability for injury to the user or third-party persons.

Alconox ®

MATERIAL SAFETY DATA SHEET

Alconox, Inc.
9 East 40th Street, Suite 200
New York, NY 10016

24 Hour Emergency Number - Chem-Tel (800) 255-3924

I. IDENTIFICATION

Product Name (as appears on label)	ALCONOX (C-P# 17775-00)
CAS Registry Number:	Not Applicable
Effective Date:	July 9, 1999
Chemical Family:	Anionic Powdered Detergent

II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point (F):	Not Applicable
Vapor Pressure (mm Hg):	Not Applicable
Vapor Density (AIR=1):	Not Applicable
Specific Gravity (Water=1):	Not Applicable
Melting Point:	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Not Applicable
Solubility in Water:	Appreciable-Soluble to 10% at ambient conditions
Appearance:	White powder interspersed with cream colored flakes.

IV. FIRE AND EXPLOSION DATA

Flash Point (Method Used):	None
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO_2, foam
Special Firefighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. REACTIVITY DATA

Stability:	Stable
Hazardous Polymerization:	Will not occur

Incompatibility (Materials to Avoid):	None
Hazardous Decomposition or Byproducts:	May release CO_2 on burning

VI. HEALTH HAZARD DATA

Route(s) of Entry:	Inhalation? Yes Skin? No Ingestion? Yes
Health Hazards (Acute and Chronic):	Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Exposure may irritate mucous membranes. May cause sneezing.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs readminister fluids. See a physician for discomfort.

VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	Material should be stored in a dry area to prevent caking.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VIII. CONTROL MEASURES

Respiratory Protection (Specify Type):	Dust mask - Recommended
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are useful but not required.
Eye Protection:	Goggles are recommended when handling solutions.
Other Protective Clothing or Equipment:	None
Work/Hygienic Practices:	Wash hands before eating, drinking or smoking.

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.

}

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Unleaded Petrol
AUT5000

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Unleaded Petrol **CAS Number:** 8006-61-9
Chemical Formula: Mixture of hydrocarbons
EINECS Number: 232-349-1
ACX Number: X1003056-5
Synonyms: AUTOMOTIVE GASOLINE, LEAD-FREE; GASOLINE; MOTOR FUEL; MOTOR SPIRITS; NATURAL GASOLINE; PETROL; UNLEADED PETROL
General Use: Lead free motor fuel for internal combustion engines, 2-stroke and 4-stroke.

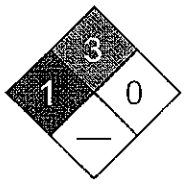
Section 2 - Composition / Information on Ingredients

Name	CAS	%
gasoline	8006-61-9	>90
benzene	71-43-2	5 max.

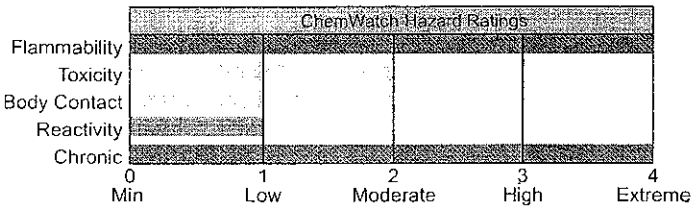
OSHA PEL **NIOSH REL**

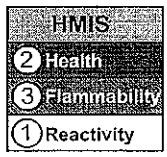
ACGIH TLV
TWA: 300 ppm, 890 mg/m^3;
STEL: 500 ppm, 1480 mg/m^3.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!


Flammable

☆☆☆☆☆ **Emergency Overview** ☆☆☆☆☆

Clear liquid; distinctive odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, drunkenness, unconsciousness. Chronic Effects: dermatitis. Possible cancer hazard. Flammable.

Potential Health Effects

Target Organs: skin, eye, respiratory system, central nervous system (CNS)
Primary Entry Routes: inhalation, ingestion, skin contact

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract and may be harmful if exposure is prolonged. Inhalation hazard is increased at higher temperatures. Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death. WARNING: Intentional misuse by concentrating/inhaling contents may be lethal. High inhaled concentrations of mixed hydrocarbons may produce narcosis characterized by nausea, vomiting and lightheadedness. Inhalation of aerosols may produce severe pulmonary edema, pneumonitis and pulmonary hemorrhage. Inhalation of petroleum hydrocarbons consisting substantially of low molecular weight species may produce irritation of mucous membranes, incoordination, giddiness, nausea, vertigo, confusion, headache, appetite loss, drowziness, tremors and anesthetic stupor. Massive exposures may produce central nervous system depression with sudden collapse and deep coma; fatalities have been recorded. Irritation of the brain and/or apneic anoxia may produce convulsions. Although recovery following overexposure is generally complete, cerebral micro- hemorrhage of focal post-inflammatory scarring may produce eleptiform seizures some months after the exposure. Pulmonary episodes may include chemical pneumonitis with edema and hemorrhage. The lighter hydrocarbons may produce kidney and neurotoxic effects. Liquid paraffins may produce anesthesia and depressant actions leading to weakness, dizziness, slow and shallow respiration, unconsciousness, convulsions and death. C_{5-7} paraffins may also produce polyneuropathy. Aromatic hydrocarbons accumulate in lipid-rich tissues (typically the brain, spinal cord and peripheral nerves) and may produce functional impairment manifested by nonspecific symptoms such as nausea, weakness, fatigue, vertigo; severe exposures may produce inebriation or unconsciousness. Many of the petroleum hydrocarbons are cardiac sensitizers and may cause ventricular fibrillations.

Eye: The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration. The vapor is discomforting to the eyes. Petroleum hydrocarbons may produce pain after direct contact with the eyes. Slight, but transient, disturbances of the corneal epithelium may also result. The aromatic fraction may produce irritation and lachrymation. The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The material is moderately discomforting to the skin if exposure is prolonged. The material contains a component that may be absorbed through the skin and may cause drying of the skin, which may lead to dermatitis from repeated exposures over long periods. Toxic effects may result from skin absorption. Open cuts, abraded or irritated skin should not be exposed to this material. The material may accentuate any pre-existing dermatitis condition.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments. The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis. Ingestion of petroleum hydrocarbons may produce irritation of the pharynx, esophagus, stomach and small intestine with edema and mucosal ulceration. Resulting symptoms include a burning sensation in the mouth and throat. Large amounts may produce narcosis with nausea and vomiting, weakness or dizziness, slow and shallow respiration, swelling of the abdomen, unconsciousness and convulsions. Myocardial injury may produce arrhythmias, ventricular fibrillation and electrocardiographic changes. Central nervous system depression may also occur. Light aromatic hydrocarbons produce a warm, sharp, tingling sensation on contact with taste buds and may anesthetize the tongue. Aspiration into the lungs may produce coughing, gagging, and a chemical pneumonitis with pulmonary edema and hemorrhage.

Carcinogenicity: NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes. Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following. Chronic poisoning may occur from vapor inhalation or skin absorption. The most significant toxic effect is insidious and irreversible injury to the blood-forming tissue by benzene. Leukemia may develop. Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes. Gasoline "sniffing" has caused severe nerve damage. Repeated or prolonged exposure to mixed hydrocarbons may produce narcosis with dizziness, weakness, irritability, concentration and/or memory loss, tremor in the fingers and tongue, vertigo, olfactory disorders, constriction of visual field, paresthesias of the extremities, weight loss and anemia and degenerative changes in the liver and kidney. Chronic exposure by petroleum workers to the lighter hydrocarbons has been associated with visual disturbances, damage to the central nervous system, peripheral neuropathies (including numbness and paresthesias), psychological and neurophysiological deficits, bone marrow toxicities (including hypoplasia, possibly due to benzene) and hepatic and renal involvement. Chronic dermal exposure to petroleum hydrocarbons may result in defatting which produces localized dermatoses. Surface cracking and erosion may also increase susceptibility to infection by microorganisms.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air. Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital, or doctor.

See DOT ERG

Eye Contact: Immediately hold the eyes open and wash continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids. Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water). Wash affected areas thoroughly with water (and soap if available). Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. If swallowed, do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short term repeated exposures to petroleum distillates or related hydrocarbons:

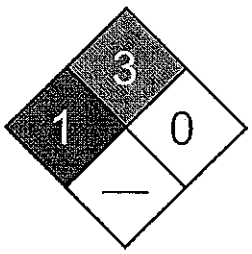
1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
3. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
4. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6. Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

Section 5 - Fire-Fighting Measures

Flash Point: -43 °C
Autoignition Temperature: 280 °C
LEL: 1.4% v/v
UEL: 7.6% v/v

See DOT ERG

Extinguishing Media: Foam. Dry chemical powder.
Bromochlorodifluoromethane (BCF) (where regulations permit). Carbon dioxide.



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable. Severe fire hazard when exposed to heat, flame and/or oxidizers. Vapor forms an explosive mixture with air. Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition. Heating may cause expansion/decomposition with violent rupture of containers. On combustion, may emit toxic fumes of carbon monoxide (CO).

Fire Incompatibility: Avoid contamination with oxidizing agents, i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc., as ignition may result.

Fire-Fighting Instructions: Alert fire department and tell them location and nature of hazard. May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water ways. If safe, switch off electrical equipment until vapour fire hazard removed. Use water delivered as a fine spray to control fire and cool adjacent area. Avoid spraying water onto liquid pools. Do not approach containers suspected to be hot. Cool fire exposed containers with water spray from a protected location. If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately. Avoid breathing vapors and contact with skin and eyes. Control personal contact by using protective equipment. Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

See DOT ERG

Large Spills: Clear area of personnel and move upwind. Alert fire department and tell them location and nature of hazard. May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water ways. No smoking, naked lights or ignition sources. Increase ventilation. Stop leak if safe to do so.
Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite. Use only

spark-free shovels and explosion proof equipment. Collect recoverable product into labeled containers for recycling. Absorb remaining product with sand, earth or vermiculite. Collect solid residues and seal in labelled drums for disposal. Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation. Wear protective clothing when risk of exposure occurs. Use in a well-ventilated area. Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked. Avoid smoking, bare lights, heat or ignition sources. When handling, DO NOT eat, drink or smoke. Vapor may ignite on pumping or pouring due to static electricity. DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling. Avoid contact with incompatible materials. Keep containers securely sealed. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately. Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can, metal drum. Packing as recommended by manufacturer. Check all containers are clearly labeled and free from leaks.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area. If inhalation risk of overexposure exists, wear a NIOSH approved organic-vapor respirator. Correct respirator fit is essential to obtain adequate protection. In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus. Provide adequate ventilation in warehouse or closed storage areas.
Personal Protective Clothing/Equipment:
Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Barrier cream with polyethylene gloves or PVC gloves. Safety footwear. Do NOT use this product to clean the skin.
Respiratory Protection:
Exposure Range >300 to 1000 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >1000 to 15,000 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >15,000 to 300,000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range >300,000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Other: Overalls. Ensure that there is ready access to eye wash unit. Ensure there is ready access to an emergency shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Purple, highly flammable, volatile liquid with characteristic sharp odor. Floats on water. Consists of a complex mixture of hydrocarbons with small amounts of residual benzene from the refining operations.

Physical State: Liquid
Odor Threshold: 0.005 ppm
Vapor Pressure (kPa): 53.33 at 20 °C
Vapor Density (Air=1): > 2
Formula Weight: Not applicable.
Specific Gravity (H_2O=1, at 4 °C): 0.72-0.735 at 15 °C
Evaporation Rate: Fast
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 38.89 °C (102 °F)
Freezing/Melting Point: Not available
Volatile Component (% Vol): 100
Decomposition Temperature (°C): Not available.
Water Solubility: Insoluble

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Presence of incompatible materials. Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 18800 mg/kg

Irritation
Skin (rabbit): 500 mg/24h mild

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.
Biochemical Oxygen Demand (BOD): 8%, 5 days

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible. Follow all applicable federal, state, and local laws. Incinerate residue at an approved site. Recycle containers where possible, or dispose of in an authorized landfil.
BEWARE: Empty solvent, paint, lacquer and flammable liquid drums present a severe explosion hazard if cut by flame torch or welded. Even when thoroughly cleaned or reconditioned, the drum seams may retain sufficient solvent to generate an explosive atmosphere in the drum.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Gasoline
ID: UN1203
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: 139, B33, B101, T8
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** E **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Havoline® Motor Oil (Deposit Shield)

Product Use: Engine Oil
Product Number(s): CPS223391, CPS223392, CPS223393, CPS223394, CPS223395, CPS223396, CPS223397
Synonyms: Havoline® Motor Oil SAE 10W-30, Havoline® Motor Oil SAE 10W-40, Havoline® Motor Oil SAE 20W-50, Havoline® Motor Oil SAE 30, Havoline® Motor Oil SAE 40, Havoline® Motor Oil SAE 5W-20, Havoline® Motor Oil SAE 5W-30
Company Identification
Chevron Products Company
Global Lubricants
6001 Bollinger Canyon Road
San Ramon, CA 94583
United States of America

Transportation Emergency Response
CHEMTREC: (800) 424-9300 or (703) 527-3887
Health Emergency
Chevron Emergency Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623
Product Information
email : lubemsds@chevrontexaco.com
Product Information: 800-LUBE-TEK
MSDS Requests: 800-414-6737

SECTION 2 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Highly refined mineral oil (C15 - C50)	Mixture	70 - 95 %weight

SECTION 3 HAZARDS IDENTIFICATION

IMMEDIATE HEALTH EFFECTS
Eye: Not expected to cause prolonged or significant eye irritation.
Skin: Contact with the skin is not expected to cause prolonged or significant irritation. Contact with the skin is not expected to cause an allergic skin response. Not expected to be harmful to internal organs if absorbed through the skin.
Ingestion: Not expected to be harmful if swallowed.
Inhalation: Not expected to be harmful if inhaled. Contains a petroleum-based mineral oil. May cause respiratory irritation or other pulmonary effects following prolonged or repeated inhalation of oil mist at airborne levels above the recommended mineral oil mist exposure limit. Symptoms of respiratory irritation may include coughing and difficulty breathing.

SECTION 4 FIRST AID MEASURES

Eye: No specific first aid measures are required. As a precaution, remove contact lenses, if worn, and flush eyes with water.
Skin: No specific first aid measures are required. As a precaution, remove clothing and shoes if contaminated. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.
Ingestion: No specific first aid measures are required. Do not induce vomiting. As a precaution, get medical advice.
Inhalation: No specific first aid measures are required. If exposed to excessive levels of material in the air, move the exposed person to fresh air. Get medical attention if coughing or respiratory discomfort occurs.

SECTION 5 FIRE FIGHTING MEASURES

FIRE CLASSIFICATION:
OSHA Classification (29 CFR 1910.1200): Not classified by OSHA as flammable or combustible.

NFPA RATINGS: Health: 0 Flammability: 1 Reactivity: 0

FLAMMABLE PROPERTIES:
Flashpoint: (Cleveland Open Cup) 200 °C (392 °F) (Min)
Autoignition: No Data Available
Flammability (Explosive) Limits (% by volume in air): Lower: Not Applicable Upper: Not Applicable

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: This material will burn although it is not easily ignited. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in vicinity of spilled material.
Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

Precautionary Measures: Keep out of the reach of children.
General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.
Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. For more information, refer to OSHA Standard 29 CFR 1910.106, 'Flammable and Combustible Liquids', National Fire Protection Association (NFPA 77, 'Recommended Practice on Static Electricity', and/or the American Petroleum Institute (API) Recommended Practice 2003, 'Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents'.
Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
Use in a well-ventilated area.

PERSONAL PROTECTIVE EQUIPMENT
Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.
Skin Protection: No special protective clothing is normally required. Where splashing is possible, select protective clothing depending on operations conducted, physical requirements and other substances in the workplace. Suggested materials for protective gloves include: 4H (PE/EVAL), Nitrile Rubber, Silver Shield, Viton.
Respiratory Protection: No respiratory protection is normally required.
If user operations generate an oil mist, determine if airborne concentrations are below the occupational exposure limit for mineral oil mist. If not, wear an approved respirator that provides adequate protection from the measured concentrations of this material. For air-purifying respirators use a particulate cartridge.
Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.
Occupational Exposure Limits:

Component	Agency	TWA	STEL	Ceiling	Notation
Highly refined mineral oil (C15 - C50)	ACGIH	5 mg/m3	10 mg/m3	--	--
Highly refined mineral oil (C15 - C50)	OSHA Z-1	5 mg/m3	--	--	--

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Amber
Physical State: Liquid
Odor: Petroleum odor
pH: Not Applicable
Vapor Pressure: <0.01 mmHg @ 100 °C (212 °F)
Vapor Density (Air = 1): >1
Boiling Point: >315°C (599°F)
Solubility: Soluble in hydrocarbons; insoluble in water
Freezing Point: Not Applicable
Specific Gravity: 0.87 @ 15.6°C (60.1°F) / 15.6°C (60.1°F) (Typical)
Density: 0.866 kg/l @ 15°C (59°F) (Typical)
Viscosity: 7.6 mm2/s @ 100°C (212°F) (Min)

SECTION 10 STABILITY AND REACTIVITY

Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Incompatibility With Other Materials: May react with strong acids or strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
Hazardous Decomposition Products: None known (None expected)
Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

IMMEDIATE HEALTH EFFECTS
Eye Irritation: The eye irritation hazard is based on evaluation of data for similar materials or product components.
Skin Irritation: The skin irritation hazard is based on evaluation of data for similar materials or product components.
Skin Sensitization: The skin sensitization hazard is based on evaluation of data for similar materials or product components.
Acute Dermal Toxicity: The acute dermal toxicity hazard is based on evaluation of data for similar materials or product components.
Acute Oral Toxicity: The acute oral toxicity hazard is based on evaluation of data for similar materials or product components.
Acute Inhalation Toxicity: The acute inhalation toxicity hazard is based on evaluation of data for similar materials or product components.

ADDITIONAL TOXICOLOGY INFORMATION:
This product contains petroleum base oils which may be refined by various processes including severe solvent extraction, severe hydrocracking, or severe hydrotreating. None of the oils requires a cancer warning under the OSHA Hazard Communication Standard (29 CFR 1910.1200). These oils have not been listed in the National Toxicology Program (NTP) Annual Report nor have they been classified by the International Agency for Research on Cancer (IARC) as; carcinogenic to humans (Group 1), probably carcinogenic to humans (Group 2A), or possibly carcinogenic to humans (Group 2B). These oils have not been classified by the American Conference of Governmental Industrial Hygienists (ACGIH) as: confirmed human carcinogen (A1), suspected human carcinogen (A2), or confirmed animal carcinogen

with unknown relevance to humans (A3).

During use in engines, contamination of oil with low levels of cancer-causing combustion products occurs. Used motor oils have been shown to cause skin cancer in mice following repeated application and continuous exposure. Brief or intermittent skin contact with used motor oil is not expected to have serious effects in humans if the oil is thoroughly removed by washing with soap and water.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY
This material is not expected to be harmful to aquatic organisms.

ENVIRONMENTAL FATE
This material is not expected to be readily biodegradable.

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. Oil collection services are available for used oil recycling or disposal. Place contaminated materials in containers and dispose of in a manner consistent with applicable regulations. Contact your sales representative or local environmental or health authorities for approved disposal or recycling methods.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Description: PETROLEUM LUBRICATING OIL, NOT REGULATED AS A HAZARDOUS MATERIAL FOR TRANSPORTATION UNDER 49 CFR
Additional Information:NOT HAZARDOUS BY U.S. DOT. ADR/RID HAZARD CLASS NOT APPLICABLE.

IMO/IMDG Shipping Description: PETROLEUM LUBRICATING OIL; NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER THE IMDG CODE

ICAO/IATA Shipping Description: PETROLEUM LUBRICATING OIL; NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER ICAO

SECTION 15 REGULATORY INFORMATION

EPCRA 311/312 CATEGORIES:

1.	Immediate (Acute) Health Effects:	NO
2.	Delayed (Chronic) Health Effects:	NO
3.	Fire Hazard:	NO
4.	Sudden Release of Pressure Hazard:	NO
5.	Reactivity Hazard:	NO

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1	03=EPCRA 313
01-2A=IARC Group 2A	04=CA Proposition 65
01-2B=IARC Group 2B	05=MA RTK

02=NTP Carcinogen

06=NJ RTK
07=PA RTK

No components of this material were found on the regulatory lists above.

CHEMICAL INVENTORIES:
All components comply with the following chemical inventory requirements: EINECS (European Union), IECSC (China), KECI (Korea), PICCS (Philippines), TSCA (United States).

One or more components has been notified but may not be listed in the following chemical inventories: DSL (Canada). Secondary notification by the importer may be required.

One or more components does not comply with the following chemical inventory requirements: AICS (Australia), ENCS (Japan).

NEW JERSEY RTK CLASSIFICATION:
Under the New Jersey Right-to-Know Act L. 1983 Chapter 315 N.J.S.A. 34:5A-1 et. seq., the product is to be identified as follows: PETROLEUM OIL (Motor oil)

WHMIS CLASSIFICATION:
This product is not considered a controlled product according to the criteria of the Canadian Controlled Products Regulations.

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 0 Flammability: 1 Reactivity: 0

HMIS RATINGS: Health: 1 Flammability: 1 Reactivity: 0
(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

LABEL RECOMMENDATION:
Label Category : ENGINE OIL 1 - ENG1

REVISION STATEMENT: This is a new Material Safety Data Sheet.
Revision Date: October 02, 2006

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Government Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	MSDS - Material Safety Data Sheet
CVX - Chevron	NFPA - National Fire Protection Association (USA)
DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration

Prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200) and the ANSI MSDS Standard (Z400.1) by the Chevron Energy Technology Company, 100 Chevron Way, Richmond, California 94802.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

MATERIAL SAFETY DATA SHEET

Kidde 90 Multi-Purpose ABC Dry Chemical (Fire Extinguishing Agent)

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	Kidde 90 Multi-Purpose ABC Dry Chemical (Fire Extinguishing Agent)
Other Trade Names	ABC, Ammonium Phosphate, Monoammonium Phosphate, Tri-Class
Manufacturer/Supplier	Kidde – Residential and Commercial A United Technologies Company
Address	1016 Corporate Park Drive Mebane, NC 27302 USA
Phone Number	(919) 304-8200 (919) 563-5911
Chemtrec Number (for emergencies only)	(800) 424-9300 (703) 527-3887 (International)
Revision Date:	August 7, 2007
MSDS Date:	January 15, 2007

This MSDS has been compiled in accordance with - EC Directive 91/155/EC - OSHA's Hazcom Standard (29 CFR 1910.1200)

2. COMPOSITION/INFORMATION ON THE COMPONENTS

Component Name	CAS#/Codes	Concentration	R Phrases	EU Classification
Monoammonium Phosphate	7722-76-1 EC#2317645	85 - 97%	None	None
Ammonium Sulfate	7783-20-2 EC#2319841	1-6%	None	None
Mica	12001-26-2	1 - 4%	None	None
Clay	8031-18-3	<2%	None	None
Amorphous Silica	7631-86-9 EC#2315454	<2%	None	None
Dye	NA	<0.1%	None	None

3. HAZARD IDENTIFICATION

EU Main Hazards
Non Hazardous Powder

Routes of Entry
- Eye contact - Inhalation - Skin contact

Carcinogenic Status
See Section 11 - Toxicity

Target Organs
- Respiratory System - Skin - Eye

Health Effects - Eyes
Contact for short periods of time may cause irritation.

Health Effects - Skin
Contact may cause mild irritation.

3. HAZARD IDENTIFICATION

Health Effects - Ingestion
Ingestion is not an expected route of exposure.

Health Effects - Inhalation
May irritate the respiratory tract. May cause transient cough and shortness of breath.

4. FIRST AID MEASURES

Eyes
Immediately flood the eye with plenty of water of warm water for at least 15 minutes, holding the eye open. Obtain medical attention if soreness or redness persists.

Skin
Wash affected area with soap and water. Obtain medical attention if irritation persists.

Ingestion
Dilute by drinking large quantities of water and obtain medical attention.

Inhalation
Move victim to fresh air. Obtain medical attention immediately for any breathing difficulty.

Advice to Physicians
Treat symptomatically.

5. FIRE FIGHTING MEASURES

Extinguishing Media
This preparation is used as an extinguishing agent and therefore is not a problem when trying to control a blaze. Use extinguishing agent appropriate to other materials involved. Keep pressurized extinguishers and surroundings cool with water spray as they may rupture or burst in the heat of a fire.

Unusual Fire and Explosion Hazards
Pressurized containers may explode in heat of fire.

Protective Equipment for Fire-Fighting
Wear full protective clothing and self-contained breathing apparatus as appropriate for specific fire conditions.

6. ACCIDENTAL RELEASE MEASURES

Sweep up or vacuum. Prevent skin and eye contact. Wear appropriate protective equipment.

7. HANDLING AND STORAGE

Pressurized extinguishers should be properly stored and secured to prevent falling or being knocked over. Do not drag, slide or roll extinguishers. Do not drop extinguishers or permit them to strike against each other. Never apply flame or localized heat directly to any part of the extinguisher or plastic container. Store pressurized extinguishers and plastic containers away from high heat sources. Storage area should be: - cool - dry - well ventilated - under cover - out of direct sunlight

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Standards
Occupational exposure limits are listed below, if they exist.
Mica
ACGIH TLV: 3 mg/m3 TWA, measured as respirable fraction of the aerosol.
OSHA PEL: 20 mppcf, <1% crystalline silica
Nuisance Dust Limit
OSHA PEL: 50 mppcf or 15 mg/m3 TWA, total dust
15 mppcf or 5 mg/m3 TWA, respirable fraction

Engineering Control Measures
Use with adequate ventilation. There should be local procedures for the selection, training, inspection and maintenance of this equipment. When used in large volumes, use local exhaust ventilation.

Respiratory Protection
Not normally required. Use dust mask where dustiness is prevalent, or TLV is exceeded.

Hand Protection
Not normally needed when used as a portable fire extinguisher. Use gloves if irritation occurs.

Eye Protection
Chemical goggles or safety glasses with side shields.

Body Protection
Normal work wear.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Powder
Color	Pale Yellow
Odor	Odorless
Specific Gravity	Not available
Boiling Range/Point (°C/F)	Not applicable
Flash Point (PMCC) (°C/F)	Not Flammable
Solubility in Water	Not applicable
Vapor Density (Air = 1)	Heavier than air.
Vapor Pressure	Not applicable
Evaporation Rate	Not applicable

10. STABILITY AND REACTIVITY

Stability
Stable under normal conditions.

Conditions to Avoid
- Heat - High temperatures - Exposure to direct sunlight

Materials to Avoid
- Strong oxidizing agents - strong acids - sodium hypochlorite

10. STABILITY AND REACTIVITY

Hazardous Polymerization
Will not occur.

Hazardous Decomposition Products
- oxides of carbon - ammonia – oxides of phosphorus – nitrogen oxides

11. TOXICOLOGICAL INFORMATION

Acute Toxicity
Low order of acute toxicity.

Chronic Toxicity/Carcinogenicity
This product is not expected to cause long term adverse health effects.

Mica and clay may contain small quantities of quartz (crystalline silica) as an impurity. Prolonged exposure to respirable crystalline silica dust at concentrations exceeding the occupational exposure limits may increase the risk of developing a disabling lung disease known as silicosis. IARC found limited evidence for pulmonary carcinogenicity of crystalline silica in humans.

Genotoxicity
This product is not expected to cause any mutagenic effects.

Reproductive/Developmental Toxicity
This product is not expected to cause adverse reproductive effects.

12. ECOLOGICAL INFORMATION

Mobility
No relevant studies identified.

Persistence/Degradability
No relevant studies identified.

Bio-accumulation
No relevant studies identified.

Ecotoxicity
No relevant studies identified.

13. DISPOSAL

Dispose of container in accordance with all applicable local and national regulations. Do not cut, puncture or weld on or near to the container. No harm to the environment is expected from this preparation.

14. TRANSPORT INFORMATION

DOT CFR 172.101 Data	Not regulated
UN Proper Shipping Name	Not regulated
UN Class	None
UN Number	None
UN Packaging Group	None

15. REGULATORY INFORMATION

EU Label Information

Classification and labelling have been performed according to EU directives 67/548/EEC and 99/45/EC including amendments.

EU Hazard Symbol and Indication of Danger.
This preparation is not classified as dangerous.

R phrases
None

S phrases
None.

US REGULATIONS (Federal, State) and INTERNATIONAL CHEMICAL REGISTRATION LAWS

TSCA Listing
This product contains ingredients that are listed on or exempt from listing on the EPA Toxic Substance Control Act Chemical Substance Inventory.

EINECS Listing
All ingredients in this product have not been verified for listing on the European Inventory of Existing Commercial Chemical Substances (EINECS) or the European List of New Chemical Substances (ELINCS).

DSL/NDSL (Canadian) Listing
All ingredients in this product are listed on the Domestic Substance List (DSL) or the Non-Domestic Substance List (NDSL) or are exempt from listing.

WHMIS Classification
D2B

This product was classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations and the MSDS contains all the information required by these regulations.

MA Right To Know Law
All components have been checked for inclusion on the Massachusetts Substance List (MSL). Those components present at or above the de minimus concentration include: - Mica (12001-26-2) 1-4% - Amorphous Silica (7631-86-9) <2% - Ammonium Sulfate (7783-20-2) 1- 6%

PA Right To Know Law
This product contains the following chemicals found on the Pennsylvania Hazardous Substance List: - Mica (12001-26-2) 1-4% - Amorphous Silica (7631-86-9) <2% - Ammonium Sulfate (7783-20-2) 1- 6%

NJ Right To Know Law
This product contains the following chemicals found on the NJ Right To Know Hazardous Substance List: - Mica (12001-26-2) 1-4% - Amorphous Silica (7631-86-9) <2%

California Proposition 65
This product does not contain materials which the State of California has found to cause cancer, birth defects or other reproductive harm.

SARA Title III Sect. 302 (EHS)
This product does not contain any chemicals subject to SARA Title III Section 302.

SARA Title III Sect. 304
This product does not contain any chemicals subject to SARA Title III Section 304.

15. REGULATORY INFORMATION

SARA Title III Sect. 311/312 Categorization
- Immediate (Acute) Health Hazard

SARA Title III Sect. 313
This product does not contain any chemicals that are listed in Section 313 at or above de minimis concentrations.

16. OTHER INFORMATION

NFPA Ratings
NFPA Code for Health - 1
NFPA Code for Flammability - 0
NFPA Code for Reactivity - 0
NFPA Code for Special Hazards - None

HMIS Ratings
HMIS Code for Health - 1
HMIS Code for Flammability - 0
HMIS Code for Reactivity - 0
HMIS Code for Personal Protection - See Section 8

Abbreviations
N/A: Denotes no applicable information found or available
CAS#: Chemical Abstracts Service Number
ACGIH: American Conference of Governmental Industrial Hygienists
OSHA: Occupational Safety and Health Administration
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
STEL: Short Term Exposure Limit
NTP: National Toxicology Program
IARC: International Agency for Research on Cancer
R: Risk
S: Safety

Prepared By: EnviroNet LLC.

The information contained herein is based on data believed to be accurate. However, no representation, warranty, or guarantee is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for its own particular use. Kidde – Residential and Commercial assumes no responsibility for personal injury or property damage resulting from use, handling or from contact with this product.

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

NITRIC ACID, 50-70%

1. Product Identification

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 50%; Nitric Acid 65%; nitric acid 69-70%
CAS No.: 7697-37-2
Molecular Weight: 63.01
Chemical Formula: HNO_3
Product Codes:
J.T. Baker: 5371, 5796, 5801, 5826, 5856, 5876, 5896, 9597, 9598, 9600, 9601, 9602, 9603, 9604, 9606, 9607, 9608, 9610, 9616, 9617, 9670
Mallinckrodt: 1409, 2704, 2705, 2716, 6623, H862, H988, H993, H998, V077, V650

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	50 - 70%	Yes
Water	7732-18-5	30 - 50%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 3 - Severe (Oxidizer)
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

Inhalation:
Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, whi be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.
Ingestion:
Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.
Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.
Explosion:
Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.
Fire Extinguishing Media:
Water spray may be used to keep fire exposed containers cool. Do not get water inside container.
Special Information:
Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guarc al Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA), 4 ppm (STEL)
-ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4 ppm (STEL)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal. Canister-type respirators using sorbents are ineffective.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Colorless to yellowish liquid.
Odor:
Suffocating, acrid.
Solubility:
Infinitely soluble.
Specific Gravity:
1.41
pH:
1.0 (0.1M solution)
% Volatiles by volume @ 21C (70F):
100 (as water and acid)
Boiling Point:
122C (252F)
Melting Point:
-42C (-44F)
Vapor Density (Air=1):
2-3

Vapor Pressure (mm Hg):
48 @ 20C (68F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate. Will react with water or steam to produce heat and toxic and corrosive fumes
Hazardous Polymerization:
Will not occur.
Incompatibilities:
A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics
Conditions to Avoid:
Light and heat.

11. Toxicological Information

Nitric acid: Inhalation rat LC50 244 ppm (NO2)/30M; Investigated as a mutagen, reproductive effector. Oral (human) LDLo: 430 mg/kg

Cancer Lists/NTP Carcinogen

Ingredient	Known	Anticipated	IARC Category
Nitric Acid (7697-37-2)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
No information found
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: NITRIC ACID
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 6.5GL

International (Water, I.M.O.)
Proper Shipping Name: NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 6.5GL

15. Regulatory Information

Chemical Inventory Status - Part 1\-

Ingredient	TSCA	EC	Japan	Australia	
Nitric Acid (7697-37-2)		Yes	Yes	Yes	Yes
Water (7732-18-5)		Yes	Yes	Yes	Yes

Chemical Inventory Status - Part 2

Ingredient	Korea	DSL	NDSL	Phil.
Nitric Acid (7697-37-2)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

Federal, State & International Regulations - Part 1
SARA 302-SARA 313

Ingredient	RQ	TPQ	List	Chemical Catg.
Nitric Acid (7697-37-2)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

Federal, State & International Regulations - Part 2
-RCRA- -TSCA-

Ingredient	CERCLA	261.33	8(d)
Nitric Acid (7697-37-2)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2PE
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 0 Other: Oxidizer
Label Hazard Warning:
POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.
Label Precautions:
Do not get in eyes, on skin, or on clothing. Do not breathe vapor or mist.
Use only with adequate ventilation. Wash thoroughly after handling.
Keep from contact with clothing and other combustible materials.
Do not store near combustible materials. Store in a tightly closed container.
Remove and wash contaminated clothing promptly.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.
Disclaimer:
****
Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
****
Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Nitric Acid Overview

Health Risk:4 – Extreme (Poison)
Flammability:0 - None
Reactivity Rating:3 – Severe (Oxidizer)
Contact Rating:4 – Extreme (Corrosive)

Protective Equipment Required: Proper Gloves, Goggles

First Aid Measures: Immediately flush skin with water for 15 minutes. Remove contaminated clothing and shoes.
Immediately flush eyes with plenty of water for 15 minutes, lifting lower and upper eyelids. **Get medical attention immediately.**

MSDS Number: H3880 * * * * * *Effective Date: 01/19/06* * * * * *Supercedes: 09/24/04*

MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS — J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

HYDROCHLORIC ACID, 33 - 40%

1. Product Identification

Synonyms: Muriatic acid; hydrogen chloride, aqueous
CAS No.: 7647-01-0
Molecular Weight: 36.46
Chemical Formula: HCl
Product Codes:
J.T. Baker: 5367, 5537, 5575, 5800, 5814, 5821, 5839, 5861, 5862, 5894, 5962, 5963, 5972, 5994, 6900, 7831, 9529, 9530, 9534, 9535, 9536, 9538, 9539, 9540, 9544, 9548
Mallinckrodt: 2062, 2515, 2612, 2624, 2626, 3861, 5583, 5587, H611, H613, H987, H992, H999, V078, V628

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hydrogen Chloride	7647-01-0	33 - 40%	Yes
Water	7732-18-5	60 - 67%	No

3. Hazards Identification

Emergency Overview
POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)
Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:
Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.
Ingestion:
Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea. Swallowing may be fatal.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Extreme heat or contact with metals can release flammable hydrogen gas.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
If involved in a fire, use water spray. Neutralize with soda ash or slaked lime.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving hydrochloric acid. Stay away from ends of tanks. Cool tanks with water spray until well after fire is out.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Hydrochloric acid:
- OSHA Permissible Exposure Limit (PEL):
5 ppm (Ceiling)
- ACGIH Threshold Limit Value (TLV):
2 ppm (Ceiling), A4 Not classifiable as a human carcinogen

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a full facepiece respirator with an acid gas cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Colorless, fuming liquid.
Odor:
Pungent odor of hydrogen chloride.
Solubility:
Infinite in water with slight evolution of heat.
Density:
1.18
pH:
For HCL solutions: 0.1 (1.0 N), 1.1 (0.1 N), 2.02 (0.01 N)
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
53C (127F) Azeotrope (20.2%) boils at 109C (228F)
Melting Point:
-74C (-101F)
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
190 @ 25C (77F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes. Thermal oxidative decomposition produces toxic chlorine fumes and explosive hydrogen gas.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
A strong mineral acid, concentrated hydrochloric acid is incompatible with many substances and highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde.
Conditions to Avoid:
Heat, direct sunlight.

11. Toxicological Information

Inhalation rat LC50: 3124 ppm/1H; oral rabbit LD50: 900 mg/kg (Hydrochloric acid concentrated); investigated as a tumorigen, mutagen, reproductive effector.

Cancer Lists\Carcinogen---

Ingredient	Known	Anticipated	IARC Category
Hydrogen Chloride (7647-01-0)	No	No	3
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.
Environmental Toxicity:
This material is expected to be toxic to aquatic life

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements

14. Transport Information

Domestic (Land, D.O.T.)
Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 475LB

International (Water, I.M.O.)
Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 475LB

15. Regulatory Information

Risk and Safety Phrases
Symbol: C
Risk: 34-37
Safety: (1/2-)26-45

Chemical Inventory Status - Part 1\---

Ingredient	TSCA	EC	Japan	Australia	
Hydrogen Chloride (7647-01-0)	Yes	Yes	Yes		Yes
Water (7732-18-5)	Yes	Yes	Yes		Yes

Chemical Inventory Status - Part 2\---

Ingredient	Korea	DSL	NDSL	Phil.
Hydrogen Chloride (7647-01-0)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

Federal, State & International Regulations - Part 1\---SARA 313-

Ingredient	RQ	TPQ	List	Chemical Catg.
Hydrogen Chloride (7647-01-0)	5000	500*	Yes	No
Water (7732-18-5)	No	No	No	No

Federal, State & International Regulations - Part 2\---RCRA--TSCA-

Ingredient	CERCLA	261.33	8(d)
Hydrogen Chloride (7647-01-0)	5000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2R
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 1
Label Hazard Warning:
POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG DAMAGE.
Label Precautions:
Do not get in eyes, on skin, or on clothing. Do not breathe vapor or mist.
Use only with adequate ventilation. Wash thoroughly after handling.
Store in a tightly closed container. Remove and wash contaminated clothing promptly.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 16.
Disclaimer:
****
Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
****
Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Hydrochloric Acid Overview

Health Risk:3 – Severe (Poison)
Flammability:0 - None
Reactivity Rating:2 – Moderate
Contact Rating:4 – Extreme (Corrosive)

Protective Equipment Required: Proper Gloves, Goggles

First Aid Measures: Immediately flush skin with water for 15 minutes. Remove contaminated clothing and shoes. Immediately flush eyes with plenty of water for 15 minutes, lifting lower and upper eyelids. **Get medical attention immediately.**

ARCADIS

Appendix G

ARCADIS H&S Procedures

1. POLICY

It is the practice of ARCADIS and its affiliated companies to implement appropriate, reasonable and practical procedures within acceptable and customary industry practices to promote the health and safety of its employees, and avoid and mitigate exposure of risk in the performance of their work. In furtherance of this policy, ARCADIS promotes and encourages compliance by all employees with this policy and procedures relating to subsurface work and/or investigations (SWI) and working in the vicinity of above ground utilities.

- This procedure is followed by all responsible ARCADIS personnel. Such procedures are included in the Project Planning processes utilized by ARCADIS personnel.

- Project Management procedural requirements are outlined in Section 5.1. All employees included in SWI and above ground utility work are familiar with these procedures.

- For all SWI, it is required to contact the locality One Call number and/or a privately contracted utility location company, and to conduct a visual inspection of the site for subsurface utility locating. In addition, for non-greenfield sites, ARCADIS obtains from the client, a detailed site utility map. Additional lines of evidence may be required based on field conditions and client requirements for subsurface utility location. The project manager or designated representative in cooperation with the H&S staff and SWI contractor determine when and if additional lines of evidence are required. Additional lines of evidence include but are not limited to the following:

  - Detailed site utility maps, preferably "As-Built" drawings (drawn to scale)
  - Hand augering or digging
  - Hydro-knife
  - Air-knife
  - Radio Frequency Detector (RFD)
  - Ground Penetrating Radar (GPR)

- Contract Terms: In agreements for SWI with a client, prime contractor, or subcontractors, required terms (Exhibit 1) shall be included for the appropriate allocation of risk of damage to subsurface facilities. If such provisions cannot be agreed upon, the reasons are documented and other risk-management actions identified, such as limits of liability, additional physical investigations, additional lines of evidence of utility location, assignment of risk to subcontractors, etc.

- The policy of ARCADIS encourages and empowers all employees to take such action as they deem appropriate to assure compliance with this policy and procedures both in project planning and field site operations. Such authority is delegated to those on the project site to

immediately stop any SWI work or work in the vicinity of above ground utilities where the employee believes that injury to persons or damage to property could occur. Such action is taken without regard to costs or schedule. Personnel immediately notify their supervisor of any concerns that they have in observing any SWI work or work in the vicinity of above ground utilities. In all agreements between ARCADIS and SWI subcontractors, (e.g., drilling subcontractors), provisions shall be included in the subcontract, work authorization or purchase order. These provisions (Exhibit 1) are found on the ARCADIS intranet at the Legal Department team site.

All ARCADIS personnel involved in SWI work or work in the vicinity of above ground utilities are appropriately trained on this procedure and have the appropriate professional experience for oversight of or involvement in SWI work or work in the vicinity of above ground utilities. ARCADIS Corporate Health & Safety can answer further questions about this policy or the hazards associated with and the control procedure for work in the vicinity of subsurface or above ground utilities.

Again, to support the efforts of ensuring the health and safety of its employees and mitigating risk to ARCADIS, ARCADIS requires that these policies and procedures be followed and implemented at all levels of project management and field implementation.

2. PURPOSE AND SCOPE

2.1 Purpose

This procedure directs general safety procedures associated with the identification and management of above ground and subsurface utility locations on project sites.

2.2 Scope

2.2.1 **Management Requirements** - ARCADIS personnel managing or working on any project requiring SWI and requiring work in the vicinity of above ground utilities must incorporate this procedure into their project planning and field work activities to ensure that all reasonable means to identify utilities are implemented and that appropriate controls have been put in place to minimize or eliminate damage to these utilities and the hazards associated with these utilities. All applicable procedures described in this document must be completed prior to initiating intrusive field work or field work in the vicinity of above ground utilities, or the work cannot proceed.

2.2.2 **Project Management Requirements** - Where SWI are required to be performed by a subcontractor to ARCADIS under its subcontract, project management shall require the subcontractor to adequately incorporate SWI procedures described herein into the subcontractor's scope of work.

3. DEFINITIONS

Above Ground Utilities - For the purpose of this procedure, above ground utilities include, but are not limited to: any above ground line, system, or facility used for producing, storing, conveying, transmitting or distributing communication or telecommunications, electricity, gas,

petroleum and petroleum products, coal slurry, hazardous liquids or gases, water under pressure, steam, or other hazardous materials.

Subsurface Utilities - For the purposes of this procedure, subsurface utilities include, but are not limited to: any underground line, system, or facility used for producing, storing, conveying, transmitting or distributing communication or telecommunications, electricity, gas, petroleum and petroleum products, coal slurry, hazardous liquids or gases, water under pressure, steam, or sanitary sewage; underground storage tanks; tunnels and cisterns; and septic tanks.

4. RESPONSIBILITIES

4.1 Project Manager Responsibilities

To prevent injury to employees, avoid disruption to utility services, and help eliminate damage to subsurface and above ground utilities, project managers have the responsibility for utility identification, location, and marking prior to initiating field activities. Most states, provinces, municipalities, and clients have rules, general statutes, or laws that specify the requirements of subsurface utility location prior to intrusive subsurface field activities (i.e., excavation, trenching, boring, and all forms of drilling operations, etc.). The project manager ensures that these laws are followed, and that the directives outlined in this procedure are met for every project involving SWI and work in the vicinity of above ground utilities.

In addition, if field activities are completed in the vicinity of above ground utilities, the project manager is responsible for working with the client to identify the nature of the utilities, and to determine what control processes need to be implemented to prevent damage to these utilities and to minimize any injury in the event there is damage.

4.2 Field Personnel Responsibilities

Field personnel conducting SWI activities and activities where above ground utilities are in the vicinity of the work have the responsibility to read, understand, and follow this procedure and complete the appropriate checklists during the on-site utility locate process. ARCADIS personnel assisting in the identification of underground utilities have previous related experience of a minimum of 1 year. Those implementing remote sensing technologies have completed training in those techniques and have 6 months experience operating and interpretation results.

If utilities cannot be located to eliminate any reasonable concern, field personnel use their Stop Work authority until utility locations can be identified. Field personnel review this procedure onsite with ARCADIS subcontractors, and ensure they follow the procedures detailed in this document. Any ARCADIS subcontractor not following these procedures are asked to stop work, and the project manager contacted. Any diversion from this procedure by ARCADIS field personnel is approved by the project manager with input from Corporate Health and Safety as necessary.

5. PROCEDURES

5.1 Procedures

A flow chart/decision tree of these procedures is presented in Exhibit 2 of this document.

5.1.1 Project Management Procedural Requirements

5.1.1.1 Planning and Information Request

Field activities are planned and designed to avoid contact with and damage to, and minimize interference with subsurface and above ground utilities in the vicinity of ARCADIS work activities. During the planning phase of a project the project manger contacts the client and/or property owner to request the following information for the area of the Site where the work will occur:

- A list of known or suspected existing and historical subsurface and above ground utilities present on a subject property;
- An accurate site plan (drawn to scale) illustrating subsurface and above ground utilities; and
- Construction, diameter, volume, depth, contents, and physical properties, etc. of each subsurface and above ground utility.

In the event that the client and/or property owner is not aware of the utilities at the subject property, can only provide a partial list, or cannot provide an otherwise accurate, scaled map, plan or drawing of utilities on the site, then additional resources are utilized to identify utilities at the subject property. This may include but are not limited to:

- Contacting utility provider billing departments directly to inquire if a bill is generated for the property address;
- Utilizing city/county computer-drawn maps, or geographical information systems (GIS) data containing utility information; and/or
- A site walk to visually inspect the subject property for evidence of subsurface and above ground utilities (i.e., manhole covers, meters, warning signs, vent pipes, fill ports, pipe runs, utility lines, etc.).

In the project planning process, the project manager and /or task manager determines the reasonable methods to be used to locate subsurface utilities prior to SWI. It is required to contact the state or province One Call number and/or a private utility locator if on private property as appropriate to the site. Also, an additional two lines of evidence are used for subsurface utility line location at all sites. If scaled and accurate site utility maps are not provided by the client, additional lines of evidence are used (see Section 5.0 for lines of evidence options). Increased flexibility is built into subsurface sampling and/or extraction programs when confidence in utility identification, location, and marking is less than optimal.

5.1.1.2 Communication and Coordination

Using list of identified and suspected utilities, the PM or their designated Task Manager:

- Notifies a public one-call service centers and/or private utility contractors prior to initiating intrusive subsurface field activities;

- Provides the list to the site safety officer for inclusion in the site-specific health and safety plan (HASP);

- Communicates potential hazards to field staff prior to mobilization;

- Instructs field staff to be aware of and implement the procedures in the Section 6.2 of this procedure and utilize the appropriate utility location checklists.

- When practical, schedules a joint meeting between the public/private utility locators and field staff to oversee the subsurface utility locating and marking in the field.

- Communicates with and provides utility location documentation to the subcontractors to inform them of the utility locations and discusses methods to be used to protect those utilities.

- Understands the subcontractor's methods for utility location and documenting the process with a clear delineation of responsibilities for utility location.

In general, subsurface utility locations marked by public utility locators are only good for 2 weeks (research your state-specific requirements). If SWI activities are not conducted during this time period, the site is remarked. At no time is SWI conducted based on old markings, hand-drawn maps/sketches, photographs, or by recollection/memory of field staff. If markings are smeared, removed, damaged, or impacted in any way, the site must be remarked before SWI begins. Flag markings are used in addition to paint markings wherever possible.

5.1.1.3 Utility Request Notifications for Public Property

Prior to intrusive work on public property (i.e., right-of-ways, easements, etc.), notification of a public one-call service center is completed a minimum of 48-72 hours (states/localities requirements vary, so the PM is responsible for verifying this) prior to initiating field activities (excluding Saturdays, Sundays, and legal holidays). Specific state or local laws related to utility location are evaluated with respect to notification and liability in the event of utility damage. During the call, ARCADIS:

- Provides accurate description of the location of all areas of the SWI;

- Documents the utility locate request to record the time and date of the call, the area to be marked, the list of utility companies and municipalities that the one call service center will notify;

- Records the associated ticket (or dig) number provided by the one call service center;

- Cross references the notification list provided by the one-call service center with the list of known or suspected utilities for the property; and

- Provides accurate contact (PM name and phone numbers) information for the one call service center so they can subsequently communicate potential questions and/or delays related to the utility location and marking.

After receiving a request, the one-call service center sends requests to participating utility operators who have utilities in the area of the intrusive field activities. Each underground utility operator dispatches their own locators to mark their facilities with paint or flags. The project manager attempts to have field staff present during the marking of the utilities by the locator organization to ensure that the area of the SWI is included in the locating activities. It is important to note:

- Not all utility operators and municipalities participate in one call programs. In some instances, one-call programs provide a list of utility providers that participate, and a list of those that do not. The utility providers that do not participate are contacted individually so that they can mark their own lines, and ARCADIS documents this call (date of call, person receiving call, date lines will be marked, etc.);

- Public utility locators are usually only required to mark utilities within the public spaces (i.e., right of ways) or at most up to a meter on private property; and

- Knowledge of existing or suspected, but unmarked utilities are documented and communicated to the site safety officer, field staff, and the client prior to implementing field activities.

If a known or suspected subsurface utility does not participate in the state one-call program, and that provider has not been individually contacted prior to the start of SWI, then the field activities are postponed. If these utility providers are contacted and do not provide utility location services, then SWI are not performed until a private utility locating company is contracted and the locating tasks completed. If utility locates are not completed by public or private utility locating companies, then the subsurface activities are performed with extreme care using hand tools, or other means of utility location are used (air knife/hydro-knife technologies, or GPR), but only upon receiving approval from the ARCADIS Health & Safety department and the client.

5.1.1.4 Utility Request Notifications for Private Property, Military Installations, or Other Government Facilities

Prior to intrusive work on private property, military installations, or other government facilities the public one call service center is contacted as previously described, to identify utilities that enter and/or are in the vicinity of the subject property. In addition,

- A private utility contractor may be required to locate and mark utilities that transect the property beyond meters and/or additional utilities that property owner has installed, which may or may not be maintained and serviced by a utility or municipality

- Where appropriate, or at a client's request, a facility or plant engineer familiar with the subsurface utilities is contacted to request marking and location of utilities

- One or more weeks of advanced notice is usually required to subcontract a private contractor or coordinate with a facility or plant engineer to locate and mark utilities

- Verbal or written requests to private contractors or onsite personnel for utility location and marking is documented to record the time and date of the request, the area to be marked, and the list of utilities to be marked

- The project manager attempts to have field staff present during the marking of the utilities by the locator organization to ensure that the area of the SWI is included in the locating activities

- Knowledge of existing or suspected, but unmarked utilities is documented and communicated to the site safety officer, field staff, and the client prior to implementing field activities

- If a known or suspected utility is not located and marked by the private utility company or facility engineer, then sampling and/or excavation activities is performed with extreme care using hand tools, hydro-knife or other method that does not damage the utility; postponed until utilities are clearly marked; or canceled. If work proceeds, it can only be completed with the approval of the ARCADIS Health and Safety department and the client.

5.1.1.5 New Nation-wide Utility Locate Call Number 811

Several state and local utility notification centers have launched a new "Call before you Dig" number to help save lives and protect underground infrastructure. This new, national number is: **811**. The number is designed to help prevent professional excavators, drillers, etc. and homeowners, from damaging underground utility lines while digging/drilling and causing injury or service outage. For more information about the 811 services, visit www.call811.com

The number 811 is a new FCC designated national n-11 number created to eliminate confusion of multiple calls before you dig numbers across the country. This quick and efficient one call service will notify the appropriate utilities, who participate in the one call program. **However,** ARCADIS callers must still verify who the one call service contacts, and then determine which utilities may need to be contacted directly (e.g. those utilities not participating in the one call service) by following the requirements outlined in this procedure.

5.1.2 Field Protocol

At no time do field activities that involve SWI or work in the vicinity of above ground utilities commence without the field staff having knowledge of the location of subsurface and above ground utilities. In addition, as stated above and in general, subsurface utility locations marked by public utility locators are only good for 2 weeks (research your state-specific requirements). If SWI activities are not conducted during this time period, the site is remarked. At no time is SWI conducted based on old markings, hand-drawn maps/sketches, photographs, or by recollection/memory of field staff. If markings are smeared, removed, damaged, or impacted in any way, the site must be remarked before SWI begins. Flag markings are used in addition to paint markings wherever possible.

5.1.2.1 SWI and Subsurface Utilities

Prior to the start of intrusive activities, all utilities are located and measures instituted to avoid subsurface utility hazards. If intrusive work must take place within close proximity to a utility line, the utility line can also be rendered controlled (i.e. through lockout/tagout procedures).

Prior to mobilizing to the site for SWI work, field staff reviews the task details with the project manager or their designated authorized TM. This may include but is not limited to review of boring logs, excavation permits, etc. Any special site or client requirements are also discussed. Prior to initiation of any intrusive activities, the utilities and structures checklist (Exhibit 3) is reviewed and completed. Generally, the following colors apply for different types of utilities/operations:

Red – Electric;
Yellow – Natural gas/oil;
Orange – Communication/cable television;
Blue – Water;
Green – Sewer;
Pink – Temporary survey marking;
White – Proposed excavation; and
Purple – Reclaimed water

In addition, the SWI subcontractor marks (i.e., paint, stakes, etc.) the location of their operations to ensure they fall within the area that has been investigated for utilities.

Once the checklist is completed and all utilities identified, any client/site specific utility location or other utility (subsurface or above ground utilities) protection procedures (i.e. such as hand digging to a specified depth, covering or shielding lines, etc.) is completed at each location where work will be completed. If a known or suspected public subsurface utility has not been marked or the markings are not clear, the state one-call number is contacted to determine if an "emergency" locate can be requested. If so, follow the procedures outlined by the locate service and contact the project manager. If it is a private utility that is not marked, the facility manager and/or the project manager should be contacted.

If uncertainty remains on utility location, and/or more precise locations of utilities are required, and where field staff determine the circumstances warrant it, additional lines of evidence are implemented including air or hydro knifing, or ground penetrating radar. Descriptions of the use and limitations of these methods are included in Exhibit 4.

If unexpected conditions are encountered (refusal, debris, pea gravel, etc.) while completing the intrusive activity, all work is immediately halted. Note that subsurface utilities at many industrial facilities are often placed in conduits or concrete to prevent damage. If a utility or subsurface structure is compromised, the field staff initiates the Emergency Action Plan Guidelines (Exhibit 5); however, more detailed emergency action procedures should be reviewed with the client and documented in the site specific health and safety plan prior to initiating work.

5.1.2.2 Work in the Vicinity of Above Ground Utilities

If activities take place in the vicinity of an above ground utility, the utility line can be rendered controlled (i.e. through lockout/tagout procedures) or protected from damage (i.e. covering overhead power lines). The following table is used to develop acceptable work distances for work involving machinery with high extensions (backhoes, drilling rig masts, etc.) in the vicinity of overhead power lines:

Power Line Voltage Phase to phase (kV)	Minimum Safe Clearance (feet)
50 or below	10
Above 50 to 200	15
Above 200 to 350	20
Above 350 to 500	25
Above 500 to 750	35
Above 750 to 1,000	45

ANSI Standard B30.5-1994, 5-3.4.5

The distance may be lengthened if directed by the client or the electric company, and any specified distances are strictly followed. In addition, work involving machinery, vehicles or equipment that may come in contact with above ground utilities is not completed until those utilities are protected or control processes are in place to avoid damage to those utilities.

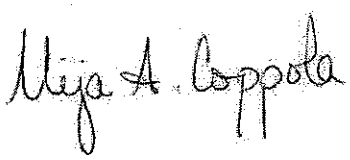
If an above ground utility is discovered that has not been previously identified prior to mobilizing to the field, the field staff notifies the project manager who requests the client to assist in the identification of the utility and the implementation of control procedures as appropriate. In addition, if a utility or subsurface structure is compromised, the field staff initiates the Emergency Action Plan Guidelines (Exhibit 5); however, more detailed emergency action procedures should be reviewed with the client and documented in the site specific health and safety plan prior to initiating work.

6. RECORDS

6.1 Checklist Records

7. APPROVALS AND HISTORY OF CHANGE

Approved By: Mija Coppola, Director H&S Compliance Assurance, LPS



History of Change

Revision Date	Revision Number	Reason for change
13 December 2006	01	Original document
26 March 2007	02	Put in new company format
15 May 2007	03	Added nation-wide 811 number
6 September 2007	04	Changing over to new template format
22 February 2008	05	Changing over to new template format

Exhibit 1 - Contract Term Language

INSERT INTO ALL CLIENT CONTRACTS OR WORK ORDERS WHERE DRILLING, EXCAVATION, INTRUSIVE WORK IS TO BE PERFORMED.

Site Conditions: ARCADIS shall not be liable for: (i) damage or injury to any subterranean structures (including, but not limited to, utilities, mains, pipes, tanks, and telephone cables) or any existing subterranean conditions; or the consequences of such damage or injury, if (with respect to this clause (i)) such structures or conditions were unknown and were not identified or shown, or were incorrectly shown, in information or on plans furnished to or obtained by ARCADIS in connection with the Services; (ii) concealed conditions encountered in the performance of the Services; (iii) concealed or unknown conditions in an existing structure at variance with the conditions indicated by the Scope of Services or Work Authorization; or (iv) unknown physical conditions below the surface of the ground that differ materially from those ordinarily encountered and are generally recognized as inherent in work of the character provided under this Agreement.

Client shall provide to ARCADIS all plans, maps, drawing and other documents identifying the location of any subterranean structures on the Site. Prior to location of any drilling or excavation below the ground surface, ARCADIS shall obtain the concurrence of the Client as to the location for such drilling or excavation.

Should: (i) concealed conditions be encountered in the performance of the Services; (ii) concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the Scope of Services or Work Authorization; or (iii) unknown physical conditions below the surface of the ground differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided under this Agreement; then the amount of this Agreement and/or time for performance shall be equitably adjusted by change order upon timely notice.

INSERT INTO ALL DRILLING, EXCAVATION, INTRUSIVE WORK SUBCONTRACTS.

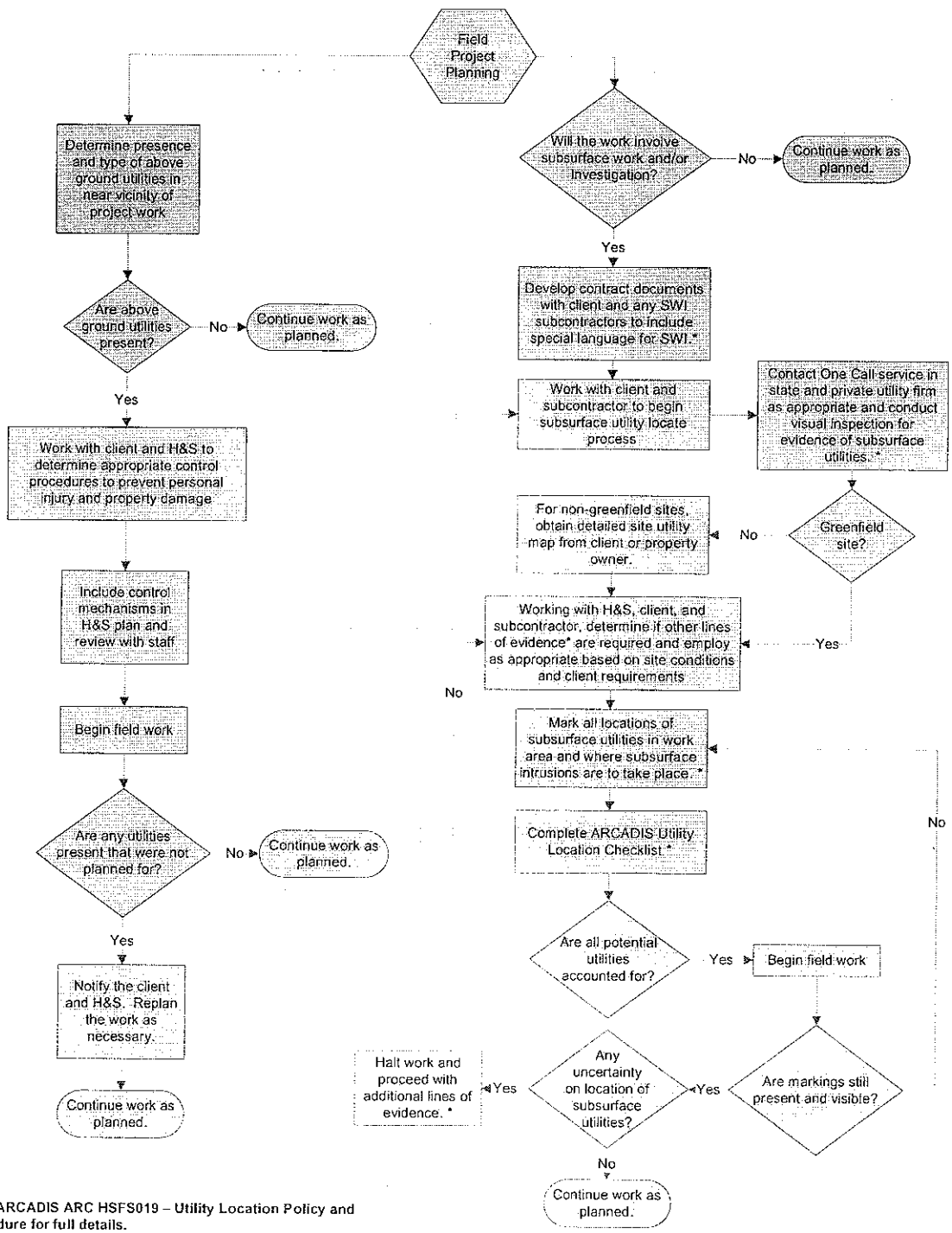
Site Conditions: SUBCONTRACTOR acknowledges that time is of the essence with respect to the performance and completion of its work under this Contract. SUBCONTRACTOR shall adhere to, commence and complete its work in accordance with any schedule incorporated into this Contract, or any schedule submitted by SUBCONTRACTOR or attached hereto; and with respect to any Changes, out of scope or additional work, SUBCONTRACTOR shall expeditiously perform such work according to any schedule therefore agreed to by the parties. In the event any schedule is incorporated in this Contract or attached to this Contract, SUBCONTRACTOR acknowledges and agrees that such schedule has accounted for all inherent or reasonably anticipated delays, including but not limited to those inherent in obtaining site information, access sufficient labor, supplies, tools, equipment and utilities required for the project work, and SUBCONTRACTOR waives any claim of extra compensation or damages therefore.

Subcontractor represents and warrants that it has had an opportunity to review and/or has carefully examined all necessary drawings, maps, schematics, specifications, governmental restrictions, permits and license requirements, and all applicable laws, regulations and rules relating to the Work to be done and the Site, it surroundings and local conditions, and has made all investigations based on reasonably available information that are necessary to develop a full understanding of the hazards and difficulties which can be encountered and are likely to impact the cost or schedule to perform the Work. SUBCONTRACTOR is thus familiar with conditions at the Site as are pertinent to or which may affect the Work and has been granted the right to

conduct, and has conducted, all investigations it deems appropriate to determine that it can fulfill the requirements of this Contract. Notwithstanding any other provision of this Contract, SUBCONTRACTOR assumes the risk of all conditions, as specified in this Contract, that may affect SUBCONTRACTOR'S ability to perform the Work and will, regardless of such conditions, or the expense or difficulty of performing the Work or the negligence, if any, of ARCADIS, with respect to same, fully complete the Work for the stated price without further recourse to ARCADIS. Information on the Site and local conditions at the Site furnished by ARCADIS are not guaranteed by ARCADIS to be accurate, and is furnished only for the convenience of SUBCONTRACTOR.

The discovery of concealed conditions which could not reasonably have been anticipated by the SUBCONTRACTOR from information available to SUBCONTRACTOR may constitute a changed condition, which, to the extent such condition materially affects the cost or schedule to perform the Work, would entitle the SUBCONTRACTOR to a change and an equitable adjustment of the Contract price or time. SUBCONTRACTOR warrants that it shall conduct appropriate investigations to determine, with reasonable certainty, the location of utility and service lines, underground storage systems, and other subsurface structures of any kind before commencement of any drilling, excavation, or other work that has the potential to disturb these structures. SUBCONTRACTOR further warrants that it shall conduct independent field investigations to confirm the location of subsurface structures before commencement of subsurface work and shall not relay exclusively on plot plans or other drawings provided to SUBCONTRACTOR in conducting these investigations.

Exhibit 2 – Utility Location Decision Tree



* See ARCADIS ARC HSFS019 – Utility Location Policy and Procedure for full details.

Exhibit 3 - Utilities and Structures Checklist

Project:	**Project Number:**
Site Location:	**Date:**

Instructions: This checklist will be used as a safety measure to insure that all underground utility lines, other underground structures as well as above ground utilities are clearly marked out and identified in the area selected for boring or excavation. **DRILLING, EXCAVATION, OR ANY TYPE OF GROUND INTRUSIVE WORK MAY NOT PROCEED UNTIL LINES ARE MARKED AND THIS CHECKLIST HAS BEEN COMPLETED.**

Pre-Field Work Requirements		
Was the state one-call notified with the required advanced notice (usually 48 to 72 hours)	YES	NO
State one-call confirmation number		
What are the 2 lines of evidence used for utility clearance?		
Was a plot plan showing site features and subsurface utilities provided by the PM/TM?	YES	NO
Was the Nation-wide 811 Number called? If no, why not?	YES_____	NO_____
If yes, what information was provided?		

Subgrade Utility Line Location	
Where is the gas line located?	
Where is the gas meter located on the site building(s)?	
Are the electric lines subsurface or overhead? Where are they located?	
Where is electric meter located on the site building(s)?	
Where are the telephone/cable lines located? Are there any overhead lines?	
Where do these lines enter the site building(s)?	

Where are the water lines located?	
Does the site occupant use water (bathrooms, industrial uses, fire suppression, etc.)? If so where do the water lines enter the building for these purposes?	
Are there small manholes/vault covers indicating water lines? If so, where?	
Was the local municipality contacted to mark sanitary lines?	
Where are the sanitary lines located?	
Where might the sanitary lines enter the building? (i.e. what side of the building are the bathrooms, kitchens, water treatment plant, etc?)	
Where are the storm sewer lines located?	
Are there storm sewer inlets located on the property? Check inlets for direction of subsurface lines.	
Are there any gutters directing storm water to the subsurface? Evaluate for direction of lines.	
Underground Storage Tank Sites	
Where are the USTs located? How many USTs are at the site (very number of USTs by counting fill ports and vent lines)?	
Where do the vent lines run?	
Where does the piping run? (Evaluate the path between USTs to dispenser islands).	
Where are the sub-surface electrical lines located which feed power to the UST system?	
General Underground Utility Location Signs	
Are there any cracks resembling straight lines that may indicate the settling of utility lines?	
Are there any patched areas where subsurface repairs may have been conducted?	
Are there any manhole covers or valve boxes that are not associated with marked lines?	

Above ground Utility Line Location	
Are there overhead power lines? If, so where are they located?	
What is the voltage of the overhead power lines?	
Are there any above ground structures (utilities, piping, etc.) that are used by the client? If so, are they located proximal to the work area?	
Do these lines need controlled (locked out) or protected prior to starting work?	
Interviews: Site Owners/Occupants MUST be interviewed for location of private utility lines at the site (if practicable) before start of work	
Name of Owner/Occupant.	
How is this person affiliated with the Site?	
Who interviewed Owner/Occupant?	
Date of Interview	
Specific comments that should be noted from the interview:	

NOTE: If any subsurface utilities listed above are not located, do not proceed with subsurface activities. Contact PM/TM immediately.

Name and signature of person who conducted utility line checklist

Name (print)	Signature	Date

Exhibit 4 - Use and Limitations of Utility Locating Methods

Ground Penetrating Radar (GPR)

The GPR system transmits high frequency electromagnetic waves into the ground and detects the energy reflected back to the surface. Energy is reflected along boundaries that possess different electrical properties. Reflections typically occur at lithologic contacts or where subsurface materials have high electrical contrasts, including metal objects such as underground storage tanks (USTs), drums, and utility pipes. These reflections are detected by the antenna and are processed into an electrical signal that can be used to image the subsurface feature. The GPR data will be reviewed in the field to assist in the delineation of potential piping or other subsurface structures.

The detection of subsurface structures located at the site depends on the electrical properties of the soil and the structure's depth, diameter, and composition. GPR is limited to the detection of smaller diameter pipes with depth. Generally, a pipe must increase in diameter by one 1 inch for each foot in depth to be seen using GPR. Also, plastic piping is more difficult to detect than metal piping using GPR, and caution should be used if plastic utility lines are suspected.

Radio Frequency Detection (RFD)

This instrument operates on the principle of radio frequency transmission and detection. The transmitter applies a known frequency to the pipe and the receiver is able to detect this frequency along the length of the structure. The success of RFD in tracing underground utilities is based on the composition of the structure (metal or plastic) and the ability to accurately position the transmitter unit so that it can be attached to, or placed directly over the structure. RFD should only be used to verify the location of utility mark-outs, and not as the primary method of utility identification.

Soil Vacuum Excavation

This method uses nondestructive vacuum excavation methods to create a visual test hole allowing the confirmation of buried utilities. This method is very accurate and relatively fast and can be performed prior to or during the drilling program. The limiting factors for this method are cost and availability. As with specialty drilling methods, a limited number of firms have the equipment to perform vacuum excavation.

The location of the structures to be cleared relative to the source and depth of impacted soil or groundwater is considered. If the zone to be cleared is known not to contain hazardous vapors or petroleum hydrocarbons via previous testing, continuous air monitoring is implemented using a lower explosive level (LEL)/O2 meter and photoionization detector (PID) or flame ionization detector (FID) to the depth of the boring. Also consistent with the site health and safety plan (HASP), air monitoring should be conducted continuously with the LEL/O2 meter during any activity if flammable or explosive vapors are suspected to be present. Prior to any subsurface investigation activities, air monitoring should be conducted to establish background levels for total organic vapors using a PID or FID. All work activity must STOP where tests indicate the concentration of flammable vapors exceeds 10% of the LEL, and the source of vapors must be investigated.

Vacuum-assisted soil excavation utility clearance will not be used in areas know to contain hazardous vapors or petroleum hydrocarbons unless the equipment to be used is suitable for flammable/explosive atmospheres. There is a significantly increased risk of explosion if these

materials are encountered while performing this type of utility clearance. Cautions will be performed, as identified below.

Cautions

Many vacuum systems that are commonly used for utility clearance are considered unsuitable for use for environmental investigation sites. Most vacuum units are "Not for use with Hydrocarbons, Explosives, Corrosive or Toxic Material," and are "Not Intrinsically Safe."

Given that many units and associated tanking are not explosion-proof, the following steps will be considered prior to using vacuum- assisted utility clearance units where soils could be impacted with petroleum hydrocarbons or flammable vapors.

1. Request from the manufacturer and/or the contractor doing the work to supply manufacturers' documentation and specifications for use of the unit at environmental sites.

2. Request documentation that the unit is intrinsically safe and may be used in areas where petroleum hydrocarbon may be present.

3. Obtain the procedures for grounding portable units to discharge potential static electricity during operation.

4 If none of the above are available, then hand auger instead and do not use vacuum-assisted methods.

Exhibit 5 - Emergency Action Plan Guidelines

When work activities result in the contact or compromise of a utility line, an appropriate response is critical to prevent injury, death or significant property damage. Although circumstances and response vary depending on site specific conditions, the following guidelines provide information that is factored into emergency action planning associated with utility damage. In any event, emergency planning is coordinated with the entity that owns the utility and the client prior to the start of work. This planning and the appropriate response actions are documented in the project health and safety plan and reviewed with all field staff.

Contact with Above or Underground Electric

Contact with above ground or underground electric lines may result in the equipment being energized. Field personnel do not assume rubber tires on equipment are insulating the equipment from the ground. For underground electric strikes, contact with the line may not be immediately noticeable but indications of a strike include: power outage, smoke, explosion, popping noises, or arching electricity. If contact with an electric line is made or is suspected, the following guidelines are followed:

- Under most circumstances, the equipment operator or any worker on a seat of the equipment should stay on the equipment. These workers should not touch anything, especially metal, on the equipment.
- If it is determined that the equipment should be vacated due to a life threatening circumstance, the worker(s) should jump clear as far as possible from the equipment. When jumping keep both feet together and hop away to a safe distance after landing on the ground. Do not use hand holds or touch any part of the equipment when preparing to jump off.
- Workers on the ground should move away from the equipment.
- Keep others away from the equipment and the area.
- If anyone is injured and in contact with the line or equipment, any attempted rescue should be performed with extreme caution. Only use long, dry, clean, unpainted pieces of wood or fiberglass pole or long dry, clean rope to retrieve the victim. Perform first aid/CPR only after the victim is sufficiently clear from the electrical hazard.
- Notify the electric utility or the client as appropriate for the site. Call 911or the client's emergency response phone number, as appropriate, for any serious injury or any situation that may result in fire or other hazard that could produce injury or property damage.

Natural Gas

If a natural gas line of any size is compromised, immediately:

- Shut off the equipment and remove any other ignition sources.
- Evacuate the area as quickly as possible.

- DO NOT attempt to turn off any gas valves.
- Call 911 or the designated client emergency response number as appropriate.
- Call the gas utility, if site response is not controlled by the client.
- Do not return to the area until permitted by the utility or by the approved client emergency response personnel, as appropriate.

Water Lines (all types)

Compromised water lines may rapidly become a significant hazard especially if the line is under considerable pressure. Ruptured pressurized water lines may undermine and wash out unconsolidated materials beneath equipment or structures causing them to become unstable. If a pressurized water line is ruptured, the following guidelines should be followed:

- Promptly shut off all equipment.
- Lower masts or other high extension components of the equipment.
- Evacuate area and call the water utility or client emergency response number, as appropriate.
- Turn off the water if the valve location is known and on the site property.
- If potable water lines have been ruptured, attempt to divert any flow away from structures prone to being flooded. Use caution and keep a safe distance from the line break since the ground surface may be compromised.
- For raw process water or other water of unknown quality, do not attempt to divert or contain. Avoid skin contact or accidental ingestion of any water.
- When returning to the area of the break, survey the area for signs of compromised land surface (cracks in asphalt or concrete, depressions in ground, observations of undercutting, etc.) and avoid moving any equipment until these conditions are repaired or resolved.

Sewers (all types)

Use the same general guidelines for water lines when responding to compromised sewers. If a sanitary sewer is compromised additional guidelines should be followed to avoid contracting any bacterial illnesses. These include:

- Promptly evacuate the area.
- Avoid contact with any sewage material.
- If contaminated, promptly was with soap (antimicrobial) and water and promptly change impacted clothing.

- If sewage is accidentally ingested or infiltrates any breach of the skin or enters the eyes, seek medical attention as a precautionary measure.

- Decontaminate equipment with commercially available disinfectant solutions or a 10% chlorine bleach solution.

Communication Lines

Contact and compromise of communication lines are generally considered more of a financial concern than a concern associated with injury. However, eye damage may occur if looking into the ends of a cut fiber optic line. Do not look into the ends of fiber optic lines or other communication lines of unknown type. Promptly contact the communication company owning the line.

Product Lines and Underground Storage Tanks (all types)

Compromise of a product line or underground storage tank (UST) requires immediate action to mitigate impact to the environment. For gasoline stations and similar facilities the following guidelines should be followed during a line or UST breach:

- Immediately shut down equipment and turn off the emergency shutoff switch for the facility dispensers.

- If there are no injuries, attempt to contain any flowing product using absorbent materials and/or by physically pumping or bailing product out of the breached area.

- If product is flowing on the surface away from the break area, attempt to protect downgradient storm drains, sewer drains, and surface water features form impact of the petroleum product using any readily available materials.

- If the bottom of a UST has been breached, immediately contact a pump truck to remove product from the affected UST.

- For releases involving diesel fuel, care will be taken to avoid any situation where diesel may be injected into the body from impalement by coated nails, wood splinters, etc. If diesel is injected into the body, seek prompt medical attention, even if no apparent symptoms of a problem exist.

- Clear area and arrange for prompt repair.

For industrial sites with lines or USTs containing multiple products with varying hazards, similar guidelines may be followed as above if the material encountered is known and workers have a fundamental understanding of the hazards associated with the material. Upon discovery of a line or UST breach due to work activities at these sites:

- Immediately stop work and notify the client representative or call the client designated emergency number. For abandoned sites call 911.

- If the material is not known, promptly evacuate the area and let HAZMAT teams deal with the release.

1. Policy

ARCADIS understands the hazards of personal exposure to benzene. Based on this understanding, ARCADIS will implement the appropriate controls to minimize or eliminate the hazards of benzene. These controls will focus first on engineering controls to mitigate benzene hazards where appropriate and practical. Administrative controls may also be implemented as appropriate and practical. Where it is not appropriate or practical to implement engineering and administrative controls, personal protective equipment (PPE) will be implemented to control benzene hazards below known occupational exposure limits.

2. Purpose and Scope

2.1 Purpose

2.1.1 Benzene Exposure Protection - This policy and associated procedures provides information to protect ARCADIS employees, subcontractors, and other effected personnel from exposures to benzene while conducting work on ARCADIS projects.

2.1.2 OSHA Requirements – This policy meets the requirements of the U.S. Occupational Safety and Health Administration (OSHA) regulations including Title 29 Code of Federal Regulations (CFR) Part 1910.1028.

2.2 Scope

This policy and the associated procedures apply to all projects where benzene is known or thought to be present, and where ARCADIS employees, subcontractors and other effected personnel are or could be exposed to benzene above the Action Level.

3. Definitions

Benzene—is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

Benzene is encountered on ARCADIS projects, frequently, as a contaminant in soils, ground and surface water, sediments, and other environmental media. Personnel may also encounter benzene in other forms at certain client facilities at which ARCADIS works. It can be encountered at petroleum-related facilities, chemical production facilities and other types of industrial sites.

Action Level—the airborne concentration established by OSHA that triggers certain regulatory requirements.

HSP—Health and Safety Procedure

Permissible Exposure Limit (PEL)—an average airborne concentration regulatory limit established by OSHA above which requires control to protect people from adverse health effects.

Short Term Exposure Limit (STEL)—a PEL or TLV established as a limit of exposure measured over a designated period of time less than 8 hours.

Threshold Limit Value (TLV)—a recommended average airborne concentration limit established by ACGIH. The TLVs are reviewed and updated as appropriate annually.

Time Weighted Average (TWA)—a measurement of airborne exposure to a chemical compound measured and averaged over a designated period of time for comparison to an STEL or an 8-hour PEL or TLV.

4. Responsibilities

4.1 Principal-In-Charge, Project and Task Managers are responsible, as part of the project hazard assessment, for determining if benzene is or is potentially present on a project site. In addition, the project or task manager is responsible for determining client requirements with respect to the control of benzene hazards. Project and Task Managers notify health and safety staff when working on sites containing benzene. Project and Task Managers are also responsible for ensuring that project staff has the appropriate and applicable training for benzene prior to those staff beginning work.

4.2 Corporate Health and Safety is responsible for keeping this policy and procedure up-to-date with current regulatory requirements and best practices. In addition, Corporate Health and Safety oversees the medical surveillance program for benzene, as applicable and provides a benzene training package for presentation to appropriate staff.

4.3 Project Health and Safety Staff including designated Writers and Reviewers of Project Health and Safety Plans (HASPs) are responsible for developing control processes and techniques on specific projects based on the levels of benzene expected to be encountered on project facilities.

4.4 Project Personnel are responsible for completing benzene training as required by this policy and procedure, and for following all hazard control processes designated by the Project Manager, Project Health and Safety Staff, and the project HASP. If project personnel believe that benzene is present that was not previously identified or is at levels that are higher than expected, they should stop work and notify project health and safety staff or the project manager immediately and not proceed until authorized.

5. Procedure

5.1 Benzene Hazards

- Benzene is primarily an inhalation hazard. Benzene vapor does not present an appreciable skin hazard; benzene liquid is absorbed through the skin.

- The acute (short term) effects of inhalation exposure are similar to most other hydrocarbons (narcosis, dizziness, weakness, headache, nausea).

- Prolonged or repeated exposure to concentrations above the permissible exposure limits may lead to blood disorders, including anemia, leucopenia (low white blood cell counts), and leukemia (cancer of the blood system).

- As with most hydrocarbons, repeated/prolonged skin exposure to liquid may lead to the aforementioned disease(s) of the blood.

5.2 Exposure Limits and Regulated Areas

The following personal exposure limits are established for benzene by inhalation:

- OSHA ACTION LEVEL – 0.5 ppm benzene in air 8-hour TWA.

- OSHA PELs
  - TWA - 1.0 part per million (ppm) benzene in air averaged over an 8 hour period.
  - STEL - 5.0 ppm benzene in air averaged over any 15 minute period.
- ACGIH TLVs
  - TWA – 0.5 ppm benzene in air averaged over an 8 hour period
  - STEL – 2.5 ppm benzene in air averaged over an 8 hour period
  - Skin notation – meaning that there is a significant contribution to overall exposure by the cutaneous route including mucous membranes and the eyes, and by contact with vapors, liquids and solids containing benzene.
- Personal exposure is the concentration of benzene to which a person would be exposed if that person were not wearing respiratory protection. Personal exposures shall be measured over the exposure period in the breathing zone of the employee. Personal exposures should not be determined by area sampling.

- REGULATED AREA
  - An area where the benzene exposure does or can be expected to exceed the PELs or TLVs. Since it may be difficult to determine the exposure time for employees working in areas with concentrations that exceed PEL or TLV values, the facility/location may wish to regulate any area that exceeds 0.5 ppm or per the requirements of the client or of the project HASP.
  - The PEL for benzene is relatively low as compared to the PEL or TLV of other hydrocarbons such as gasoline (300 ppm); therefore, depending on exposure conditions, it may be very "easy" to exceed the PEL or TLV for benzene even though other hydrocarbon levels are not considered very high. Also of concern is historic monitoring data that indicates that short term work activities such as draining a cargo hose of gasoline or pumping free product from an aquifer may result in a benzene exposure exceeding the STEL.

5.3 Actions for Employee Exposures Greater Than or Equal to the OSHA Action Level or ACGIH TLV – TWA but Less than the OSHA PEL - TWA

- Training: Annual benzene training is required.

- Respiratory Protection: full-face air purifying respirators equipped with organic vapor cartridges will be used per the project HASP.

- Medical Surveillance: Initial and annual medical exams (see below) are required if employee personal exposures do or can be reasonably expected to exceed the Action Level on at least 30 calendar days during the coming year.

- Periodic Monitoring - shall be conducted at least annually until at least two consecutive exposure determinations (no less than 7 days apart) indicate the exposure is below the Action Level.

5.4 Actions for Employee Exposures Greater Than PELs

- Respiratory Protection: respirators shall be used in all regulated areas.

- Training: Annual benzene training is required.

- Medical Surveillance: Initial and annual medical exams (see below) are required if employee personal exposures do or can be reasonably expected to exceed the PEL on a least 10 calendar days during the coming year.

- Written Program: A written program to reduce personal exposure is required detailing the methods to be used to reduce exposures below the TLVs and the OSHA Action Level. These written programs will be in the form of the project HASP based on project-specific and client requirements. The HASP will indicate the schedule for the implementation of the any benzene-related hazard control processes or methods. The HASP is reviewed periodically per the ARCADIS HSP ARC HSFS010 – Health and Safety Plans. All project personnel have access to the project HASP at all times.

- Periodic Monitoring - at least every 6 months until at least two consecutive exposure determinations (no less than 7 days apart) indicate the exposure is below the PEL; then annually until at least two consecutive exposure determinations (no less than 7 days apart) indicate the exposure is below the PEL Action Level.

5.5 Exposure Monitoring

- Representative personal exposure monitoring is required for each type of operation involving the handling of or potential exposure to benzene.

- Personal exposure monitoring shall utilize standard industrial hygiene sampling techniques and recordkeeping.

  - Passive badges such as the 3M 3500 or charcoal tube sampling may be used for this sampling activity.
  - Detection tubes shall not be used for compliance personal exposure determination but may be used for work and confined space entry permitting and defining regulated areas.
  - Employees who have been monitored for benzene exposure shall be notified of the monitoring results within 15 working days of receipt of these results. If the PEL is exceeded, the notification must indicate the follow-up plans or corrective actions to be taken to reduce exposures to below the PEL.

- Personal STEL monitoring should be used to characterize exposures for specific tasks such as gauging, O&M of treatment equipment, hose connect and disconnect, maintenance tasks such as flange breaking, etc.

- Personal TWA monitoring can be used for extended tasks, such as well developing and sampling, loading, tasks inside vessel holds, tank cleaning, and maintenance tasks such as pump removal, etc.

- Area sampling can be used to determine regulated areas; the sampling media shall determine the duration of sampling:

  - Detection tubes (Kitagawa #118SB, or Draeger 0.5/c) can be used for real-time determination.
  - Charcoal tube samples must be taken for at least 15 minutes (passive badges are not recommended for area sampling).

- Periodic Monitoring is required if exposures exceed the Action Level or PELs.

5.6 Requirements for Regulated Areas

- Posting: Regulated areas shall be indicated such as by barricades, barricade tape, painted demarcations, or other devices.

- A sign shall be posted at the access to the regulated area with the warning:

1. DANGER
2. BENZENE
3. CANCER HAZARD
4. FLAMMABLE - NO SMOKING
5. AUTHORIZED PERSONNEL ONLY

[Minimum lettering height: DANGER BENZENE 4"; others 3"]

- Respiratory Protection: Respirators shall be worn by all personnel when in a regulated area, regardless of the time period or over-all personal exposure measurement.

- Labeling

  - In addition to appropriate Hazard Communication labeling, containers or equipment containing > 0.1% benzene must also be labeled as such:

DANGER CONTAINS BENZENE CANCER CAUSING AGENT

  - Pipelines do not need to be labeled.

5.7 Exposure Reduction

- Written Program

  - The Project Manager and the Project Health and Safety Staff will develop a written program for exposure reduction if there is a determination that employee exposures may exceed the PELs or TLVs.
  - The written program must list the corrective actions that will be taken to reduce employee exposure to at or below the PELs and TLVs:
    - identify regulated areas/tasks;
    - engineering controls;
    - revised work practices;
    - respiratory protection and protective clothing; and
    - schedule of development and implementation.

- Spills and Emergencies

An emergency is any occurrence which may result in an unexpected significant release of benzene that may result in a significant inhalation or skin exposure. After an emergency, appropriate monitoring must be conducted to assure the ambient benzene levels are back to normal; and conduct appropriate medical surveillance for affected employee(s).

- Respiratory Protection and Personal Protective Equipment

  - Respirators shall be worn, maintained and managed in accordance with the OSHA standard, 29 CFR 1910.134 and ARCADIS HSP ARC HSGE017 – Respiratory Protection. In addition, any client requirements on project sites will be followed.
  - Per the project HASP, respiratory protection will be worn at all times when airborne concentrations of benzene exceed the OSHA Action Level or the ACGIH TLV-TWA. The respirator will be a full-face air purifying respirator equipped with organic vapor cartridges. Action limits for upgrading to a higher level of protection will be documented in the project HASP or per client requirements.
  - Appropriate eye protection will be worn as necessary. Protective clothing and gloves suitable for the particular product (such as for gasoline) will generally be suitable for protection against the benzene in that product. For most hydrocarbon products, nitrile gloves, provide adequate protection. Chemical resistant clothing may vary depending on the product and degree of exposure.
  - For "pure" benzene the following materials are recommended:
    - gloves: poly-vinyl alcohol (PVA)
    - clothing: Saranex or Barricade (DuPont) or equivalent.

5.8 Medical Surveillance

- Initial medical surveillance is required:

  - If employee personal exposures are reasonably expected to exceed the Action Level on at least 30 calendar days per year; or
  - If employee personal exposures are reasonably expected to exceed the PEL on a least 10 calendar days per year.

- Periodic exams are required on an annual basis for employees who continue to meet the criteria listed above. Annual exams may be discontinued after the exam conducted the year after personal exposures fall below the limits stated above in this section.

- The specific medical exam requirements are explained in detail in ARCADIS HSP ARC HSGE010 - Medical Surveillance.

- The physician must be supplied a copy of the OSHA benzene regulation 29 CFR 1910.1028 and a description of the employee's benzene exposure.

- For employees exposed to benzene from an emergency, a urine sample must be taken at the end of the shift. A urinary phenol test must be performed on the sample within 72 hours.

- OSHA regulations for benzene have specific medical removal provisions for medical examinations results falling outside of certain criteria. The facility/location should contact the Corporate Health and Safety Manager if the examining physician indicates that an employee may fall into these criteria.

5.9 Training

- Initial benzene training is required for all employees assigned to a work area suspected or known to contain benzene.

- Annual benzene training is required for all employees actually or potentially exposed to greater than the Action Level (TWA > 0.5 ppm).

- Initial and annual training shall consist of:

  - The operations that involve benzene exposure.
  - The methods/observations that can be used to detect the presence or release of benzene
  - The physical and health hazards of benzene.
  - Methods used to protect against the hazards of benzene.
  - The proper use of personal protective equipment in emergency situations.
  - The meaning of a regulated area and how such are demarcated.
  - A review of the applicable standard and where copies can be found.
  - An explanation of the medical surveillance program

6. References

- OSHA 29 CFR 1910.1128 Benzene

- ACGIH 2006 TLVs and BEIs – Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices

- ARCADIS Medical Surveillance HSP – ARC HSGE006

7. Records

- All exposure, medical, and training records shall be kept for 30 years.
- All exposure and medical records shall be made available to appropriate regulatory agencies upon written request.
- Employees who have been monitored for benzene exposure shall be notified of the monitoring results within 15 working days of receipt of these results; a written request is not required

8. Approvals and History of Change

Approved By: Mija Coppola, Director H&S Compliance Assurance and LPS

Mija A. Coppola

History of Change

Revision Date	Revision Number	Reason for change
26 March 2007	01	Original document
7 June 2007	02	Change to new template
6 September 2007	03	Changing over to new template format
22 February 2008	04	Template change

1. POLICY

ARCADIS understands the hazards of personal exposure to cadmium. Based on this understanding, ARCADIS will implement the appropriate controls to minimize or eliminate the hazards of cadmium. These controls will focus first on engineering controls to mitigate cadmium hazards where appropriate and practical. Administrative controls may also be implemented as appropriate and practical. Where it is not appropriate or practical to implement engineering and administrative controls, personal protective equipment (PPE) will be implemented to control cadmium hazards below known occupational exposure limits.

2. PURPOSE AND SCOPE

2.1 Purpose

2.1.1 Exposure to Cadmium

This policy and associated procedures provides information to protect ARCADIS employees, subcontractors, and other effected personnel from exposures to cadmium while conducting work on ARCADIS projects.

2.1.2 OSHA Requirements

It meets the requirements of the U.S. Occupational Safety and Health Administration (OSHA) regulations including Title 29 Code of Federal Regulations (CFR) Part 1910.1027 and Part 1926.1127.

2.2 Scope

This policy and the associated procedures apply to all projects where cadmium is known or thought to be present, and where ARCADIS employees, subcontractors and other effected personnel are or could be exposed to cadmium above the Action Level.

3. DEFINITIONS

Action Level is the airborne concentration established by OSHA that triggers certain regulatory requirements.

Authorized person means any person authorized by ARCADIS and required by work duties to be present in cadmium regulated areas.

Cadmium is a natural element in the earth's crust. It is usually found as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide).

All soils and rocks, including coal and mineral fertilizers, contain some cadmium. Most cadmium used in the United States is extracted during the production of other metals like zinc, lead, and copper. Cadmium does not corrode easily and has many uses, including batteries, pigments, metal coatings, and plastics.

Cadmium is encountered on ARCADIS projects as a contaminant in soils, ground and surface water, sediments, and other environmental media. It can also be encountered through the air where dusts containing cadmium are present. Personnel may also encounter cadmium in other forms at certain client facilities at which ARCADIS works. It can be encountered at mining and

smelting operations, battery manufacturing facilities, chemical production facilities where metal coatings or plastics are manufactured and other types of industrial sites.

High-Efficiency Particulate Air [HEPA] filter means a filter capable of trapping and retaining at least 99.97 percent of mono-dispersed particles of 0.3 micrometers in diameter.

Permissible Exposure Limit (PEL) is an average airborne concentration regulatory limit established by OSHA above which requires control to protect people from adverse health effects.

Short Term Exposure Limit (STEL) is a PEL or TLV established as a limit of exposure measured over a designated period of time less than 8 hours.

Threshold Limit Value is a recommended average airborne concentration limit established by ACGIH. The TLVs are reviewed and updated as appropriate annually.

Time Weighted Average (TWA) is a measurement of airborne exposure to a chemical compound measured and averaged over a designated period of time for comparison to an STEL or an 8-hour PEL or TLV.

4. RESPONSIBILITIES

4.1 Project Managers

Project Managers are responsible, as part of the project hazard assessment, for determining if cadmium is or is potentially present on a project site. In addition, the project manager is responsible for determining client requirements with respect to the control of cadmium hazards. Project Managers notify health and safety staff when working on sites containing cadmium. Project Managers are also responsible for ensuring that project staff has the appropriate and applicable training for cadmium prior to those staff beginning work.

4.2 Corporate Health and Safety

Corporate Health and Safety is responsible for keeping this policy and procedure up-to-date with current regulatory requirements and best practices. In addition, Corporate Health and Safety oversees the medical surveillance program for cadmium, as applicable and provides a cadmium training package to for presentation to appropriate staff.

4.3 Project Health and Safety Staff

Project Health and Safety Staff including designated Writers and Reviewers of Project Health and Safety Plans (HASPs) are responsible for developing control processes and techniques on specific projects based on the levels of cadmium expected to be encountered on project facilities.

4.4 Project Personnel

Project Personnel are responsible for completing cadmium training as required by this policy and procedure, and for following all hazard control processes designated by the Project Manager, Project Health and Safety Staff, and the project HASP. If project personnel believe that cadmium is present that was not previously identified or is at levels that are higher than expected, they should stop work and notify project health and safety staff or the project manager immediately and not proceed until authorized.

5. PROCEDURE

5.1 Cadmium Hazards

The health effects of cadmium are based on the type of exposure encountered by workers.

- Acute — Indicates that metal fume fever may result from acute exposure with flu-like symptoms of weakness, fever, headache, chills, sweating and muscular pain. Acute pulmonary edema usually develops within 24 hours and reaches a maximum by three days. If death from asphyxia does not occur, symptoms may resolve within a week.

- Chronic — Identifies the most serious consequence of chronic cadmium poisoning is cancer (lung and prostate). The first observed chronic effect is generally kidney damage, manifested by excretion of excessive (low molecular weight) protein in the urine. Cadmium also is believed to cause pulmonary emphysema and bone disease (osteomalcia and osteoporosis). The latter has been observed in Japan ("itai-itai" disease) where residents were exposed to cadmium in rice crops irrigated with cadmium-contaminated water. Cadmium may also cause anemia, teeth discoloration (Cd forms CdS) and loss of smell (anosmia).

5.2 Exposure Limits and Regulated Areas

The following personal exposure limits are established for cadmium by inhalation:

- OSHA ACTION LEVEL – 2.5 micrograms per cubic meter of air ($\mu g/m^3$) cadmium in air 8-hour time weighted average (TWA).

- OSHA PERMISSIBLE EXPOSURE LEVELS (PELs)

TWA - 5 $\mu g/m^3$ cadmium in air averaged over an 8 hour period.

- ACGIH THRESHOLD LIMIT VALUES (TLVs)

TWA – 10 $\mu g/m^3$ cadmium in air averaged over an 8 hour period.

TWA – 2 $\mu g/m^3$ cadmium-in-air averaged over an 8 hour period for the respirable fraction which, are those particles that enter deep into the lung where gas exchange takes place.

- Personal exposure is the concentration of cadmium to which a person would be exposed if that person were not wearing respiratory protection. Personal exposures shall be measured over the exposure period in the breathing zone of the employee. Personal exposures should not be determined by area sampling.

- REGULATED AREA – An area where the cadmium exposure does or can be expected to exceed the PELs. Since it may be difficult to determine the

exposure time for employees working in areas with concentrations that exceed PEL values, the facility/location may wish to regulate any area that exceeds the 8-hour TWA PEL. Only Authorized Persons are permitted to enter regulated areas.

5.3 Actions for Employee Exposures Greater Than or Equal to the Action Level but Less Than the PELs

- Training – Annual cadmium training is required.
- Medical Surveillance – Initial and annual medical exams (see below) are required if employee personal exposures do or can be reasonably expected to exceed the Action Level on at least 30 calendar days during the coming year.
- Periodic Monitoring – shall be conducted at least annually until at least two consecutive exposure determinations (no less than 7 days apart) indicate the exposure is below the Action Level.

5.4 Actions for Employee Exposures Greater Than PELs

- Respiratory Protection – a minimum of full face air-purifying respirators equipped with HEPA filters shall be used in all regulated areas.
- Training – Annual cadmium training is required.
- Medical Surveillance – Initial and annual medical exams (see below) are required if employee personal exposures do or can be reasonably expected to exceed the PEL on a least 10 calendar days during the coming year.
- Written Program – A written program to reduce personal exposure is required detailing the methods to be used to reduce exposures below the PEL. These written programs will be in the form of the project HASP based on project-specific and client requirements. The HASP will indicate the schedule for the implementation of the any cadmium-related hazard control processes or methods. The HASP is reviewed periodically but at least annually per the ARCADIS SOP ARC HSFS010 – Health and Safety Plans. All project personnel have access to the project HASP at all times.
- Periodic Monitoring – at least every 6 months until at least two consecutive exposure determinations (no less than 7 days apart) indicate the exposure is below the PEL; then annually until at least two consecutive exposure determinations (no less than 7 days apart) indicate the exposure is below the PEL Action Level.

5.5 Exposure Monitoring

- Representative personal exposure monitoring is required for each type of operation involving the handling of or potential exposure to cadmium.

- Initial monitoring can be omitted if there is documented data or industrial hygiene calculations to demonstrate that exposures are below the action level.

- Personal exposure monitoring shall utilize standard industrial hygiene sampling techniques and recordkeeping.

Employees who have been monitored for cadmium exposure shall be notified of the monitoring results within 15 working days of receipt of these results. If the PEL is exceeded, the notification must indicate the follow-up plans or corrective actions to be taken to reduce exposures to below the PEL.

- Personal TWA monitoring can be used for extended tasks, such as soil and sediment sampling, working on mine sites where cadmium is present, where clients require monitoring, etc.

- Area sampling can be used to determine regulated areas.

- Periodic Monitoring is required if exposures exceed the Action Level or PELs.

5.6 Requirements for Regulated Areas

- Posting: Regulated areas shall be indicated such as by barricades, barricade tape, painted demarcations, or other devices.

- A sign shall be posted at the access to the regulated area with the warning:

DANGER

CADMIUM

CANCER HAZARD

CAN CAUSE LUNG AND KIDNEY DISEASE

AUTHORIZED PERSONNEL ONLY

RESPIRATOR REQUIRED IN THIS AREA

(Minimum lettering height: DANGER CADMIUM 4"; others 3")

- Respiratory Protection: Respirators shall be worn by all personnel when in a regulated area, regardless of the time period or over-all personal exposure measurement.

- Labeling

In addition to appropriate Hazard Communication labeling, containers or equipment containing cadmium or cadmium compounds must also be labeled as such:

DANGER

CONTAINS CADMIUM

CANCER HAZARD

AVOID CREATING DUST

CAN CAUSE LUNG AND KIDNEY DISEASE

- Eating, drinking, smoking, chewing any item, or applying cosmetics is strictly prohibited in a cadmium regulated area.

5.7 Exposure Reduction

- Written Program

The Project Manager and the Project Health and Safety Staff will develop a written program and make a determination as to the initial exposure levels to be included in the project HASP for exposure reduction if there is a determination that employee exposures may exceed the OSHA Action Level. The HASP will be reviewed at least annually. The program must include:

- The locations and operations of potential cadmium exposure
- Means to achieve compliance
- Available air monitoring data or industrial hygiene estimates of airborne concentrations
- Schedule for implementing control procedures
- Exposure control processes
- Medical surveillance requirements
- Training requirements
- Emergency response

The written program must list the corrective actions that will be taken to reduce employee exposure to at or below the OSHA Action Level:

- Identify regulated areas/tasks and the operations where cadmium may be encountered

- The specific means to achieve compliance with OSHA, client, and other applicable requirements
- Engineering controls
- Revised work practices
- Respiratory protection and protective clothing
- Schedule of development and implementation

- Spills and Emergencies

An emergency is any occurrence which may result in an unexpected significant release of cadmium or cadmium-containing compounds that may result in a significant inhalation. After an emergency, appropriate monitoring must be conducted to assure the ambient cadmium levels are back to normal; and conduct appropriate medical surveillance for affected employee(s).

- Respiratory Protection and Personal Protective Equipment

  - Respirators shall be worn, maintained and managed in accordance with the OSHA standard, 29 CFR 1910.134 and ARCADIS SOP ARC HSGE017 – Respiratory Protection. In addition, any client requirements on project sites will be followed.
  - Respiratory protection will be worn in all areas as determined in the project HASP and per client requirements. Respirators will be at a minimum, full-face air purifying respirators equipped with HEPA filters.
  - Protective clothing will be worn per the requirements of the client or the project HASP and will include at a minimum at or above the OSHA Action Level:

    Coveralls

    Gloves

    Hood

    Boots and boot covers

    Face shield (depending on operation)

    Goggles

- Ventilation Systems

Where appropriate, ventilation systems will be utilized to control the level of airborne cadmium per the client and HASP requirements. These ventilation systems will be equipped with HEPA filtration and be maintained to ensure effective collection of the cadmium particulate. Personnel who maintain these systems and

change the filters will be appropriately protected per this policy and procedure to minimize exposure.

- Personal Hygiene

Where cadmium is present at any level, project personnel handling such media containing cadmium will where gloves to minimize exposure of cadmium to the skin that can then be transferred to the mouth. In all areas where cadmium is present, personnel will dutifully wash their hands and face before leaving the area to eat, drink, smoke, chew or apply cosmetics. In situations as indicated in the project HASP, PPE will be worn to protect the skin from exposure. However, even where PPE is worn, hand and face washing is required.

5.8 Medical Surveillance

- Initial medical surveillance is required:
  - If employee personal exposures are reasonably expected to exceed the Action Level on at least 30 calendar days per year; or
  - If employee personal exposures are reasonably expected to exceed the PEL on a least 10 calendar days per year.
- Periodic exams are required on an annual basis for employees who continue to meet the criteria listed above. Annual exams may be discontinued after the exam conducted the year after personal exposures fall below the limits stated above in this section.
- The specific medical exam requirements are explained in detail in ARCADIS SOP ARC HSGE010 - Medical Surveillance.
- The physician must be supplied a copy of the OSHA cadmium regulation 29 CFR 1910.1027 and a description of the employee's cadmium exposure.
- For employees exposed to cadmium from an emergency, ARCADIS will immediately call WorkCare and follow all instructions for treatment and testing.

5.9 Training

- Initial cadmium training is required for all employees assigned to a work area suspected or known to contain cadmium. This training can be accomplished at the project orientation prior to the initiation of site work.
- Annual cadmium training is required at a minimum for all employees actually or potentially exposed to greater than the Action Level.
- Initial and annual training shall consist of:
  - The operations that involve cadmium exposure.

- The methods/observations that can be used to detect the presence or release of cadmium
- The physical and health hazards of cadmium.
- Methods used to protect against the hazards of cadmium including PPE and respiratory protection.
- The proper use of personal protective equipment in emergency situations.
- The meaning of a regulated area and how such are demarcated.
- A review of the applicable standard and where copies can be found.
- An explanation of the medical surveillance program and an employee's right to access medical and exposure records.

6. REFERENCES

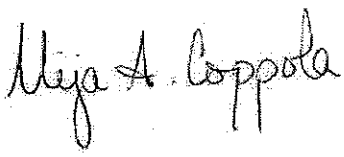
- OSHA 29 CFR 1910.1027 – Cadmium
- OSHA 29 DFR 1926.1127 – Cadmium
- ARCADIS Medical Surveillance SOP – ARC HSGE006
- ARCADIS Respiratory Protection SOP – ARC HSGE017

7. RECORDS

- All exposure, medical, and training records shall be kept for 30 years.
- All exposure and medical records shall be made available to appropriate regulatory agencies upon written request.
- Employees who have been monitored for cadmium exposure shall be notified of the monitoring results within 15 working days of receipt of these results; a written request is not required.

8. APPROVALS AND HISTORY OF CHANGE

Approved by: Mija A. Coppola, Director H&S Compliance Assurance, LPS



History of Change

Revision Date	Revision Number	Reason for change
26 March 2007	01	Original document
6 September 2007	02	Changing over to new template format
26 February 2008	03	Template Change

1. POLICY

It is the policy of ARCADIS to assess noise hazards resulting from or encountered by our staff during job activities and to control such noise hazards to minimize and eliminate hearing loss among our staff, subcontractors, clients, and the public. Any employee who will be exposed to noise at or over 85 decibels (excluding brief intermittent ambient noise) for any amount of time will be required to wear appropriate hearing protection. When in doubt, ARCADIS will provide hearing protection.

2. PURPOSE AND SCOPE

2.1 Purpose

ARCADIS is committed to providing a healthy and safe work environment for our employees, subcontractors, clients and visitors. To this end, ARCADIS embraces this Hearing Conservation Health & Safety (HS) Policy. The purpose of the ARCADIS Hearing Conservation HS Policy is to provide a standard policy on the health and safety requirements and processes for all employees with potential exposure to excessive noise (levels in excess of 85dBA for any amount of time) and to comply with 29CFR1910.95. ARCADIS defines excessive noise as any noise environment that requires speech levels above those used for normal conversation.

2.2 Scope

This policy and associated procedures apply to every project and all operations conducted by ARCADIS. Hearing Protection is supplied and/or approved by ARCADIS for use by employees in carrying out their assignments. All employees conducting work where the potential for excessive noise is present, are required to have their assigned hearing protection available and used as required by the project Health and Safety Plan (HASP), Job Safety Analysis (JSA), or client requirements.

3. DEFINITIONS

NRR – Noise Reduction Rating is the measure, in decibels, of how well a hearing protector reduces noise, as specified by the Environmental Protection Agency. The higher the number, the greater the noise reduction. When dual protectors are used, the combined NRR provides approximately 5 decibels more than the higher rated of the two products. For example, using ear plugs (NRR of 29 decibels) with ear muffs (NRR 27) would provide a Noise Reduction Rating of 34 decibels. For practical purposes, users should assume they will actually receive protection that is 5 decibels less than the published value.

HSP – Health and Safety Procedure

TWA – Time Weighted Average; The average exposure to a contaminant or condition (such as noise) to which workers may be exposed without adverse effect over a period of 8 hours a day or a 40 hour work week.

Decibels – A Weighted – the unit of measure to be used when measuring noise levels on ARCADIS work sites and when comparing to occupational exposure standards and limits.

4. RESPONSIBILITIES

Employees – are required to wear prescribed hearing protection during activities with identified excessive noise levels. In addition, employees are required to have their provided hearing protection available where the potential for excessive noise exists and to use as required by HASPs, JSAs, or client requirements.

In addition, employees have the responsibilities to adhere to this HSP and to communicate HS concerns, issues and questions to their supervisor or their respective Health and Safety resource. In addition, all employees have the responsibility to:

- Use the TRACK process prior to any activity;
- Follow all ARCADIS and client requirements;
- Participate in the medical monitoring program, including annual audiogram and hearing conservation training as applicable based on their job duties;
- Notify the Corporate Health and Safety if they were exposed to high noise levels and required to wear hearing protection during the previous year and are not already in the medical monitoring program;
- To understand and appropriately utilize the "Stop Work Authority" concept.

Managers – Have the responsibility to steward the HS program to ensure that staff in their practice are appropriately equipped with the necessary hearing protection and have been provided the appropriate training. To accomplish this, Business Practice Managers (BPMs) have the responsibility to know and understand our HS program, policy, vision, and this HSP in detail enough so as to be prepared to explain it to a client when required. In addition, Managers have the responsibility to provide oversight management for the HS of employees in their respective operations. Each will assure that appropriate time and resources are provided to facilitate the implementation of this HSP. In addition, the Managers will involve themselves in any "Stop Work" issued by an employee as requested by an ARCADIS employee, project manager, or Principal-in-Charge (PIC). Managers will assist in resolving the issue associated with the "Stop Work Authority" issued by an employee.

Project Managers and Principals in Charge (PICs) – Have the responsibility to know and follow all applicable ARCADIS and client HS requirements, for ensuring work is conducted under the policy stated in this HSP, and for implementing the procedure requirements provided for in this HSP on any project and/or in offices that pose hazards to ARCADIS employees or employees of its subcontractors, clients, and other organizations present in the vicinity of work controlled by ARCADIS

For project related work, Project Managers and PICs responsibilities also include determining and communicating any specific client requirements that are applicable, including:

- Communicating with and appropriately managing subcontractors, ensuring that employees have appropriate training and qualifications, and for ensuring all client HS requirements are met;

- Involving the appropriate ARCADIS HS Staff and project client staff, as necessary;
- Ensuring that all subcontractors have been communicated with concerning the minimum HS requirements for the project
- Providing adequate resources and budget for personal protective equipment (PPE), including hearing protection; PPE will be provided at not cost to the employee

In addition, as project and client agents and on behalf of ARCADIS, the Project Managers and Client Managers for client-related work shall be responsible for:

- Understanding and compliance by employees with HS rules and the requirements;
- Guaranteeing each employee the absolute right to exercise "Stop Work Authority" in good faith without fear of retribution or disciplinary action
- Using the ARCADIS Incident Investigation process for formally resolving a "Stop Work" condition.

Using this "Stop Work Authority" process, the manager and the employee will:

- Discuss and document the condition;
- Identify and document the root cause for the condition;
- Determine and document the solutions;
- Implement the solutions;
- Sign and acknowledge the solutions are in place to the satisfaction of the employee.

Corporate HS Staff – Have the responsibility for:

- Communicating the policy and procedure requirements in this HSP with all offices within ARCADIS – US;
- Ensuring that offices are aware of this HSP;
- Ensuring this HSP is being implemented effectively;
- Provide required training or guidance on approved training options;
- Providing the necessary suppliers and criteria for selection of H&S equipment.

Health and Safety Managers and Specialists – Are responsible for facilitating the policy and procedure requirements in this HSP in their area of responsibility and for providing "hands-on" assistance to ARCADIS staff to ensure this procedure is appropriately implemented.

5. PROCEDURE

5.1 Noise Monitoring and Exposure Assessments

Noise monitoring should be conducted on any or all activities where excessive noise may be present. The monitoring will be prescribed by H&S professionals during the development of HASP and/or JSA. Noise monitoring may also be conducted at the discretion of the health and safety supervisor (HSS) or any staff members that have questions or concerns about potential noise exposure. ARCADIS defines excessive noise as any noise environment that requires speech levels above those used for normal conversation. If noise monitoring is not feasible, the staff will assume that exposures that require elevated speech are above 85 db and will use appropriate hearing protection. Monitoring results will be collected in accordance with guidance provided in 29CFR1910.95 Appendix G - Monitoring noise levels non-mandatory informational appendix. Monitoring results will be communicated to staff and used to determine adequate types and effectiveness (NRR) of hearing protection.

Community based noise monitoring may also be required based on the scope of the project. Community based noise monitoring will be conducted in accordance with the Project specifications and applicable Environmental Protection Agency (EPA), State or Local ordinances.

5.2 Audiometric Testing

Audiometric tests will be scheduled in conjunction with pre-placement, periodic, and termination medical examinations as required by the Medical Surveillance Program. All employees that are not already part of the medical monitoring program must inform their supervisor and Corporate Health and Safety if they were exposed to high noise levels as part of their job duties. Employees that were exposed to high noise levels must receive an audiogram as specified by the Medical Surveillance Program. Employees will be informed of the requirement that they avoid both non-occupational and occupational noise exposure for 14 hours prior to audiometric testing.

Audiograms will be compared to baseline and prior tests to determine if a standard threshold shift has occurred. If a shift is detected, retesting may be done within 30 days. If a shift is confirmed, the employee will be informed in writing and may need to be refitted and retrained in hearing protection use. If subsequent testing shows that a standard threshold shift is not present, the employee will be informed. Additional audiometric testing may be conducted at the discretion of Health and Safety.

The Physician or audiologist will determine if further evaluation is needed and, if so, will provide to the specialist all the information that is required by 29 CFR 1910.95 (g)(7)(iii). If the physician determines that the medical pathology is unrelated to work exposure or wearing hearing protectors, the employee will be informed by the physician.

5.3 Hearing Protection Devices

Employees must use hearing protection selected, supplies, and/or approved by the firm. Requests for hearing protective devices must be directed to the Regional Health and Safety Managers and Specialists. Hearing protective devices are required to be selected by the Project Manager, or their designee, based on consultation with Corporate HS staff.

6. TRAINING

Employees required to wear hearing protection will receive training as provided by Corporate H&S. The training will be provided at least annually with refresher training as necessary and will include information regarding: effects of noise on hearing, the purpose of hearing protectors, their advantages/disadvantages and attenuation of various types, the proper selection, fit, use and care of protectors, and the purpose of audiometric testing. Employees will be trained concerning site specific noises hazards and hearing protection by H&S or project H&S staff as applicable.

7. REFERENCES

- OSHA Standard 29 CFR 1910.95

8. RECORDS

Record Maintenance – All records regarding noise exposure measurements will be maintained by the offices for two years. All audiometric test records will be maintained for the duration of the affected employee's employment. Original copies of shipping declarations and related shipping documents for hazardous materials will be kept in central file in each office location with copies kept in project files, as appropriate. These documents will be kept for a minimum of 2 years (3 years for manifests) or with the project files as long as the project files are kept.

9. APPROVALS AND HISTORY OF CHANGE

Approved By:

Mija A. Coppola, Director, H&S Compliance Assurance, LPS, Communications

Mija A Coppola

Revision Date	Revision Number	Reason for change
1 December 2007	01	Original document
30 January 2008	02	Change to new template

ARCADIS
Infrastructure, environment, facilities

Imagine the result

Lead – Health and Safety Policy and Procedures

ARCADIS SOP: ARC HSIH010

Revision #2

Revision Date: 6 September 2007

Table of Contents

Lead – Health and Safety Policy and Procedures

Approval Signatures

Approved by: Michael A. Thomas

Michael A. Thomas, CIH, Corporate HS Director

Approved by: Patricia A. Vollertsen

Patricia A. Vollertsen,

Revision Date	Revision Number	Reason for change
26 March 2007	01	Original document
6 September 2007	02	Changing over to new template format

Corporate HS Manager

1.0 Policy

ARCADIS understands the hazards of personal exposure to lead. Based on this understanding, ARCADIS will implement the appropriate controls to minimize or eliminate the hazards of lead. These controls will focus first on engineering controls to mitigate lead hazards where appropriate and practical. Administrative controls may also be implemented as appropriate and practical. Where it is not appropriate or practical to implement engineering and administrative controls, personal protective equipment (PPE) will be implemented to control lead hazards below known occupational exposure limits.

2.0 Purpose and Scope

2.1 Purpose

2.1.1 **Exposure to Lead -** This policy and associated procedures provides information to protect ARCADIS employees, subcontractors, and other effected personnel from exposures to lead while conducting work on ARCADIS projects.

2.1.2 **OSHA Standards** – This policy meets the requirements of the U.S. Occupational Safety and Health Administration (OSHA) regulations including Title 29 Code of Federal Regulations (CFR) Part 1910.1025 and Part 1926.62

2.2 Scope

This policy and the associated procedures apply to all projects where lead is known or thought to be present, and where ARCADIS employees, subcontractors and other effected personnel are or could be exposed to lead above the Action Level.

3.0 Definitions

Action Level is the airborne concentration established by OSHA that triggers certain regulatory requirements.

Authorized person means any person authorized by ARCADIS and required by work duties to be present in lead regulated areas.

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead

from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years.

Lead is encountered on ARCADIS projects as a contaminant in soils, ground and surface water, sediments, and other environmental media. It can also be encountered through the air where dusts containing lead are present. Personnel may also encounter lead in other forms at certain client facilities at which ARCADIS works. It can be encountered at mining and smelting operations, battery manufacturing facilities, chemical production facilities where metal coatings or plastics are manufactured and other types of industrial sites. In addition, other activities that may expose ARCADIS staff to lead include:

- Demolition or salvage of structures where lead or materials containing lead are present;
- Removal or encapsulation of materials containing lead;
- New construction, alteration, repair, or renovation of structures, substrates, or portions thereof, that contain lead, or materials containing lead;
- Installation of products containing lead;
- Lead contamination/emergency cleanup;
- Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed, and
- Maintenance operations associated with the construction activities described in this paragraph.

High-efficiency particulate air [HEPA] filter means a filter capable of trapping and retaining at least 99.97 percent of mono-dispersed particles of 0.3 micrometers in diameter.

Permissible Exposure Limit (PEL) is an average airborne concentration regulatory limit established by OSHA above which requires control to protect people from adverse health effects.

Short Term Exposure Limit (STEL) is a PEL or TLV established as a limit of exposure measured over a designated period of time less than 8 hours.

Threshold Limit Value is a recommended average airborne concentration limit established by ACGIH. The TLVs are reviewed and updated as appropriate annually.

Time Weighted Average (TWA) is a measurement of airborne exposure to a chemical compound measured and averaged over a designated period of time for comparison to an STEL or an 8-hour PEL or TLV.

4.0 Responsibilities

4.1 Project Managers are responsible, as part of the project hazard assessment, for determining if lead is or is potentially present on a project site. In addition, the project manager is responsible for determining client requirements with respect to the control of lead hazards. Project Managers notify health and safety staff when working on sites containing lead. Project Managers are also responsible for ensuring that project staff has the appropriate and applicable training for lead prior to those staff beginning work.

4.2 Corporate Health and Safety is responsible for keeping this policy and procedure up-to-date with current regulatory requirements and best practices. In addition, Corporate Health and Safety oversees the medical surveillance program for lead, as applicable and provides a lead training package to for presentation to appropriate staff.

4.3 Project Health and Safety Staff including designated Writers and Reviewers of Project Health and Safety Plans (HASPs) are responsible for developing control processes and techniques on specific projects based on the levels of lead expected to be encountered on project facilities.

4.4 Regional and Division HS Staff are responsible for supporting and assisting the project and task managers, and the project HS staff in the implementation of this policy and the associated procedures.

4.5 Project Personnel are responsible for completing lead training as required by this policy and procedure, and for following all hazard control processes designated by the Project Manager, Project Health and Safety Staff, and the project HASP. If project personnel believe that lead is present that was not previously identified or is at levels that are higher than expected, they should stop work and notify project health and safety staff or the project manager immediately and not proceed until authorized.

5.0 Procedure

5.1 Procedure

5.1.1 Lead Hazards

The health effects of lead are based on the type of exposure encountered by workers.

The primary route of exposure to lead in the work place is through inhalation of airborne lead. However, oral ingestion may represent a major route of exposure in contaminated workplaces. Most exposures occur with inorganic lead. Organic (tetraethyl and tetramethyl) lead, which was added to gasoline until the late 1970s, is not commonly encountered. Organic forms may be absorbed through the skin, while inorganic forms cannot.

Inorganic lead is not metabolized, but is directly absorbed, distributed and excreted. The rate depends on its chemical and physical form and on the physiological characteristics of the exposed person (e.g. nutritional status and age). Once in the blood, lead is distributed primarily among three compartments – blood, soft tissue (kidney, bone marrow, liver, and brain), and mineralizing tissue (bones and teeth). Absorption via the gastro-intestinal (GI) track following ingestion is highly dependent upon presence of levels of calcium, iron, fats, and proteins.

5.1.2 Exposure Limits and Regulated Areas

The following personal exposure limits are established for lead by inhalation:

- OSHA ACTION LEVEL – 30 micrograms per cubic meter of air (ug/m^3) lead in air 8-hour time weighted average (TWA).
- OSHA PERMISSIBLE EXPOSURE LEVELS (PELs)
  - TWA - 50 ug/m^3 lead in air averaged over an 8 hour period.
- ACGIH THRESHOLD LIMIT VALUES (TLVs)
  - TWA – 50 ug/m^3 lead in air averaged over an 8 hour period.
- Personal exposure is the concentration of lead to which a person would be exposed if that person were not wearing respiratory protection. Personal exposures shall be measured over the exposure period in the breathing zone of the employee. Personal exposures should not be determined by area sampling.

- REGULATED AREA

An area where the lead exposure does or can be expected to exceed the PEL. Since it may be difficult to determine the exposure time for employees working in areas with concentrations that exceed PEL values, the facility/location may wish to regulate any area that exceeds the 8-hour TWA PEL.. Only Authorized Persons are permitted to enter regulated areas.

5.1.3 Actions for Employee Exposures Greater Than or Equal to the Action Level but Less Than the PELs

- Training – Annual lead training is required.
- Medical Surveillance – Initial and annual medical exams (see below) are required if employee personal exposures do or can be reasonably expected to exceed the Action Level on at least 30 calendar days during the coming year.
- Periodic Monitoring – shall be conducted at least annually until at least two consecutive exposure determinations (no less than 7 days apart) indicate the exposure is below the Action Level.

5.1.4 Actions for Employee Exposures Greater Than PELs

- Respiratory Protection – a minimum of full face air-purifying respirators equipped with HEPA filters shall be used in all regulated areas.
- Training – Annual lead training is required.
- Medical Surveillance – Initial and annual medical exams (see below) are required if employee personal exposures do or can be reasonably expected to exceed the PEL on a least 10 calendar days during the coming year.
- Written Program – A written program to reduce personal exposure is required detailing the methods to be used to reduce exposures below the PEL. These written programs will be in the form of the project HASP based on project-specific and client requirements. The HASP will indicate the schedule for the implementation of the any lead-related hazard control processes or methods. The HASP is reviewed periodically but at least annually per the ARCADIS SOP ARC HSFS010 – Health and Safety Plans. All project personnel have access to the project HASP at all times.
- Periodic Monitoring – at least every 6 months until at least two consecutive exposure determinations (no less than 7 days apart) indicate the exposure is below the PEL; then

annually until at least two consecutive exposure determinations (no less than 7 days apart) indicate the exposure is below the PEL Action Level.

5.1.5 Exposure Monitoring

- Representative personal exposure monitoring is required for each type of operation involving the handling of or potential exposure to lead.
- Initial monitoring can be omitted if there is documented data or industrial hygiene calculations to demonstrate that exposures are below the action level.
- Personal exposure monitoring shall utilize standard industrial hygiene sampling techniques and recordkeeping.
  - Employees who have been monitored for lead exposure shall be notified of the monitoring results within 15 working days of receipt of these results . If the PEL is exceeded, the notification must indicate the follow-up plans or corrective actions to be taken to reduce exposures to below the PEL.
- Personal TWA monitoring can be used for extended tasks, such as soil and sedmiment sampling, working on mine sites where lead is present, where clients require monitoring, etc.
- Area sampling can be used to determine regulated areas;
- Periodic Monitoring is required if exposures exceed the Action Level or PELs.

5.1.6 Requirements for Regulated Areas

- Posting – Regulated areas shall be indicated such as by barricades, barricade tape, painted demarcations, or other devices.
- A sign shall be posted at the access to the regulated area with the warning:

DANGER
LEAD WORK AREA
POISON
NO SMOKING OR EATING

[Minimum lettering height: DANGER LEAD WORK AREA 4"; others 3"]

- Respiratory Protection – Respirators shall be worn by all personnel when in a regulated area, regardless of the time period or over-all personal exposure measurement.

- Labeling:

  – In addition to appropriate Hazard Communication labeling, containers or equipment containing lead or lead compounds must also be labeled as such:

CAUTION
ITEMS CONTAMINATED WITH LEAD
DO NOT REMOVE DUST BY BLOWING OR SHAKING
DISPOSE OF LEAD CONTAMINATED MATERIALS AND WASH WATER IN ACCORDANCE WITH LOCAL, STATE (PROVINCIAL) OR FEDERAL REGULATIONS

- Eating, drinking, smoking, chewing any item, or applying cosmetics is strictly prohibited in a lead regulated area.

5.1.7 Exposure Reduction

- Written Program:

  – The Project Manager and the Project Health and Safety Staff will develop a written program and make a determination as to the initial exposure levels to be included in the project HASP for exposure reduction if there is a determination that employee exposures may exceed the OSHA Action Level. The HASP will be reviewed at least annually. The program must include:

    - The locations and operations of potential lead exposure
    - Means to achieve compliance
    - Available air monitoring data or industrial hygiene estimates of airborne concentrations
    - Schedule for implementing control procedures
    - Exposure control processes
    - Medical surveillance requirements
    - Training requirements
    - Emergency response

  – The written program must list the corrective actions that will be taken to reduce employee exposure to at or below the OSHA Action Level:

    - identify regulated areas/tasks and the operations where lead may be encountered;

- the specific means to achieve compliance with OSHA, client, and other applicable requirements;
- engineering controls;
- revised work practices;
- respiratory protection and protective clothing; and
- schedule of development and implementation.

- Spills and Emergencies:

An emergency is any occurrence which may result in an unexpected significant release of lead or lead-containing compounds that may result in a significant inhalation. After an emergency, appropriate monitoring must be conducted to assure the ambient lead levels are back to normal; and conduct appropriate medical surveillance for affected employee(s).

- Respiratory Protection and Personal Protective Equipment:
  - Respirators shall be worn, maintained and managed in accordance with the OSHA standard, 29 CFR 1910.134 and ARCADIS SOP ARC HSGE017 – Respiratory Protection. In addition, any client requirements on project sites will be followed.
  - Respiratory protection will be worn in all areas as determined in the project HASP and per client requirements. Respirators will be at a minimum, full-face air purifying respirators equipped with HEPA filters.
  - Protective clothing will be worn per the requirements of the client or the project HASP and will include at a minimum at or above the OSHA Action Level:

    Coveralls
    Gloves
    Hood
    Boots and boot covers
    Face shield (depending on operation)
    Goggles

- Ventilation Systems:

Where appropriate, ventilation systems will be utilized to control the level of airborne lead per the client and HASP requirements. These ventilation systems will be equipped with HEPA filtration and be maintained to ensure effective collection of the lead particulate. Personnel who maintain these systems and change the filters will be appropriately protected per this policy and procedure to minimize exposure.

- Personal Hygiene:

Where lead is present at any level, project personnel handling such media containing lead will where gloves to minimize exposure of lead to the skin that can then be transferred to the mouth. In all areas where lead is present, personnel will dutifully wash their hands and face before leaving the area to eat, drink, smoke, chew or apply cosmetics. Decontamination and changing facilities will be provided as necessary. In situations as indicated in the project HASP, PPE will be worn to protect the skin from exposure. However, even where PPE is worn, hand and face washing is required.

5.1.8 Medical Surveillance

- Initial medical surveillance is required:
  - If employee personal exposures are reasonably expected to exceed the Action Level on at least 30 calendar days per year; or
  - If employee personal exposures are reasonably expected to exceed the PEL on a least 10 calendar days per year.
- Periodic exams are required on an annual basis for employees who continue to meet the criteria listed above. Annual exams may be discontinued after the exam conducted the year after personal exposures fall below the limits stated above in this section.
- The specific medical exam requirements are explained in detail in ARCADIS SOP ARC HSGE010 - Medical Surveillance. In addition, ARCADIS will work with WorkCare to ensure the proper medical surveillance, testing and notification is completed related to exposure to lead. This includes timing of sampling (e.g., at least every 6 months to each covered employee; at least every two months for each employee whose last blood sampling and analysis indicated a blood lead level at or above 40 ug/100 g of whole blood; and at least monthly during the removal period), treatment if levels are elevated (e.g., temporary removal from the site), and employee notification (i.e., within 5 days of levels are not acceptable).
- The physician must be supplied a copy of the OSHA lead regulation 29 CFR 1910.1025 and a description of the employee's lead exposure.
- For employees exposed to lead from an emergency, ARCADIS will immediately call WorkCare and follow all instructions for treatment and testing

5.1.9 Training

- Initial lead training is required for all employees assigned to a work area suspected or known to contain lead. This training can be accomplished at the project orientation prior to the initiation of site work.

- Annual lead training is required at a minimum for all employees actually or potentially exposed to greater than the Action Level.

- Initial and annual training shall consist of:

  - The operations that involve lead exposure.
  - The methods/observations that can be used to detect the presence or release of lead
  - The physical and health hazards of lead.
  - Methods used to protect against the hazards of lead including PPE and respiratory protection.
  - The proper use of personal protective equipment in emergency situations.
  - The meaning of a regulated area and how such are demarcated.
  - A review of the applicable standard and where copies can be found.
  - An explanation of the medical surveillance program and an employee's right to access medical and exposure records.

6.0 References

- OSHA 29 CFR 1910.1025 – Lead

- OSHA 29 CFR 1926.62 – Lead

- ACGIH 2006 TLVs and BEIs – Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices

- ARCADIS Medical Surveillance SOP – ARC HSGE006

- ARCADIS Respiratory Protection SOP – ARC HSGE017

7.0 Records

- All exposure, medical, and training records shall be kept for 40 years or at least 20 years past the last date of employment.

- All exposure and medical records shall be made available to appropriate regulatory agencies upon written request.

- Employees who have been monitored for lead exposure shall be notified of the monitoring results within 15 working days of receipt of these results; a written request is not required

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Appendix H

Emergency Action Plan and Route to Hospital

EMERGENCY ACTION PLAN

Emergency Contact List

Emergency Contact	Phone
Local Police – New York City Police Department (60th Precinct)	911 (if appropriate) and 212.334.0611
Local Ambulance – New York City Fire Department	911
Local Fire Department – New York City Fire Department	911
Local Hospital – Coney Island Hospital	718.616.3000
Local Weather Data – John F. Kennedy International Airport	718.244.4444
Poison Control	800.332.3073
National Response Center (all spills in reportable quantities)	800.424.8802
U.S. Coast Guard (spills to water)	800.424.8802
Project Manager – Steven Feldman	Office: 631.391.5244 Cell: 516.369.6609
Site Manager – TBD	
H&S Manager – Charles Webster	Office: 315.671.9297 Cell: 315.247.5971
Client Contact – Andrew Prophete	718.963.5412

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List the Emergency Notification Procedure for the project:

Step 1: Call 911
Step 2: Obtain proper medical care
Step 3: Report incident to Project Manager
Step 4: Report incident to Work Care

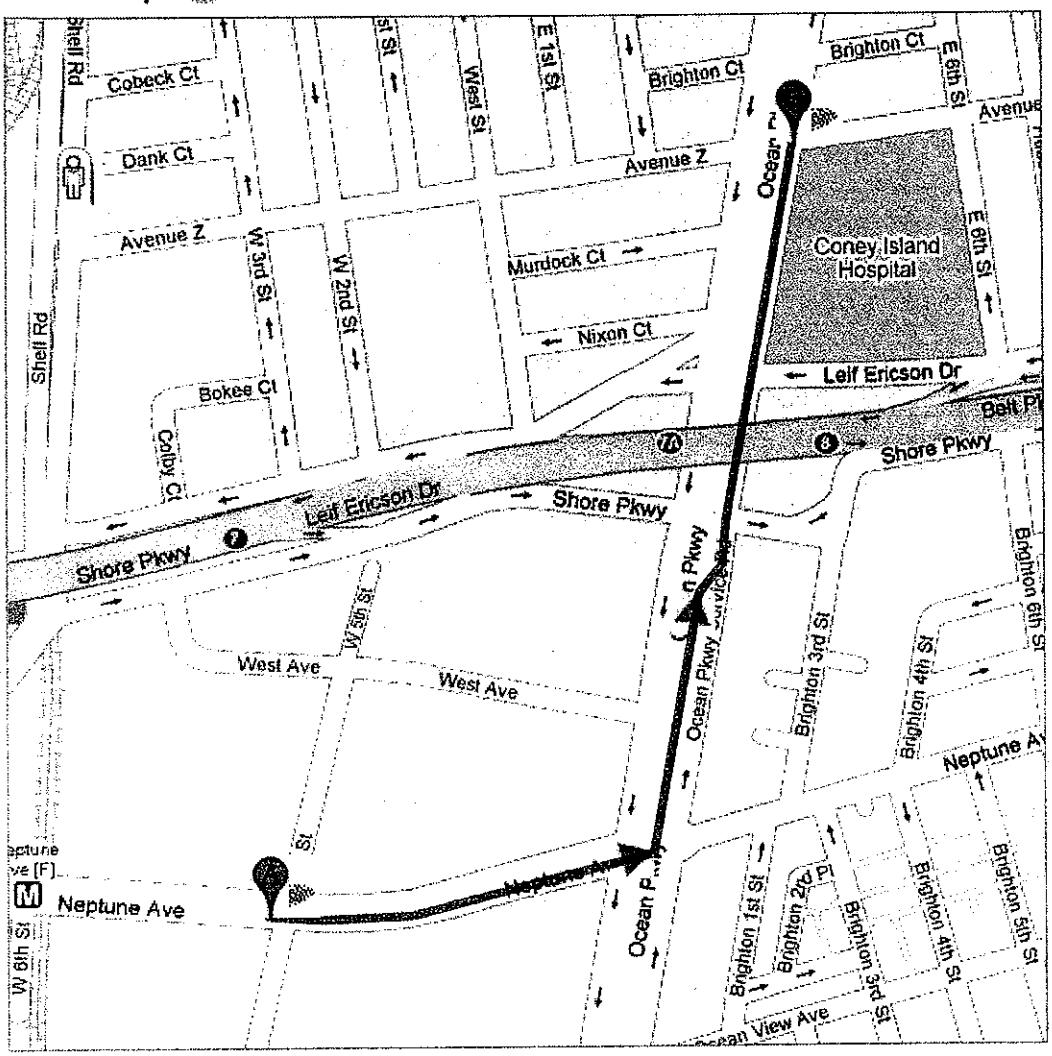
If emergency attention is not needed but professional medical attention is necessary, the employee will be taken to (see hospital route):

Medical Facility: Coney Island Hospital
Address: 2601 Ocean Parkway
Brooklyn, NY 11235
Phone Number: (718) 616-3000

Emergency Supplies and Equipment List

Emergency Supplies and Equipment (check all that apply)	Location on Project Site
☒ First Aid Kit	Field Vehicles
☒ Fire Extinguisher	Field Vehicles
☒ Mobile Phone ☐ Satellite Phone	All Field Personnel
☒ Traffic Cones	Field Vehicles
☐ Walkie Talkies	
☒ Water or Other Fluid Replenishment	Field Vehicles
☐ Eye Wash/Quick Drench Station	
☒ Eye Wash Bottle	Field Vehicles
☒ Wash and Dry Towelettes	Field Vehicles
☒ Sunscreen (SPF 15 or higher)	Field Vehicles
☒ Insect Repellant	Field Vehicles
☒ Chemical Spill Kit	Field Vehicles
☐ *Other (specify):*	

Google Maps



Driving directions to 2601 Ocean Pkwy, Brooklyn, NY 11235

0.7 mi – about **2 mins**

A **486 Neptune Ave**
Brooklyn, NY 11224

1. Head **east** on **Neptune Ave** toward **W 5th St**	0.2 mi
2. Turn **left** at **Ocean Pkwy**	0.2 mi
3. Slight **left** at **Ocean Pkwy/Ocean Pkwy Service Rd** Destination will be on the right	0.3 mi

B **2601 Ocean Pkwy**
Brooklyn, NY 11235

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route

accordingly. You must obey all signs or notices regarding your route.