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Consolidated Edison Company of New York, Inc.

Site Characterization Work Plan

Former Woodworth Avenue Works
(Site No. V00564)

Yonkers, New York 10701

January 2009

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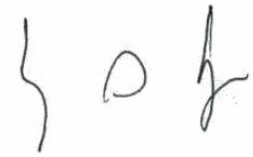

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Site Characterization Work Plan

Former Woodworth Avenue Works Site
Yonkers, New York

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1. Introduction

1.1 General

This document presents the *Site Characterization Work Plan* (SC Work Plan) for the former Woodworth Avenue Manufactured Gas Plant (MGP) site (Site) located in the City of Yonkers, Westchester County, New York. This SC Work Plan was prepared in accordance with the requirements of Voluntary Cleanup Agreement Index No. D2-0003-02-08 (VCA) between Consolidated Edison Company of New York, Inc. (Con Edison) and the New York State Department of Environmental Conservation (NYSDEC) dated August 15, 2002. The Site location is shown on Figure 1.

1.2 Site Characterization Objectives

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

- Determine if MGP-related chemical constituents are present in overburden soil and shallow groundwater at the Site at concentrations that exceed applicable and appropriate NYSDEC standards, criteria, and guidance values
- Determine if MGP-related and/or non-MGP-related by-product residuals (such as coal tar, dense non-aqueous phase liquid [DNAPL], petroleum, solvents, etc.) are present in overburden soil and shallow groundwater in the eastern half of the Site
- Assess the horizontal and vertical distribution of MGP-related and/or non-MGP-related residuals in the western half of the Site
- Determine the potential for MGP-related and/or non-MGP-related residuals and chemical constituents to migrate into the upper bedrock
- Determine the potential for off-site migration of MGP-related soil vapor and residuals
- Determine groundwater flow direction in the shallow, unconfined aquifer, and evaluate, to the extent practicable, whether groundwater flow may be a pathway for offsite migration of identified chemical constituents (if present)

- Provide sufficient data to evaluate the necessity for further investigation and/or remedial action

Although the objectives of the SC Work Plan focus on evaluating the presence and extent of MGP-related constituents and residual materials in environmental media, the sampling approach presented in the SC Work Plan was also developed to differentiate between MGP-related and non-MGP-related impacts.

1.3 Work Plan Organization

Following this introductory section, this SC Work Plan is organized into the following sections and appendices:

- Section 2 of this SC Work Plan presents a Site description, and a discussion of Site history, surface topography and drainage, and geologic/hydrogeologic conditions in the vicinity of the Site

- Section 3 describes the Site Characterization field activities to be conducted

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

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

- Section 6 presents references that were used to develop this SC Work Plan

- Appendix A – Field Sampling Plan (FSP) presents 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 and groundwater 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 during the field activities

- Appendix D – Health and Safety Plan (HASP) presents work practices and procedures that will be implemented to establish and maintain safe working conditions during implementation of the field activities described in the SC Work Plan

- Appendix E – DNAPL Contingency Plan presents procedures that will be implemented to minimize the potential for remobilization and downward migration of DNAPL during the SC Field Activities.

2. Site Description and History

2.1 General

This section presents a description of the former Woodworth Avenue MGP Site and a discussion of Site history, surface topography and drainage, and geologic/ hydrogeologic conditions in the vicinity of the Site. Information on historical MGP operations at the Site was obtained from the document entitled *Historical Investigation Report – Former Yonkers Woodworth Avenue MGP Site* prepared by The Retec Group, Inc. (Retec, 2003). Information presented in the Retec document includes a review of available Sanborn Fire Insurance Maps, current and historical use of the Site and adjacent properties, potential environmental issues associated with these current and historical activities, and a summary of site investigations previously conducted at the Site. This information was used to develop the approach for the investigation activities described in Section 3 of this SC Work Plan.

2.2 Site Description

The current layout of the Site is shown on Figure 2. The Site is located on the west side of Woodworth Avenue between Babcock Place and Ashburton Avenue in the city of Yonkers, Westchester County, New York. As shown on Figure 2, the Site is bifurcated into western and eastern sections by rail lines of the Metro-North Commuter Railroad. The Site and surrounding area are zoned industrial (I) by the City of Yonkers. Surrounding land use zoning includes Wholesale Business and Commercial Storage/Light Manufacturing. It should be noted that the site is included as part of the City of Yonkers Alexander Street Urban Renewal Plan and the Alexander Street Master Plan. As stated in the Urban Renewal Plan, the Yonkers Community Development Agency (CDA) intends to

…remove blighted conditions, relocate affected businesses and households (if any), encourage private investment, redevelop cleared sites, and generally improve the economy and conditions of the City of Yonkers as a whole (Yonkers, 2007).

In the Urban Renewal Plan, Babcock Place which borders the site to the north is identified as a view corridor to the Hudson River. The Greyston Bakery (constructed on the western portion of the site during 2004) is identified as an *important existing feature*. The Greyston Bakery is a non-profit commercial bakery operated by the Greyston Foundation that employees economically disadvantaged people. Remedial activities have previously been implemented in the western portion of the site in

connection with the construction of the bakery building under the New York State Voluntary Cleanup Program (VCP Site No. V00361).

As defined in the VCA, the Site (NYSDEC No. V00564) is approximately 4.3 acres in size and is comprised of three blocks and seven lots (shown on Figure 2), designated by the City of Yonkers Assessor's Office as follows:

Tax Block/Lot	Land Use	Current Description	Current Property Owner
Block 2618,Lot 1	Industrial	Greyston Bakery, Commercial Bakery	104 Ashburton Avenue, LLC
Block 2618, Lot 2	Vacant	Bus turnaround	Yonkers CDA
Block 2618, Lot 200	Vacant	Vacant	State of New York
Block 7000, Lot 1	Railroad	Metro-North Railroad	MTA Metro-North
Block 2100, Lot 1	Industrial	Pollack Paint Inc.	Insl-X Products Corp.
Block 2100, Lot 4	Industrial	Steven's Paints	Stevens Paint Corp.
Block 2100, Lot 10	Industrial	A&D Carting Inc.	Stevens Paint Corp.

2.3 Site History

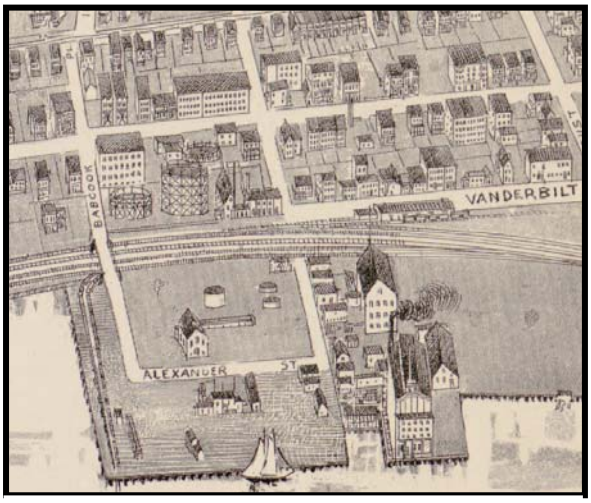
This section provides a brief summary of the historical use of the Site with emphasis on the former MGP operations. The layout of historical MGP structures at the site is shown on Figure 3. A comprehensive discussion of the Site historical use including historical maps and photographs is provided in the Historical Information Report (Retec, 2003).

According to the Atlas of New York and Vicinity (Beers, 1868), the Yonkers Gas Company occupied two parcels between Woodworth Avenue and the Hudson River Railroad. The location of the Hudson River Railroad appears to correspond to the present day location of the Metro-North Rail Line. One gasholder (Gas Holder No. 1 on Figure 3) and four unidentified buildings are depicted on the 1868 Atlas. The Hudson River shoreline is located west and adjacent to the rail line. However, a pier into the Hudson River is present directly west of the gas plant.

The 1881 Atlas of Westchester County, New York (Bromley, 1881) indicates that the gas plant has expanded to the north and west. A second gas holder (Gas Holder No. 2 on Figure 3) and unidentified building have been added in the eastern portion of the

site. Babcock Place is shown as the northern property boundary. An unidentified building is located west of the rail line. The rail line has expanded to three tracks and is now part of the New York Central and Hudson River Railroad. Additional filling of the Hudson River has occurred northwest of the site.

The 1886 Sanborn map indicates additional expansion of the gas plant operations. The gas plant is identified as the Yonkers Gas Light Company. MGP structures located on the portion of the site east of the rail line include two gas holders, valve and meter shop, and pipe shop, coke shed, coal shed, office, superintendent's dwelling, tool house, pump room, engine room and retorts. MGP structures located west of the rail line include a purifying house, dry houses and oil tank. A tar barrel storage area is also depicted west of the rail line. The configuration of the Hudson River shoreline appears to be the same as depicted in 1881.



Panoramic View of Yonkers Gas Light Company – 1899 (Landis and Hughes, 1899)
Source: US Library of Congress

The 1898 Sanborn map depicts further expansion of gas plant operations. A third gas holder is shown located east of the rail line. A new purifying house was constructed north of the original purifying house. A lard oil tank and store house is depicted west of the rail line.

The 1917 Sanborn map depicts the gas plant, now identified as the Westchester Lighting Company, at its most developed stage. According to the history report, the Yonkers Gas Light Company merged with the Westchester Lighting Company, a Con Edison predecessor company, in 1900. Additional structures depicted on the 1917 Sanborn map in the portion of the site located west of the rail line include three circular and two rectangular oil tanks located adjacent to Ashburton Avenue and a coal pile located on the northern portion of the site. Additional structures located east of the rail line include a concrete retaining wall and a meter and stove storage house. The 1917 Sanborn also indicates the original gas holder has been converted to a tar tank.

The Westchester Lighting Company continued to operate the Site as a gas plant until 1928 and continued to own the Site after gas manufacturing operations ceased. According to Retec, the MGP plant was dismantled in 1930 and demolished in 1931.

The 1951 and 1956 Sanborn maps show both portions of the Site as vacant land, with the exception of a machine shop/warehouse located on Woodworth Avenue. In 1957 an auto repair and gasoline station occupied the southeastern corner of the Site, while the western portion of the site was used for parking. The 1991 Sanborn map shows the Metro-North substation at its current location, while the western portion of the Site was occupied by an auto repair facility and buildings of an unidentified commercial or light manufacturing use.

2.3.1 Previous Investigations

Based on available information, no previous investigation efforts have been conducted to evaluate the eastern portion of the Site. The western portion of the site has been previously characterized by several investigations conducted by Ecosystems Strategies, Inc. (Ecosystems) and others, in connection with the VCP for the Greyston Bakery. Remedial efforts implemented in connection with the construction of the Bakery included the installation of a NAPL recovery system (consisting of a funnel and gate system and collection sump as shown on Figure 2), a sub-slab depressurization system, and a clay liner across soil areas that are not covered by the building or asphalt. Investigation activities conducted in connection with the VCP for the Geyston Bakery include:

Ecosystems Strategies Inc. Phase I/Phase II investigation (Ecosystems 1989)

Ecosystems conducted a Phase II ESA at the Site in 1989. A copy of the Phase II ESA report was not available for review by ARCADIS, but its findings were summarized in the Historical Investigation Report (Retec 2003). According to Retec, five monitoring wells were installed at the Site. Collected groundwater samples contained volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs) at concentrations that exceeded regulatory criteria.

Ecosystems Strategies, Inc. Draft Remediation Services Report (Ecosystems, 2004)

This report contains information about Site investigations conducted after 1989.

Malcolm Pirnie, another consultant, collected groundwater samples from the above-mentioned monitoring wells in 1995. Four of the five groundwater samples contained "dissolved hydrocarbons at levels exceeding NYSDEC groundwater protection standards." These wells were subsequently destroyed during construction of the Greyston Bakery.

In 1999, Ecosystems conducted a follow up subsurface investigation at the Site. Soil samples collected during this investigation were found to contain VOCs and PAHs at levels exceeding NYSDEC guidance values. Both light and dense non-aqueous phase liquids (LNAPL and DNAPL, respectively) were encountered in the northeast corner of the parcel. As such, the northeast corner of the parcel was designated as area of concern No. 1 (AOC # 1). The former location of the MGP crude oil tanks (shown on Figure 3) was designated as AOC # 2.

Ecosystems collected additional groundwater samples during April 2000, which yielded similar laboratory results. Collected groundwater samples continued to indicate the presence of dissolved benzene, toluene, ethylbenzene, xylenes (BTEX) and methyl-ether-butylene (MTBE) at concentrations that exceeded regulatory criteria.

A funnel and gate NAPL collection system was installed by Ecosystems in AOC 1 during construction of the Greyston Bakery. The collection system consists of an L-shaped hydraulic barrier constructed of sheet piling driven to 28 feet below ground surface (bgs), and one 4"-diameter recovery well screened from 13 to 20 feet bgs. The hydraulic barrier is 40 feet long in the north-south direction and approximately 25 feet long in the east-west direction. The approximate location of the NAPL barrier is shown on Figure 2.

Ecosystems Strategies, Inc. Operations and Maintenance Report (Ecosystems, 2007)

This report documents the ongoing groundwater sampling program at the Site. The program includes gauging and sampling three monitoring wells constructed after completion of the Greyston Bakery. The report also includes gauging the NAPL recovery well and removing NAPL on an as needed basis. Five sampling events have been conducted by Ecosystems between May 2005 and August 2007, confirming the presence of VOCs and PAHs at concentrations that exceed regulatory criteria. NAPL in the recovery well is described as "petroleum." This report also indicates that the current collection system has not been effective in recovering LNAPL or DNAPL.

2.4 Surface Topography and Drainage

The surface elevation at the site ranges from approximately 10 feet above mean sea level (MSL) along the western property boundary to more than 30 feet above MSL in the northeast corner of the site along Woodworth Avenue. Natural topography has been altered with concrete retaining walls which separate both portions of the Site from the Metro North rail lines. The Site is primarily paved or occupied by buildings.

2.5 Geologic/Hydrogeologic Setting

Based on information presented in the Historical Investigation Report (Retec, 2003) and the *USGS Surficial Geology Map of New York – Lower Hudson Sheet (Caldwell, 1989)*, the Site is underlain by the Fordham Gneiss formation of Upper Proterozoic age. The depth of bedrock at the Site is estimated to range between 10 and 20 feet fbg to the east and 60 feet fbg or deeper to the west toward the Hudson River. The overburden soil at the Site is described as glacial till, likely overlain by urban fill.

Based on the proximity of the Hudson River, shallow groundwater flow in the vicinity of the Site is expected to be generally west. Ecosystems' reports indicate a southwest groundwater flow direction. Depth to the water table at the Site reportedly ranges from 6 to 9 feet bgs.

3. Site Characterization Field Activities

3.1 General

This section of the SC Work Plan describes field activities to be conducted at the former Woodworth Avenue MGP site. Project personnel will conduct the following work activities to evaluate the potential presence of environmental concerns at the Site:

- Mobilize to the Site and conduct a utility markout to document existing conditions and mark the proposed sample locations
- Conduct a soil investigation, including completion of soil borings, test pits, and laboratory analysis of subsurface soil samples
- Conduct a groundwater investigation, including installation of groundwater monitoring wells, characterization of groundwater flow and quality, and assessment of the presence/characteristics of NAPL (if encountered)
- Conduct a soil vapor investigation, including the installation of temporary soil vapor probes, sample collection, ambient air sample collection, and laboratory analysis of subsurface and ambient air samples.
- Surveying the limits of the Site and soil boring locations, test pit locations, and groundwater monitoring well locations

A detailed description of the SC field activities is presented below.

3.2 Mobilization and Utility Markout

Utilities will be cleared according to the Con Edison Utility Clearance Process for Intrusive Activities (Revision 1, dated October 8, 2003). Prior to mobilization to the Site, hard copies of available utility plates, drawings, and/or maps will be reviewed to determine the approximate size and location of aboveground and underground utilities in the vicinity of the Site. Prior to implementing work activities, field personnel will mobilize to the Site to verify existing Site conditions and mark the proposed sample locations. Once sample locations are marked, ARCADIS will contact the local One-Call utility markout center. Following the utility markout, a private utility-locating

contractor will confirm the presence and location of underground utilities in all areas of the Site where ground-intrusive activities will occur. If necessary, the Site property owners, adjacent property owners, and/or the Con Edison Engineering Department will be contacted for assistance with marking out the locations of aboveground and below ground utilities. Once the utilities are marked, equipment and personnel necessary to implement the SC field investigation activities will mobilize to the Site.

3.3 Soil Investigation

The objectives for the SC soil investigation and the general procedures for obtaining and analyzing subsurface soil samples are detailed below.

3.3.1 Soil Investigation Objectives

The objectives of the soil investigation include:

- Determine if MGP-related or non-MGP-related chemical constituents are present in soil at the Site by collecting, visually characterizing, and analyzing subsurface soil samples.

- Identify the potential presence of MGP-related and non-MGP-related by-product residuals (such as coal tar, NAPL, purifier waste, petroleum, solvents, etc.) in subsurface soil at the Site.

- Obtain sufficient information to evaluate the necessity for further investigation and/or remedial action at the Site

In addition to the objectives outlined above, the information obtained as part of this investigation will be used to characterize subsurface materials at the site, including the distribution, saturated thickness, and relative permeability of subsurface soil. No surface soil samples will be collected during the site characterization investigation since the western portion of the site is mostly covered with asphalt and the eastern portion of the site has been reworked since the MGP operations have ceased and structures have been removed.

3.3.2 Test Pits

A total of five test pits (TP-101 through TP-105) will be completed at the target locations shown on Figure 4 to identify the presence/absence of MGP-related

structures. The rationale for selecting each test pit location is provided on Table 1. The test pits will also aid in determining if MGP impacts are present near the historic gas holders. The proposed test pit locations shown on Figure 4 may be adjusted in the field (as necessary) based on the location of aboveground or underground utilities and/or visual observations. Test pits will not be relocated more than 10 feet from the proposed location without prior consultation with the NYSDEC's Project Manager. In addition, proposed test pit locations and dimensions are subject to review and approval by the property owner.

Prior to test pit excavation activities, utility clearance will be completed following procedures described in Section 3.2. After clearing or exposing the underground utilities, each test pit will be completed to a depth at which the target structure is identified, to a depth of refusal (if encountered), to a depth at which subsurface soil conditions become unstable (as determined by the onsite geologist), to the water table is reached, or to a maximum depth of 10 feet below ground surface (bgs). Test pits will not be extended below the water table. If a test pit cannot be completed and backfilled during one work day, safety barriers and other measures detailed in the HASP will be used to barricade or cover the test pit to mitigate any safety hazards until work is completed.

Photo documentation of the test pits will be performed and will consist of photos of the test pit locations prior to excavation, during excavation, and following excavation. Photos of each excavation will include any subsurface structures encountered, changes in subsurface stratigraphy, and obvious visually-impacted subsurface materials. Field personnel will attempt to obtain photographs of adequate quality to document subsurface conditions, subject to limitations associated with light conditions, weather, and safety considerations with working adjacent to open excavations. A photo log with photo identification, time, camera view/direction, and description will be maintained to organize site characterization photos. Soil recovered from each test pit will be visually characterized for soil type, grain size, color, texture, and moisture content and placed in a container for headspace screening using a PID. In addition, the presence of visible staining, NAPL (if encountered), and obvious odors will be noted. If NAPL is encountered in any of the test pits, the DNAPL Contingency Plan presented in Appendix E will be implemented to limit the potential for remobilization and downward migration of DNAPL. Subsurface soil samples will only be collected for laboratory analysis from test pits where obvious soil impacts and/or elevated headspace screening measurements are encountered. A minimum of one soil sample will collected for laboratory analysis from each test pits where obvious impacts or elevated headspace screening measurements are encountered. Where feasible, a

hand-held bucket auger will be used to collect soil samples directly from the test pit side wall within the interval where elevated headspace readings or visible impacts are encountered. For deeper test pits where health and safety concerns limit the ability to work from the ground surface immediately adjacent to the excavation, soil samples will be collected from material recovered from the backhoe bucket.

The soil samples will be submitted to a New York State Department of Health (NYSDOH-) accredited laboratory certified for the selected analyses on a standard turnaround basis for reporting of analytical results. Each sample will be analyzed for:

- Target Compound List (TCL) VOCs according to USEPA Method 5035 and 8260B
- TCL Semivolatile Organic Compounds (SVOCs) according to USEPA Method 8270C
- Target Analyte List (TAL) metals according to USEPA Method 6000/7000
- Total cyanide according to USEPA Method 9012 and amenable cyanide according to USEPA Method 335.1

Other analyses may include gasoline-range organics (GRO) and/or diesel-range organics (DRO), if suspected petroleum impacts are encountered. If NAPL is observed, a sample may be collected for fingerprint/forensic analysis using modified USEPA Method 8015 or other appropriate method.

Analytical methods, sample handling, and laboratory protocols are outlined in the QAPP (Appendix B). 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.

Excavated soil with gross impacts (i.e., visible NAPL) (if any) will be placed in new Department of Transportation- (DOT-) approved steel 55-gallon drums and/or a rolloff container prior to transportation for appropriate offsite disposal by ARCADIS. Excavated soil that does not exhibit gross impacts (including stained soil) will be used to backfill the test pit. In order to minimize the potential for backfilling activities to possibly redistribute impacted soil at the test pit locations (i.e., potential mixing of impacted soil with subsurface soil in the excavation), the following excavation/backfill techniques will be used to the extent practicable:

- Soil will be excavated from each test pit in approximately 2-foot depth intervals and stockpiled on polyethylene sheeting adjacent to the test pit, separately for each 2-foot depth interval (i.e., 0 to 2 feet below grade, 2 to 4 feet below grade, and greater than 4 feet below grade)

- Following completion of the test pit excavation, the test trenches will be backfilled using the stockpiled soil in the reverse order that the soil was excavated. For example, if the test pit was excavated to a total depth of 5 feet below grade, soil from 4 to 5 feet below grade will be placed first, followed by soil from 2 to 4 feet and 0 to 2 feet below grade. Clean fill material will be used as needed, to compensate for impacted soils that can not be reused.

- The surface of the test pit will be temporarily covered with compacted cold-batch asphalt. Final surface restoration will be completed by a paving contractor following the completion of the site characterization field sampling program.

Total VOCs and fugitive dust emissions in the worker breathing zone during implementation of the test pit excavation activities will be monitored using a PID and a mini-RAM. Requirements for additional perimeter monitoring of air emissions at the boundary of the work area during the investigation are detailed in the CAMP presented as Appendix C of this SC Work Plan.

3.3.3 Soil Borings

A total of 22 subsurface soil borings (SB-101 through SB-122) will be completed at the target locations shown on Figure 4 to evaluate subsurface conditions. The rationale for selecting each soil boring location is provided in Table 1. The proposed soil boring locations shown on Figure 4 may be adjusted in the field (as necessary) based on the location of aboveground or underground utilities and visual observations. Soil borings will not be relocated more than 10 feet from the proposed location without prior consultation with the Con Edison Project Manager. In addition, proposed soil boring locations are subject to review and approval by the property owner.

Each soil boring will be completed using hollow-stem auger, direct push or rotosonic drilling methods in accordance with the protocols presented in the FSP (Appendix A). At a minimum, the first 5 feet of each soil boring (i.e., ground surface to 5 feet below ground surface) will be excavated by non-mechanical means (i.e., hand auger, post-hole digger, and/or vacuum truck) as part of the utility clearance activities. Below 5 feet, soil samples will be collected continuously to the top of competent bedrock. The

proposed soil borings will vary in depth from approximately 10 feet bgs on the eastern portion of the site to approximately 60 feet bgs on the western portion of the site. The range of the soil boring depths is due to the site topography and the review of historical soil boring logs for the site and adjacent areas of the City of Yonkers. The drill rig will be left at boreholes not completed in one work day. If the drill rig needs to be moved to facilitate the operation of on-site businesses, unfinished boreholes will be covered with a skid-resistant stainless steel plate and its location marked with safety cones until work is completed.

Soil recovered from each sample interval will be visually characterized (for soil type, grain size, color, texture, and moisture content) and placed in a container for headspace screening using an organic vapor meter (OVM) equipped with a photoionization detector (PID). In addition, 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 presented in Appendix E will be implemented to limit the potential for remobilization and downward migration of DNAPL.

Up to five soil samples collected from each soil boring may be selected for laboratory analysis using the following sample selection criteria:

1. From the sampling interval within the vadose zone where the strongest evidence of suspected impacts is identified, based on PID readings, visual observation and/or odors

2. At the soil/groundwater table interface

3. From the sampling interval within the saturated zone where the strongest evidence of suspected impacts is identified, based on PID readings, visual observation and/or odors

4. From the sampling interval above the top of the first low permeability unit encountered in the soil boring

5. At boring locations where suspected impacts are identified, from a sampling interval of apparently clean material below impacted soil (to provide data for vertical delineation)

If no environmental impacts are identified at a boring location based on PID readings, visual observation, and/or odors, a minimum of two soil samples will be submitted for laboratory analysis, including the samples recovered from the soil/groundwater table interface and from the uppermost low permeability unit encountered at the boring.

Specific soil sampling methods are described in the FSP (Appendix A). The soil samples will be submitted to a NYSDOH accredited laboratory certified for the selected analyses on a standard turnaround basis for reporting of analytical results. Each sample will be analyzed for:

- Target Compound List (TCL) VOCs according to USEPA Method 5035 and 8260B
- TCL Semivolatile Organic Compounds (SVOCs) according to USEPA Method 8270C
- Target Analyte List (TAL) metals according to USEPA Method 6000/7000
- Total cyanide according to USEPA Method 9012 and amenable cyanide according to USEPA Method 335.1

Other analyses may include gasoline-range organics (GRO) and/or diesel-range organics (DRO), if suspected petroleum impacts are encountered. If NAPL is observed, a sample may be collected for fingerprint/forensic analysis using modified USEPA Method 8015 or other appropriate method.

Analytical methods, sample handling, and laboratory protocols are outlined in the QAPP (Appendix B). 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.

Total VOCs and fugitive dust emissions in the worker breathing zone during implementation of the drilling activities will be monitored using a PID and a Real-Time Aerosol Monitor (MIE mini-RAM, or equivalent). Requirements for additional perimeter monitoring of air emissions at the boundary of the work area during the investigation are detailed in the CAMP presented as Appendix C of this SC Work Plan.

Following collection of the subsurface soil samples, each soil boring will be tremie-grouted to the ground surface using a cement-bentonite grout. Soil borings completed in a paved area will be repaired with an asphalt patch or concrete, as appropriate.

3.4 Groundwater Investigation

The SC groundwater investigation objectives and general procedures for obtaining and analyzing groundwater samples are detailed below.

3.4.1 Groundwater Investigation Objectives

The objectives of the groundwater investigation are to:

- Determine the direction and gradient of groundwater flow in the unconfined, shallow aquifer beneath the Site
- Evaluate, to the extent practicable, whether groundwater flow may be a pathway for offsite migration of identified chemical constituents (if present)
- Gather sufficient analytical data to evaluate the necessity for further investigation and/or remedial action
- Determine if MGP-related constituents are present in groundwater beneath the Site by collecting and analyzing groundwater samples (petroleum impacts are present in groundwater at the Site, as described above)
- Determine the potential presence of NAPL in subsurface materials, and, if present, quantify relevant physical properties of the NAPL

3.4.2 Groundwater Monitoring Well Installation

A total of eleven shallow groundwater monitoring wells (MW-101 through MW-111) will be installed to evaluate groundwater quality and flow characteristics at the Site at the proposed locations shown on Figure 4. The rationale for selecting each monitoring well location is provided in Table 1. The final locations of the monitoring wells may be modified in the field based on the Site reconnaissance and utility locations. Monitoring well locations will not be relocated more than 10 feet from the proposed location without prior consultation with the NYSDEC's Project Manager. In addition, proposed monitoring well locations are subject to review and approval by the property owner.

Following completion of the soil boring at each proposed well location (as discussed above in Section 3.3.3), a groundwater monitoring well will be constructed using the protocols presented in the FSP. The monitoring wells will be constructed using two-inch diameter Schedule 40 polyvinyl chloride (PVC) screen and riser. Each monitoring well will be constructed with a 10-foot well screen with the top of screened interval placed approximately three feet above the water table surface. However, if the water table is within two feet of the surface, an alternate monitoring well installation protocol will be used to ensure that an adequate surface seal is maintained (as described in the FSP). If the water table is encountered at a depth of less than five feet above bedrock, the bottom of the well screen will be set at the top of the competent bedrock surface or sample refusal. Each monitoring well will be installed with a 2-foot sump grouted in place if NAPL is encountered and/or suspected.

Based on subsurface conditions encountered during implementation of the SC field activities (including the depth of groundwater, depth of bedrock, and presence/extent of NAPL), Con Edison, in consultation with the NYSDEC, may elect to complete additional wells, if needed as overburden installations, overburden/bedrock interface installations, or bedrock installations. Procedures for constructing an overburden/bedrock interface monitoring well or a bedrock groundwater monitoring well are presented in the FSP.

Following installation (and immediately prior to development as discussed below), each monitoring well will be checked for the presence of NAPL using procedures described in the FSP. Each monitoring well will then be developed by pumping water from the well using the procedures outlined in the FSP. Well development will continue until the turbidity is reduced to 50 nephelometeric turbidity units (NTUs) or less, or until pH and conductivity measurements have stabilized. Wastewater generated during monitoring well development and equipment decontamination will be placed in new closed-top DOT-approved steel 55-gallon drums or an onsite polyethylene storage tank prior to transportation for appropriate offsite disposal by ARCADIS.

Total VOCs and fugitive dust emissions in the worker breathing zone during installation of the groundwater monitoring wells will be monitored using a PID and a mini-RAM. Requirements for additional perimeter monitoring of air emissions at the boundary of the work area during the investigation are detailed in the CAMP presented as Appendix C of this SC Work Plan.

3.4.3 Groundwater Flow Pattern Characteristics

The groundwater flow patterns beneath the Site will be evaluated by conducting a comprehensive fluid-level measurement round from all Site groundwater monitoring wells (including both new and existing wells) to determine 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 presented in the FSP. The measurements will be converted to elevations based on survey of the monitoring well locations.

3.4.4 Groundwater Quality Characterization

To assess the potential presence of dissolved MGP-related and/or non-MGP-related chemical constituents in groundwater at the Site, one complete round of groundwater sampling will be conducted within two weeks after completion of the monitoring well installation and development activities. The groundwater sampling event will consist of collecting one groundwater sample from each groundwater monitoring well. Existing monitoring wells installed by others as part of previous Site investigations will also be included in the groundwater sampling event if access to these wells is granted by the property owner. The monitoring wells will be purged using low-flow methods as described in the FSP. Each well will be checked for the presence of NAPL prior to and during purging. Ground water samples will not be collected for laboratory analysis from monitoring wells that contain a measurable quantity of NAPL.

Following purging, one groundwater sample will be collected from each monitoring well using low-flow sampling techniques as described in the FSP and submitted for laboratory analysis for:

- Target Compound List (TCL) VOCs according to USEPA Method 5035 and 8260B
- TCL Semivolatile Organic Compounds (SVOCs) according to USEPA Method 8270C
- Target Analyte List (TAL) metals according to USEPA Method 6000/7000
- Total cyanide according to USEPA Method 9012.

The sample for analysis of VOCs will be collected prior to collecting samples for laboratory analysis of other constituents. Field parameters collected during

groundwater sampling will include pH, oxidation/reduction potential (ORP), turbidity, temperature, conductivity, and dissolved oxygen using the procedures outlined in the FSP.

3.4.5 Assess the Presence/Characteristics of NAPL

Each monitoring well installed during the site characterization will be gauged for the presence of NAPL during the water-level monitoring round. Existing monitoring wells installed by others as part of previous Site investigations will also be gauged if access to these wells is granted by the property owner. If LNAPL and/or DNAPL are observed to be present in sufficient volume at any monitoring well, a NAPL sample will be collected and submitted for laboratory analysis for density, viscosity, and interfacial tension. Laboratory analyses will be conducted at ambient groundwater temperatures.

3.5 Soil Vapor Investigation

The objectives for the SC soil vapor investigation and the general procedures for obtaining and analyzing subsurface soil vapor samples are detailed below.

3.5.1 Soil Vapor Investigation Objectives

The objective of the soil vapor investigation is to evaluate the potential for offsite migration of MGP-related soil vapor from the western portion of the site.

The soil vapor investigation will only focus on the western portion of the site where MGP-related concerns have been identified by previous investigation activities. Soil vapor investigation activities are not proposed as part of the initial SC Investigation efforts for the eastern portion of the site.

3.5.2 Soil Vapor Sampling

A total of four soil vapor samples (SV-101 through SV-104) will be collected at the target locations presented on Figure 4 to evaluate the potential for off-site migration of MGP-related soil vapor. The rationale for the soil vapor sampling locations is provided in Table 1. Sampling locations for the soil vapor investigation may be adjusted in the field (as necessary) based on the location of aboveground or underground utilities and visual observations. Sample locations will not be relocated more than 10 feet from the proposed location without prior consultation with the NYSDEC's Project Manager. In

addition, proposed soil vapor sample locations are subject to review and approval by the property owner.

Prior to intrusive work, the first 5 feet of each boring location (i.e., ground surface to 5 feet bgs) will be excavated by non-mechanical means (i.e., hand auger, post- hole digger, and/or vacuum truck) as part of the utility clearance activities. Subsequent to clearing the first 5 feet, the temporary soil vapor monitoring points will be constructed by advancing an expandable point connected to an expandable point holder and steel drive rods to the target subsurface depth (approximately 6 to 8 feet bgs) using a direct-push sampling rig (i.e., Power Probe, or similar). The steel drive rods will then be retracted to create a void space in the subsurface and facilitate collection of the soil vapor samples. Following installation of each soil vapor monitoring point the annular space will be backfilled with clean silica sand. A surface seal will be installed to prevent short-circuiting to the ground surface, using hydrated bentonite, melted beeswax or other non-VOC-containing non shrinking product.

The soil vapor sampling points will be installed in the unsaturated (vadose) zone at depths of between approximately 6 to 8 feet bgs. Prior to the installation of the soil vapor points, monitoring wells MW-1, MW-2 and MW-3 will be gauged to confirm the depth of groundwater in the area of the proposed soil vapor samples. The target depth for the soil vapor sampling points will be adjusted as necessary based on the groundwater gauging information.

After installation of the probes, one to three volumes of vapor (i.e., the volume of the sample probe and tube) will be purged using a PID prior to collecting the samples. The flow rates for purging and sample collection will not exceed 0.2 liters per minute.

A helium tracer gas will be used as a QA/QC tool to verify the integrity of the soil vapor probe seal and to confirm that infiltration of outdoor air is not occurring. An inverted plastic bucket will be used as an enclosure to keep the tracer gas in contact with the probe during integrity testing, as described in the NYSDOH's final soil vapor guidance document (October 2006). A portable helium monitoring device will be used to analyze a sample of soil vapor prior to and after sample collection. A detailed procedure for verifying the integrity of the soil vapor probe seal is provided in the FSP.

Laboratory-supplied SUMMA canisters will be used to collect the soil gas samples from each sampling location. The flow controls/regulator on the SUMMA canister, along with the vacuum in the canister, will be used to collect the soil-gas samples directly from the subsurface stainless steel sampling point. The soil-gas samples will be

collected for an approximately 2-hour time period. The SUMMA regulators will be calibrated by the analytical laboratory to collect the soil vapor samples at a flow rate not to exceed 0.2 liters per minute. The project-specific compound list is presented in the FSP.

The temporary sample probes will be installed and removed the same day that the samples are collected. The sample probes will be decontaminated between sampling locations using an alconox wash and distilled water rinse, then drawing ambient air through the tube via a Gilian pump for a minimum of 5 minutes.

Concurrent with sub-surface soil vapor sampling, it is anticipated that one outdoor ambient air sample will be collected per each day of sampling to characterize site-specific ambient (i.e., background) outdoor air conditions. The ambient air samples will be collected to evaluate potential outdoor air interference associated with the infiltration of outdoor air into the subsurface and/or sampling apparatus while the soil-gas sample is collected. A representative upwind location for the ambient air sample will be selected in the field away from wind obstructions (e.g., trees or bushes). The ambient air sample will be collected at a height above the ground to represent breathing zones (approximately 3 to 5 feet above ground surface). A detailed procedure for collecting ambient air samples is provided as Attachment B.

Detailed information on field conditions will be gathered at the time of sampling as described in the FSP to document conditions and aid in interpretation of the test results.

The soil vapor samples will be submitted to a NYSDOH-accredited laboratory certified for the selected analyses on a standard turnaround basis for reporting of analytical results. Each sample will be analyzed for:

- Target Analyte List (TAL) VOCs according to USEPA Method TO-15 entitled Determination of VOCs In Air Collected In Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS).

- naphthalene, 2-methylpentane, isopentane, 2,3-dimethylpentane, isooctane, indene, indane, and thiopene

Analytical methods, sample handling, and laboratory protocols are outlined in the QAPP (Appendix B). 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 vapor samples will be reported using NYSDEC ASP Category B data deliverables.

Following the completion of the soil vapor sampling at locations SV-101, SV-103, and SV-104, a soil boring will be completed (as discussed in Section 3.3.4) in accordance with the protocols presented in the FSP.

3.6 Site Survey

Following completion of the soil and groundwater investigations, a New York State licensed surveyor will field survey all soil boring locations, test pit locations, groundwater monitoring well locations, and subsurface structures encountered during the SC activities (if any). For each groundwater monitoring well, the survey will include the location, ground-surface elevation, and measuring-point elevation (defined as the top of the inner casing). The survey will be tied to the New York State Plane Coordinate System and to Mean Sea Level.

3.7 Equipment Decontamination

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. The integrity of the decontamination procedures will be checked periodically with equipment rinse blanks, as required by the QAPP.

3.8 Management of IDW

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

One composite sample of drill cuttings and one composite sample of the wastewater generated by the field activities will be collected and submitted for laboratory extraction using the toxicity characteristic leaching procedure (TCLP) followed by laboratory

analysis of the leachate for TCLP VOCs, TCLP SVOCs, and TCLP metals (including cyanide). In addition, the soil sample will be analyzed for PCBs, reactivity, corrosivity and ignitability and the wastewater sample will be characterized for PCBs, or other testing as required by the disposal facility. ARCADIS will use the analytical results for the waste characterization samples to profile the waste materials for appropriate offsite disposal.

4. Site Characterization Report

4.1 General

This section presents an outline for the SC Report that will be prepared to summarize the SC investigation activities and analytical results obtained for the SC activities. 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
- An understanding of the conceptual site model, including the geologic and hydrogeologic site conditions
- Summary of the distribution of MGP-related and/or non-MGP-related chemical constituents (if present) in soil and groundwater at the site

Following receipt of analytical results for the laboratory analysis of samples collected for 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 in accordance with the data validation approach presented in the QAPP. The validated analytical data will be presented in the SC Report.

The text of the SC Report will be supported by presentation of field notes, subsurface logs, analytical data summary tables, and Figures illustrating site-specific data including hydrogeologic conditions and the potential distribution of constituents in subsurface soil and groundwater (if present). The SC Report will include a conceptual site model that incorporates the location, extent, and potential magnitude of MGP-related and/or non-MGP-related chemical constituents at the Site. The conceptual site model will be developed based on information generated by the SC investigation activities. The SC Report and conceptual site model will not be developed if the NYSDEC requests Con Edison to proceed with a Remedial Investigation (RI) of the site based on the SC Investigation results.

5. Schedule

5.1 General

This section presents a conceptual schedule for implementing the field investigation activities presented in this SC Work Plan. Following receipt of any comments on the draft SC Work Plan from the NYSDEC, Con Edison will revise the draft SC Work Plan and submit the final document to the NYSDEC. 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. Please note that the start of the field investigation activities is contingent on obtaining site access from the property owners. The project duration may depend on whether additional investigation efforts are required to meet project objectives due to unforeseen field conditions and findings.

Work Activity	Duration
SC Work Plan Approval	--
Implement SC Field Activities	4 weeks
Laboratory Analysis of Samples	4 weeks
Data Validation	4 weeks
Prepare SC Report	4 weeks
NYSDEC Review of SC Report	4 to 8 weeks
Revise SC Report	4 weeks
Submit Final SC Report	Complete

6. References

Consolidated Edison Company of New York, Inc. 2005. *Technical Specification No. REM-MGP-2005-01 for Environmental Consulting Services in Support of the Former Manufactured Gas Plant Sites Program*. (July, 2005).

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Ecosystems Strategies, Inc., 2004. *Draft Remediation Services Report* (February, 2004)

Ecosystems Strategies, Inc., 2007. *Operations and Maintenance Report* (December, 2007)

New York State Department of Environmental Conservation. 2000. *Analytical Services Protocol (ASP)*.

New York State Department of Health. 2006. *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006).

The Sanborn Library, LLC. Sanborn Fire Insurance Maps, Bronx, New York. (1896, 1898, 1917, 1942, 1951, 1956, 1957, 1978, 1989, 1990, and 1991).

USGS, 1989 *USGS Surficial Geology Map of New York – Lower Hudson Sheet*

Tables

Table 1

Site Characterization Sampling Rationale
Former Woodworth Avenue Works Site
Yonkers, New York

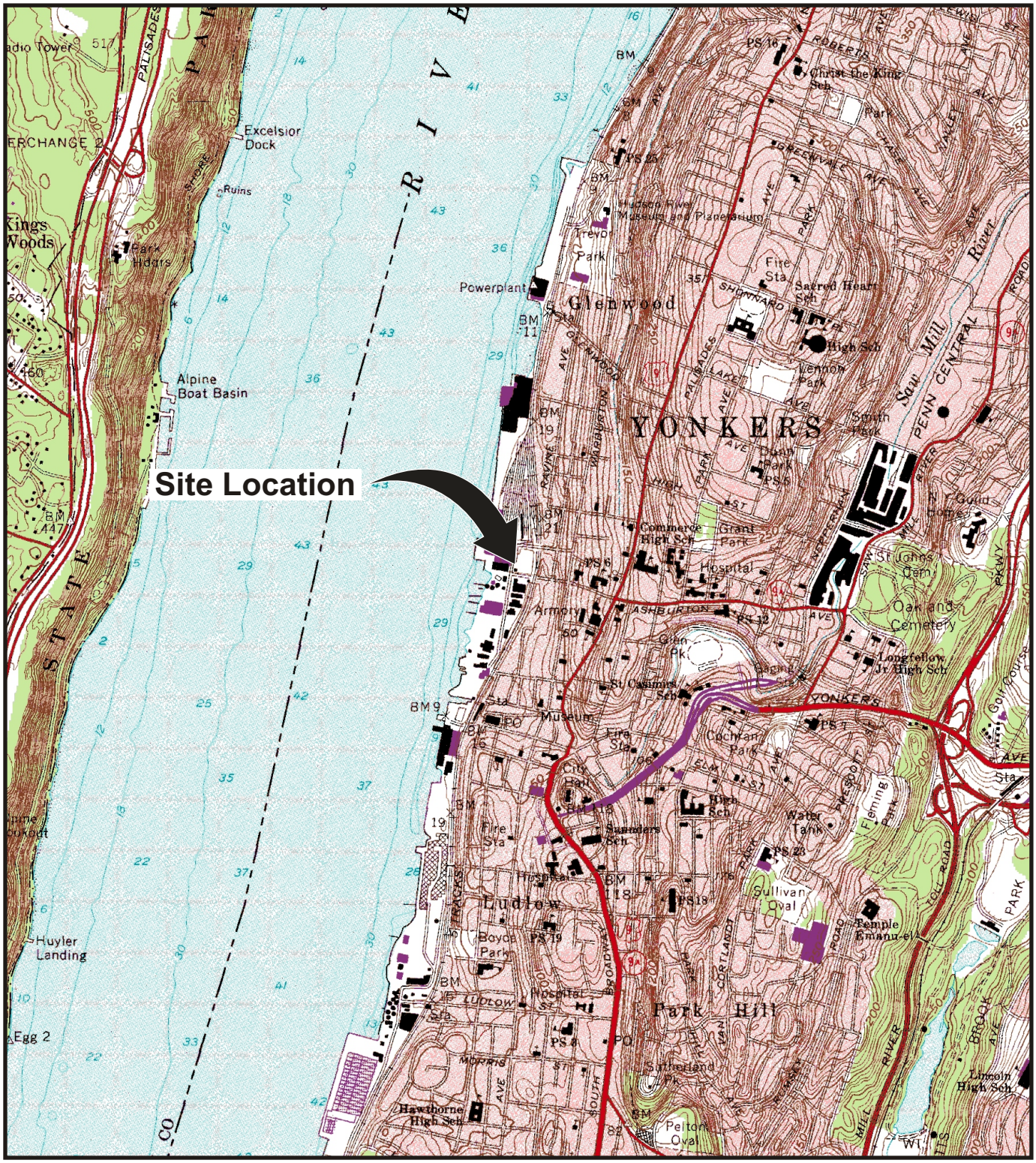
Borings/Wells	Location	Rationale	Sample Matrix	Analytical Parameters	Target Depth	Sampling Method
Eastern Half of the Property (Block 2100)						
SB-101/MW-101	Northeast corner of Block 2100	Assess potential groundwater impacts from up-gradient sources	Soil and Groundwater	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon/Low Flow
SB-102	Center of Holder No. 1	Assess environmental conditions in the center and below Gas Holder No. 1	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
SB-103	Southern edge of Holder No. 1	Assess environmental conditions between Gas Holder No. 1 and Gas Holder No. 3	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
SB-104	Center of Holder No. 3	Assess environmental conditions in the center and below Gas Holder No. 3	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
SB-105/MW-102	Between the Pollack Paint building and the western retaining wall	Assess environmental conditions downgradient of Gas Holder No. 1	Soil and Groundwater	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon/Low Flow
SB-106/MW-103	Downgradient of Holder No. 3, along western retaining wall	Assess environmental conditions downgradient of Gas Holder No. 3	Soil and Groundwater	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon/Low Flow
SB-107/MW-104	Upgradient of Holder No. 2, along Woodworth Avenue	Assess environmental conditions upgradient of Gas Holder No. 2	Soil and Groundwater	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon/Low Flow
SB-108	Center of Holder No. 2	Assess environmental conditions in the center and below Gas Holder No. 2	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
SB-109/MW-105	Southwest of Holder No. 2	Assess environmental conditions downgradient of Gas Holder No. 2	Soil and Groundwater	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon/Low Flow
SB-110	Center of former generator building	Assess environmental conditions in the area of the former generator building	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
SB-111/MW-106	Southwestern corner of Block 2100	Assess environmental conditions in the area of the former retort house	Soil and Groundwater	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon/Low Flow
TP-101	Eastern edge of Gas Holder No. 1	Identify the location and construction of Holder No. 1, if present	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
TP-102	Western edge of Gas Holder No. 2	Identify the location and construction of Holder No. 2, if present	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
TP-103	Western edge of Gas Holder No. 3	Identify the location and construction of Holder No. 3, if present	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
TP-104	Southwestern corner of Block 2100	Identify the presence/absence of former retort house foundations	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
Western Half of the Property (Block 2618)						
SB-112/MW-107	Southwestern corner of former purifying house	Identify the presence/absence of NAPL downgradient from hydraulic barrier and assess environmental conditions in the area of the former purifying house	Soil and Groundwater	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon/Low Flow
SB-113	West of Metro-North substation	Assess environmental conditions in the area of former oil tanks	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon

Table 1

Site Characterization Sampling Rationale
Former Woodworth Avenue Works Site
Yonkers, New York

Borings/Wells	Location	Rationale	Sample Matrix	Analytical Parameters	Target Depth	Sampling Method
SB-114	Southern parking lot	Assess environmental conditions downgradient of the former oil tanks	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
Western Half of the Property (Block 2618) – Continued						
SV-104/SB-115	Southern parking lot	Assess environmental conditions downgradient of former oil tanks and potential offsite soil vapor migration	Soil Vapor and Soil	TAL VOCs (Vapor), TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Summa Canister and Split Spoon
SB-116	Southern edge of the property, along Ashburton Avenue	Assess environmental conditions in the vicinity of the former oil tanks	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
SB-117/MW-108	Northern edge of the property, along Babcock Place	Assess potential groundwater impacts from up-gradient sources	Soil and Groundwater	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon/Low Flow
SV-103/SB-120/MW-109	Southwestern corner of the property, along the bus turnaround	Assess potential groundwater impacts from up-gradient sources	Soil and Groundwater	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon/Low Flow
SB-121/MW-110	Southwestern edge of the property, adjacent to the southwestern corner of the Greyston Bakery Building	Assess groundwater conditions downgradient of the former oil tanks and potential offsite soil vapor migration	Soil Vapor, Soil and Groundwater	TAL VOCs (Vapor), TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Summa Canister/ Split Spoon/Low Flow
SV-102	Western edge of the property, adjacent to the Alexander Street.	Access potential offsite soil vapor migration	Soil Vapor	TAL VOCs	Based on field screening and stratigraphy	Summa Canister
SV-101/SB-122/MW-111	Northwestern edge of the property, adjacent to the Greyston Bakery Building	Assess potential groundwater impacts from up-gradient sources and potential offsite soil vapor migration	Soil Vapor, Soil, and Groundwater	TAL VOCs (Vapor), TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Summa Canister/ Split Spoon//Low Flow
TP-105	Eastern edge of former purifying house	Assess presence/absence of former purifying house foundations	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
Western Half of the Property – Metro North Substation						
SB-118	Center of purifying house	Assess environmental conditions in the area of the former purifying house	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon
SB-119	Approximate location of former tar barrels storage area	Assess environmental conditions in the area of the former tar barrel storage	Soil	TCL VOCs, TCL SVOCs, TAL Inorganics, Total Cyanide	Based on field screening and stratigraphy	Split Spoon

Figures



REFERENCE: BASE MAP SOURCE USGS 7.5 MINUTE QUAD. SERIES YONKERS, NY - NJ, 1966, PHOTOREVISED 1979.

2000' 0 2000'

Approximate Scale: 1" = 2000'

AREA LOCATION

CONSOLIDATED EDISON COMPANY OF NEW YORK
FORMER WOODWORTH AVENUE MGP SITE
CITY OF YONKERS, NEW YORK

SITE LOCATION MAP

ARCADIS

FIGURE
1

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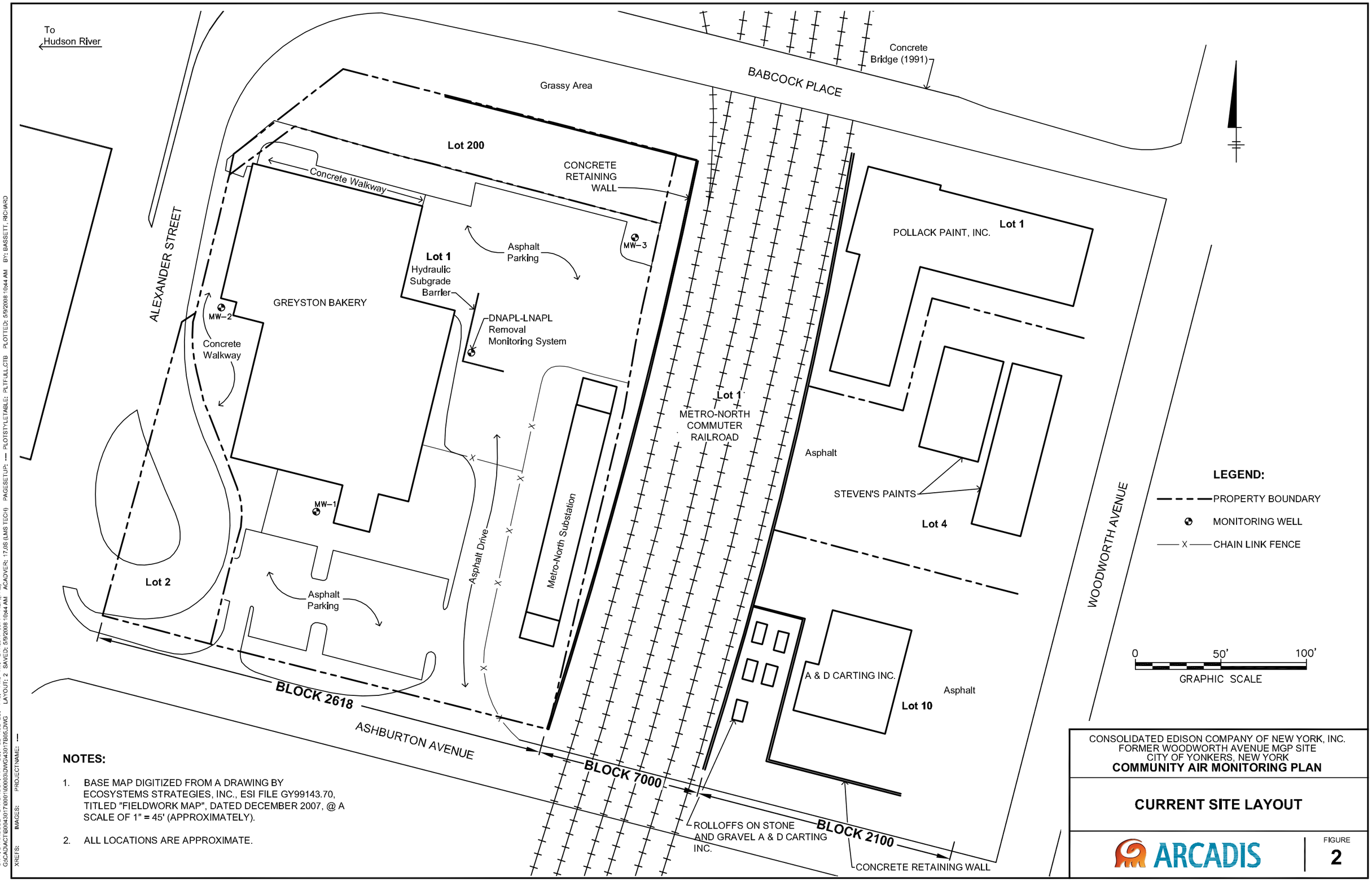
B0043017/0001/00003/CDR/43017N01.CDR



NOTES:

1. BASE MAP DIGITIZED FROM A DRAWING BY ECOSYSTEMS STRATEGIES, INC., ESI FILE GY99143.70, TITLED "FIELDWORK MAP", DATED DECEMBER 2007, @ A SCALE OF 1" = 45' (APPROXIMATELY).

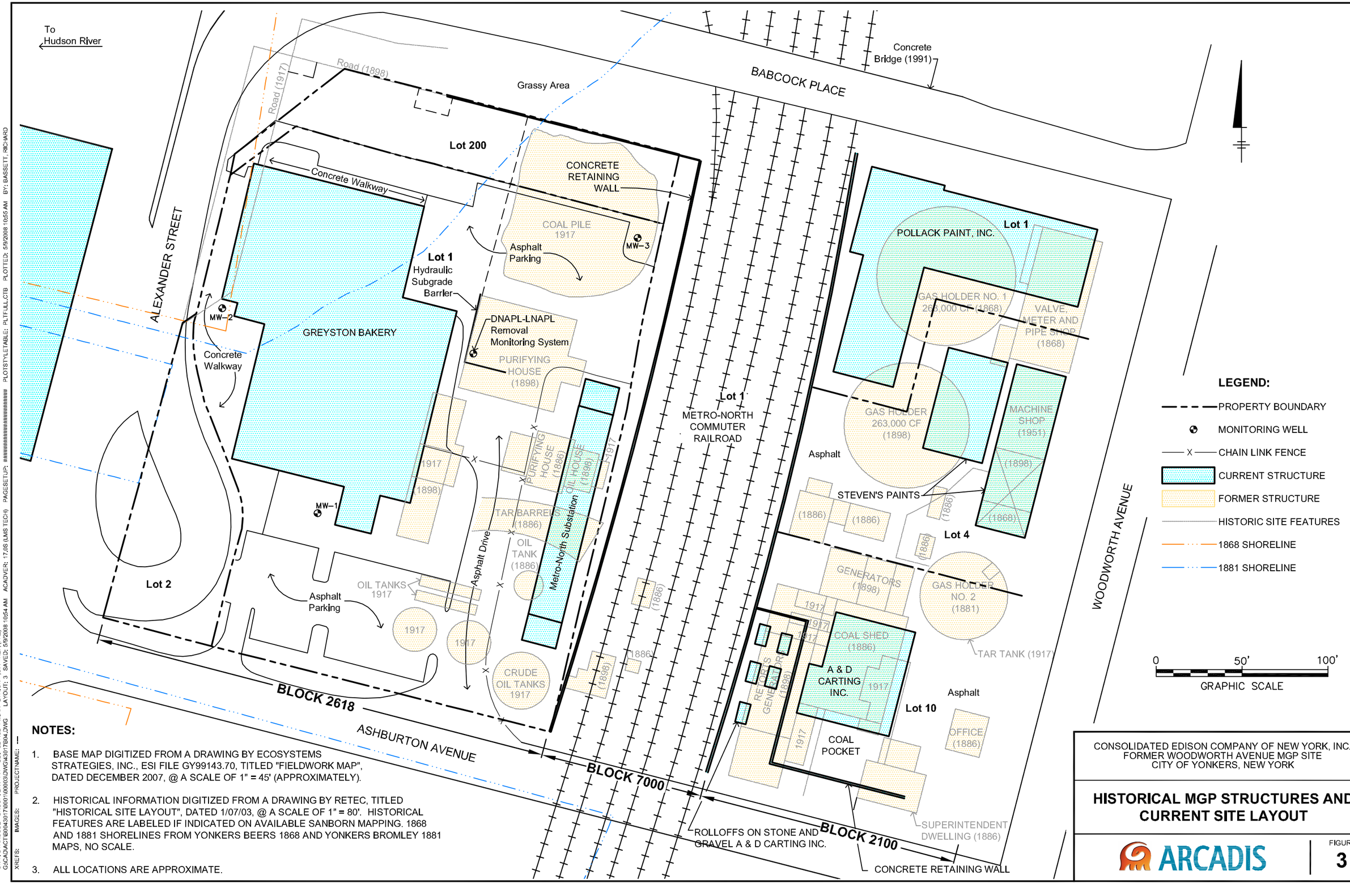
2. ALL LOCATIONS ARE APPROXIMATE.

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE MGP SITE
CITY OF YONKERS, NEW YORK
COMMUNITY AIR MONITORING PLAN

CURRENT SITE LAYOUT

ARCADIS

FIGURE
2



NOTES:

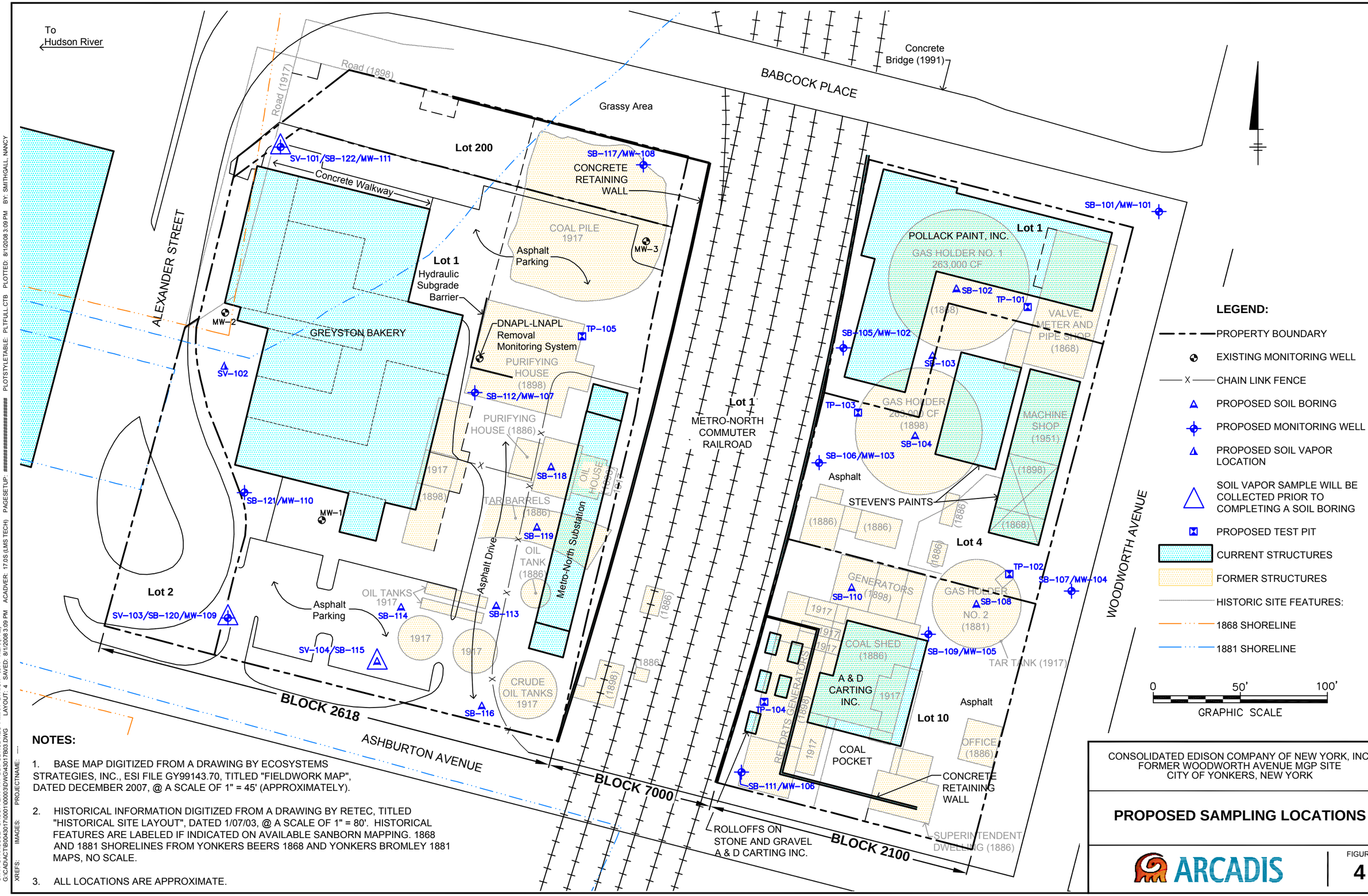
1. BASE MAP DIGITIZED FROM A DRAWING BY ECOSYSTEMS STRATEGIES, INC., ESI FILE GY99143.70, TITLED "FIELDWORK MAP", DATED DECEMBER 2007, @ A SCALE OF 1" = 45' (APPROXIMATELY).
2. HISTORICAL INFORMATION DIGITIZED FROM A DRAWING BY RETEC, TITLED "HISTORICAL SITE LAYOUT", DATED 1/07/03, @ A SCALE OF 1" = 80'. HISTORICAL FEATURES ARE LABELED IF INDICATED ON AVAILABLE SANBORN MAPPING. 1868 AND 1881 SHORELINES FROM YONKERS BEERS 1868 AND YONKERS BROMLEY 1881 MAPS, NO SCALE.
3. ALL LOCATIONS ARE APPROXIMATE.

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE MGP SITE
CITY OF YONKERS, NEW YORK

HISTORICAL MGP STRUCTURES AND CURRENT SITE LAYOUT

ARCADIS

FIGURE 3



NOTES:

1. BASE MAP DIGITIZED FROM A DRAWING BY ECOSYSTEMS STRATEGIES, INC., ESI FILE GY99143.70, TITLED "FIELDWORK MAP", DATED DECEMBER 2007, @ A SCALE OF 1" = 45' (APPROXIMATELY).

2. HISTORICAL INFORMATION DIGITIZED FROM A DRAWING BY RETEC, TITLED "HISTORICAL SITE LAYOUT", DATED 1/07/03, @ A SCALE OF 1" = 80'. HISTORICAL FEATURES ARE LABELED IF INDICATED ON AVAILABLE SANBORN MAPPING. 1868 AND 1881 SHORELINES FROM YONKERS BEERS 1868 AND YONKERS BROMLEY 1881 MAPS, NO SCALE.

3. ALL LOCATIONS ARE APPROXIMATE.

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE MGP SITE
CITY OF YONKERS, NEW YORK

PROPOSED SAMPLING LOCATIONS

ARCADIS

FIGURE
4

Appendix A

Field Sampling Plan

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Infrastructure, environment, facilities

Consolidated Edison Company of New York, Inc.

Field Sampling Plan (FSP)

Former Woodworth Avenue Works Site
(Site No. V00564)

Yonkers, New York

January 2009

ARCADIS

Terry Taylor
Senior Scientist

Michael C. Jones
Vice President

Field Sampling Plan (FSP)

Former Woodworth Avenue
Works Site

Prepared for:
Consolidated Edison Company of New York, Inc.

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Our Ref.:
43017

Date:
January 2009

Table of Contents

Table of Contents

1. Introduction

1.1 General

This Field Sampling Plan (FSP) has been prepared by ARCADIS to support Site Characterization (SC) activities proposed for the Consolidated Edison Company of New York, Inc. (Con Edison) former Woodworth Avenue Manufactured Gas Plant (MGP) Site (the Site) located in Yonkers, New York. The details of the SC activities are presented in the *Site Characterization Work Plan* (SC Work Plan) (ARCADIS, January 2009). This FSP presents field procedures and sample collection methods to be used during implementation of the SC field activities. This FSP is intended to be used in conjunction with the SC Work Plan, the Quality Assurance Project Plan (QAPP), the Health and Safety Plan (HASP), the Community Air Monitoring Plan (CAMP) and the Dense, Non-Aqueous Phase Liquid (DNAPL) Contingency Plan. 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, HASP, and DNAPL Contingency Plan are provided in Appendix B, Appendix C, Appendix D, and Appendix E of the SC Work Plan.

1.2 Site Characterization Objectives

The purpose of the SC investigation activities outlined in the SC Work Plan is to provide data to address the following objectives:

- Determine if MGP-related chemical constituents are present in overburden soil and shallow groundwater at the Site at concentrations that exceed applicable and appropriate NYSDEC standards, criteria, and guidance values

- Determine if MGP-related and/or non-MGP-related by-product residuals (such as coal tar, non-aqueous phase liquid [NAPL] petroleum, solvents, etc.) are present in overburden soil and shallow groundwater in the eastern half of the Site

- Assess the horizontal and vertical distribution of NAPL in the western half of the Site

- Determine the potential for MGP-related and/or non-MGP-related residuals and chemical constituents to migrate into the upper bedrock

- Determine the potential for off-site migration of MGP-related soil vapor and residuals

- Determine groundwater flow direction in the shallow, unconfined aquifer, and evaluate, to the extent practicable, whether groundwater flow may be a pathway for offsite migration of identified chemical constituents (if present)

- Provide sufficient data to evaluate the necessity for further investigation and/or remedial action

1.3 Overview of Field Investigation Activities

To obtain information necessary to meet the above-referenced objectives, the SC field investigation activities will include:

- Implementing a soil investigation, including completion of soil borings, test pits, and laboratory analysis of subsurface soil samples

- Conducting a groundwater investigation, including installation of groundwater monitoring wells, characterization of groundwater flow and quality, and assessment of the presence/characteristics of NAPL (if encountered)

- Conducting a soil vapor investigation, including the installation of subsurface soil vapor monitoring points, to evaluate the potential offsite migration of MGP-related soil vapor from the western portion of the site

- Surveying the limits of the Site and soil boring locations, test pit locations, and groundwater monitoring well locations

The proposed sampling locations and quantities for each field sampling activity are described in detail in the SC Work Plan, and therefore, are not further described in this FSP. Soil, groundwater, and soil vapor samples will be analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), Target Analyte List (TAL) inorganic constituents (including cyanide), and waste characterization parameters, as discussed in the SC Work Plan. Other analyses may include gasoline-range organics (GRO) and/or diesel-range organics (DRO) if petroleum impacts are encountered. If NAPL is observed, a sample may be collected for fingerprint/forensic analysis using modified USEPA Method 8015 or other

appropriate method. Table 1 of the QAPP presents the anticipated number of samples for specific laboratory analyses from each matrix type.

A Site location map is presented on Figure 1 in the SC Work Plan. The rationale for selection of each sampling location is presented in Table 1 to the SC Work Plan. The locations of physical features at the Site are presented on Figure 2 in the SC Work Plan and the locations of historical manufactured gas plant (MGP) structures are presented on Figure 3 in the SC Work Plan. The proposed sampling locations are presented on Figure 4 in the SC Work Plan.

2. Field Activities

2.1 General

This section presents detailed information for conducting the SC field investigation activities. Information regarding the frequency of QA/QC samples to be collected and the corresponding parameters to be analyzed during the SC investigation are presented in the QAPP. In addition, information regarding the sample containers, preservation, and holding times for samples is presented in the QAPP. Detailed sample collection procedures are presented below.

2.2 Site Utility Markout and Hazard Identification

Prior to mobilization to the Site, hard copies of available utility plates, drawings, and/or maps shall be reviewed to determine the approximate size and location of aboveground and underground utilities in the vicinity of the Site. Prior to implementing work activities, field personnel will mobilize to the Site to verify existing Site conditions and label and/or stake (with flagging) the proposed sample locations. Once the sample locations are marked, Dig Safely New York will be contacted to mark underground utilities in areas where ground-intrusive activities (i.e., drilling and excavation activities) will occur. Subsequent to the completion of the utility markout, a private utility-locating contractor will mark underground utilities in all areas of the Site where ground-intrusive activities will occur. If necessary, the Site property owners, adjacent property owners, and/or the Con Edison Engineering Department will be contacted for assistance with marking out the locations of aboveground and belowground utilities in accordance with the Con Edison document entitled *Utility Clearance Process for Intrusive Activities EH&S Remediation Program* (Con Edison, 2003) (included as Attachment A-1). Once the utilities are marked, equipment and personnel necessary to implement the SC field investigation activities will be mobilized to the Site.

Other potential onsite hazards such as traffic, overhead power lines, and building hazards will be identified during a Site reconnaissance visit prior to mobilization to the Site.

2.3 Field Reconnaissance Activities

Prior to work activities at the Site, field reconnaissance activities will be performed at the Site and in the vicinity of the Site. During the reconnaissance, the following observations will be recorded and mapped:

- Land use/conditions at the Site and in the vicinity of the Site
- Stressed vegetation at the Site and in the immediate vicinity of the Site
- Piping, outfalls, and/or other point source discharges or potential migration pathways associated with Westchester Creek (located to the east of the Site)
- The presence of seeps, staining, sheens, and/or waste materials/debris at the Site and in the vicinity of the surrounding area
- The locations and conditions (if possible) of underground utilities (including storm sewer lines, water lines, gas lines, oil lines, electric lines, communication lines, etc.), subterranean tunnels, or other potential migration pathways at the Site and in the surrounding area

Observations noted during the Site reconnaissance activities will be recorded in a dedicated field notebook.

2.4 Soil Boring Completion

Twenty-two soil borings (SB-101 through SB-122) will be completed at the target locations presented on Figure 4 in the SC Work Plan to evaluate subsurface conditions. Sampling locations for the SC investigation may be adjusted in the field (as necessary) based on the location of aboveground or underground utilities and visual observations. Soil borings will not be relocated more than 10 feet from the proposed location without prior consultation with the NYSDEC's Project Manager. In addition, proposed soil boring locations are subject to review and approval by the property owner.

Subsurface drilling activities will be conducted by ARCADIS' drilling subcontractor in accordance with the procedures described in the dense non-aqueous phase liquid (DNAPL) Contingency Plan.

All proposed soil borings will be advanced to the top of competent bedrock or refusal, whichever is shallower. It is anticipated that the depth of the soil borings will vary from approximately 10 feet below ground surface (bgs) in the eastern portion of the site to approximately 60 feet bgs in the western portion of the site. If suspected MGP impacts are encountered within the last 5 feet of any boring that is not completed to either refusal, or a confining layer, the decision to either continue or terminate the boring will be made in conjunction with Con Edison's and the NYSDEC's Project Manager. The first 5 feet of each soil boring (i.e., ground surface to 5 feet below ground surface) will be excavated by non-mechanical means (i.e., hand auger, post-hole digger, and/or vacuum truck). Subsequent to clearing the first 5 feet of each soil boring by non-mechanical means, soil samples will be collected continuously from each soil boring by advancing a 2-foot long, 3-inch outer diameter (OD) split-spoon device ahead of the augers or a 10-foot core sampling device using rotosonic methods. A 3-inch OD split spoon is recommended to improve sample recoveries.

Collected soils samples will be described in accordance with procedures outlined in Attachment A-2. Up to five soil samples collected from each soil boring may be selected for laboratory analysis for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), and Target Analyte List (TAL) inorganics (including cyanide). Other analyses may include gasoline-range organics (GRO) and/or diesel-range organics (DRO) if petroleum impacts are encountered. If NAPL is observed, a sample may be collected for fingerprint/forensic analysis using modified USEPA Method 8015 or other appropriate method.

Based on field screening of the soil core, soil samples may be submitted for laboratory analysis from each soil boring location, using the following sample selection criteria:

1. From the sampling interval within the vadose zone where the strongest evidence of suspected impacts is identified, based on PID readings, visual observation and/or odors

2. At the soil/groundwater table interface

3. From the sampling interval within the saturated zone where the strongest evidence of suspected impacts is identified, based on PID readings, visual observation and/or odors

4. At boring locations where suspected impacts are identified, from a sampling interval of apparently clean material below impacted soil (to provide data for vertical delineation)

5. From the sampling interval above the top of the first low permeability unit encountered in the soil boring

If no suspected impacts are identified at a boring location based on PID readings, visual observation, and/or odors, a minimum of two (2) soil samples will be submitted for laboratory analysis, including the samples recovered from the soil/groundwater table interface and from above the top of the first low permeability unit.

QA/QC samples (including field duplicate, matrix spike, matrix spike duplicate, and rinse blank samples) will be submitted for laboratory analysis, as referenced in the QAPP. The soil samples will be analyzed using United States Environmental Protection Agency (USEPA) SW-846 analytical methods as referenced in the NYSDEC Analytical Services Protocol (ASP) (latest revision). Analytical results will be reported using NYSDEC ASP Category B data deliverables.

Following collection of the subsurface soil samples, the soil borings will be tremie-grouted to the ground surface with a cement-bentonite grout. In addition, soil borings that were completed in paved areas will be restored with an asphalt or grout patch (as appropriate based on surrounding surface conditions).

Drilling and sampling equipment will be decontaminated prior to beginning drilling activities, between each soil boring location, and prior to demobilization from the site. Equipment decontamination will be performed in accordance with the protocols presented in Section 4.

Subsurface soil samples will be placed into appropriate sample containers as described in Section 3. The samples will be handled, labeled, packaged, and shipped following the procedures outlined in Attachment A-3.

2.5 Test Pit Excavation

A total of five test trenches (TP-101 through TP-105) will be completed at the target locations presented on Figure 4 in the SC Work Plan to identify the presence/absence of MGP-related structures. The test pits will also provide help determine if MGP impacts are present near the historic gas holders. The proposed test pit locations may

be adjusted in the field (as necessary) based on the location of aboveground or underground utilities and/or visual observations. Test pits will not be relocated more than 10 feet from the proposed location without prior consultation with the NYSDEC's Project Manager. In addition, proposed test pit locations and dimensions are subject to review and approval by the property owner.

Test pit excavation activities will be conducted by ARCADIS' subcontractor in accordance with the procedures described in the DNAPL Contingency Plan.

After the location of the proposed test pit is assess for underground utilities by geophysical means, a "soft-digging" approach will be used in lieu of vacuum clearing or hand digging. Soft digging will be performed by removing the soil in 6" increments with a dedicated spotter working in conjunction with the backhoe operator to avoid damaging potential utilities. Each test pit will be completed to a depth at which the target structure is identified, to a depth of refusal (if encountered), to a depth at which subsurface soil conditions become unstable (as determined by the onsite geologist), to the water table, or to a maximum depth of 10 feet below ground surface. If the target structure is not encountered during the initial excavation at a test pit location, Con Edison may extend the test pit or choose to excavate perpendicular to the original test pit location. The test pits will be completed using a rubber-tired backhoe in accordance with the protocols presented in Attachment A-4. Photo documentation of the test pits will be performed and will consist of photos of the test pit locations prior to excavation, during excavation, and following excavation. Photos of each excavation will include any subsurface structures encountered, changes in subsurface stratigraphy, and obvious visually-impacted subsurface materials. Field personnel will attempt to obtain photographs of adequate quality to document subsurface conditions, subject to limitations associated with light conditions, weather, and safety considerations with working adjacent to open excavations. A photo log with photo ID, time, camera view/direction, and description will be maintained to organize site characterization photos. Soil recovered from each test pit will be visually characterized (for soil type, grain size, color, texture, and moisture content) and placed in a container for headspace screening using a PID. In addition, the presence of visible staining, NAPL (if encountered), and obvious odors will be noted. If NAPL is encountered in any of the test pits, the DNAPL Contingency Plan will be implemented to limit the potential for remobilization and downward migration of DNAPL. If obvious soil impacts and/or elevated headspace screening measurements are encountered at a test pit location, a minimum of one soil sample will be collected for laboratory analysis for TCL VOCs, TCL SVOCs, and TAL metals (including cyanide). Where feasible, a hand-held bucket auger will be used to collect soil samples directly from the test pit side wall within the

interval where elevated headspace readings or visible impacts are encountered. For deeper test pits where health and safety concerns limit the ability to work from the ground surface immediately adjacent to the excavation, soil samples will be collected from material recovered from the backhoe bucket.

Each test pit will be backfilled in accordance with the protocols presented in Attachment A-4. The backhoe bucket will be decontaminated prior to beginning excavation activities, between each test pit location, and prior to demobilization from the site. Equipment decontamination will be performed in accordance with the protocols presented in Section 4.

If a test pit cannot be completed and backfilled during one work day, safety barriers and other measures detailed in the HASP will be used to barricade or cover the test pit to mitigate any safety hazards until work is completed.

2.6 Monitoring Well Installation

A total of eleven shallow groundwater monitoring wells (MW-101 through MW-111) will be completed at the (general) locations presented on Figure 4 in the SC Work Plan to evaluate subsurface conditions. The final locations of the monitoring wells may be modified in the field based on the Site reconnaissance and utility locations. Well locations will not be relocated more than 10 feet from the proposed location without prior consultation with the NYSDEC's Project Manager. In addition, all proposed monitoring well locations are subject to review and approval by the property owner.

Based on subsurface conditions encountered during implementation of the SC field activities (including the depth of groundwater, depth of bedrock, and presence/extent of NAPL), Con Edison, in consultation with the NYSDEC, may elect to complete additional wells, if needed as overburden installations, as overburden/bedrock interface installations, or bedrock installations.

Prior to installing the monitoring wells, ARCADIS' drilling subcontractor will complete a soil boring at each monitoring well location to a depth of approximately 5 feet into saturated overburden (or to the depth of bedrock if groundwater is not encountered within overburden). Subsurface drilling activities will be conducted with the procedures described in the DNAPL Contingency Plan. The first 5 feet of each soil boring (i.e., ground surface to 5 feet below ground surface) will be excavated by non-mechanical means (i.e., hand auger, post-hole digger, and/or vacuum truck). Subsequent to clearing the first 5 feet of each soil boring by non-mechanical means, soil samples will

be collected continuously from each soil boring by using either 3-inch OD split-spoon or the 4-inch diameter rotosonic core barrel. Soil recovered from each sample interval will be visually characterized (for soil type, grain size, color, texture, and moisture content) and containerized for headspace screening using a PID. In addition, 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 will be implemented to limit the potential for remobilization and downward migration of DNAPL.

Up to five soil samples from the soil boring completed at each groundwater monitoring well location may be submitted for laboratory analysis using the sample selection approach outlined in Section 2.4.

Subsurface soil samples will be placed into appropriate sample containers as described in Section 3. The samples will be handled, labeled, packaged, and shipped following the procedures outlined in Attachment A-3.

Following completion of the soil borings, surface mount monitoring wells will be installed at each location in accordance with Attachment A-5. The monitoring wells will be constructed using two-inch diameter Schedule 40 polyvinyl chloride (PVC) pipe and will be completed to a depth of approximately 5 feet below the groundwater table. The monitoring wells will be screened over a 10-foot interval, from approximately 3 feet above the water table to the depth of completion. Each monitoring well will be installed with a 2-foot sump grouted in place if NAPL is encountered and/or suspected. However, if the water table is within 2 feet of the surface, an alternate monitoring well installation protocol will be used to ensure that an adequate surface seal is maintained (as described in Attachment A-5). In addition, based on subsurface conditions that may be encountered during implementation of the SC field activities (including the depth of groundwater, depth of bedrock, and presence/extent of NAPL), Con Edison, in consultation with the NYSDEC, may elect to complete additional wells, if needed, as overburden installations, overburden/bedrock interface installations or bedrock installations. Procedures for constructing an overburden/bedrock interface monitoring well or a bedrock groundwater monitoring well are presented in Attachment A-5.

Drilling and sampling equipment will be decontaminated prior to beginning drilling activities, between each monitoring well location, and prior to demobilization from the site. Equipment decontamination will be performed in accordance with the protocols presented in Section 4.

2.7 Groundwater Level Measurements

A round of fluid-level elevations will be collected from all Site monitoring wells (both new and existing) in conjunction with the groundwater sampling event. The measurements will be collected prior to the sampling event and will be made in as short a timeframe as practical to minimize temporal fluctuations in hydraulic conditions. The groundwater level measurements will be collected in accordance with the protocols presented in Attachment A-6. The measurements will be converted to elevations (referenced to a site-specific datum).

2.8 Specific Capacity Testing

Specific capacity (hydraulic conductivity) data will be collected after each monitoring well is developed and has stabilized. The specific capacity test data will be used to estimate the hydraulic conductivity of the geologic formation surrounding the screened portion of the monitoring wells. The specific capacity testing will be performed in general agreement with the procedures outlined in Attachment A-7. Modifications to these procedures may include using a LevelTROLL® 100 or similar equipment to record changes in water elevation during the test.

2.9 Low-Flow Groundwater Sampling Procedures for Monitoring Wells

One round of groundwater samples will be collected from monitoring wells MW-101 though MW-111 and from existing monitoring wells MW-1 through MW-3 using the low-flow purging and sampling techniques in accordance with the sampling protocol presented in Attachment A-6. Samples will be submitted to the selected analytical laboratory for laboratory analysis for TCL VOCs, TCL SVOCs, and TAL inorganic constituents (including cyanide) using the NYSDEC ASP analytical methods. QA/QC samples (including trip blank, field duplicate, matrix spike, matrix spike duplicate, and rinse blank samples) will be submitted for laboratory analysis, as referenced in the QAPP.

Groundwater samples will be placed into appropriate sample containers as described in Section 3. The samples will be handled, labeled, packaged, and shipped following the procedures in Attachment A-3.

2.10 Soil Vapor Sampling

Four soil vapor samples (SV-101 through SV-104) will be collected at the target locations presented on Figure 4 in the SC Work Plan to evaluate the potential presence, concentration, and distribution of MGP related volatile organic compounds (VOCs) in onsite soil vapor and the potential for vapor migration offsite. Sampling locations for the soil vapor investigation may be adjusted in the field (as necessary) based on the location of aboveground or underground utilities and visual observations. Sample locations will not be relocated more than 10 feet from the proposed location without prior consultation with the NYSDEC's Project Manager. In addition, proposed soil vapor sample locations are subject to review and approval by the property owner.

Subsurface drilling activities will be conducted in accordance with the procedures described in the dense non-aqueous phase liquid (DNAPL) Contingency Plan.

Prior to the installation of the soil vapor points, monitoring wells MW-1, MW-2, and MW-3 will be gauged to confirm the depth of groundwater in the area of the proposed soil vapor samples. The first 5 feet of each boring location (i.e., ground surface to 5 feet bgs) will be excavated by non-mechanical means (i.e., hand auger, post-hole digger, and/or vacuum truck) as part of the utility clearance activities. All proposed soil vapor sampling points will be installed in the unsaturated (vadose) zone at depths between 6 to 8 feet bgs that will be determined in the field based on conditions encountered during the drilling activities and the depth of the groundwater encountered at adjacent sampling locations. Subsequent to clearing the first 5 feet, the temporary soil vapor monitoring points will be constructed by advancing an expandable point connected to an expandable point holder and steel drive rods to the target subsurface depth using a direct-push sampling rig (i.e., Power Probe, or similar). The steel drive rods will then be retracted to create a void space in the subsurface and facilitate collection of the soil vapor samples. Following installation of each soil vapor monitoring point the annular space will be backfilled with clean silica sand. A surface seal will be installed to prevent short-circuiting to the ground surface, using hydrated bentonite, melted beeswax or other non-VOC-containing non shrinking product.

After installation of the probes, one to three volumes of vapor (i.e., the volume of the sample probe and tube) will be purged using a PID prior to collecting the samples. The flow rates for both purging and sample collection will not exceed 0.2 liters per minute.

A helium tracer gas will be used as a QA/QC tool to verify the integrity of the soil vapor probe seal and to confirm that infiltration of outdoor air is not occurring. An inverted

plastic bucket will be used as an enclosure to keep the tracer gas in contact with the probe during integrity testing, as described in the NYSDOH's final guidance document. A portable helium monitoring devise will be used to analyze a sample of soil vapor prior to and after sample collection. A detailed procedure for verifying the integrity of the soil vapor probe seal is included in Attachment A-8.

Laboratory-supplied SUMMA canisters will be used to collect the soil vapor samples from each sampling location. The flow controls/regulator on the SUMMA canister, along with the vacuum in the canister, will be used to collect the soil-vapor samples directly from the subsurface stainless steel sampling point. The soil-vapor samples will be collected for an approximately 2-hour time period. The SUMMA regulators will be calibrated by the analytical laboratory to collect the soil vapor samples at a flow rate not to exceed 0.2 liters per minute. The project-specific compound list is included in Attachment A-8.

The temporary sample probes will be installed and removed the same day that the samples are collected. The sample probes will be decontaminated between sampling locations using an alconox wash and distilled water rinse, then drawing ambient air through the tube via a Gilian pump for a minimum of 5 minutes.

Concurrent with soil vapor sampling, it is anticipated that one outdoor ambient air sample will be collected per day to characterize site-specific ambient (i.e., background) outdoor air conditions. The ambient air samples will be collected to evaluate potential outdoor air interference associated with the infiltration of outdoor air into the subsurface and/or sampling apparatus while the soil-gas sample is collected. A representative upwind location for the ambient air sample will be selected in the field away from wind obstructions (e.g., trees or bushes). The ambient air sample will be collected at a height above the ground to represent breathing zones (approximately 3 to 5 feet above ground surface). A detailed procedure for collecting ambient air samples is included in Attachment A-8.

Detailed information will be gathered at the time of sampling to document conditions and aid in interpretation of the test results. Field personnel will document the following information in the project field notebook:

- weather conditions (precipitation, temperature, and wind direction) prior to and during the sampling activities

- date and time (start and end time) each sample was collected

- sample identification
- identification of laboratory samplers/regulators/devices
- purge volumes
- volume of air/vapor extracted
- vacuum pressure of canister (before and after sample is collected); and
- chain of custody identification.

The sampling team members will avoid actions that cause sample interference, such as pumping gas prior to testing, wearing aftershave or cologne, or using permanent marking pens.

Following the completion of the soil vapor samples SV-101, SV-103, and SV-104 a soil boring will be completed in accordance with the protocols presented in the Section 2.5.

Drilling equipment will be decontaminated prior to beginning drilling activities, between each soil vapor location, and prior to demobilization from the site. Equipment decontamination will be performed in accordance with the protocols presented in Section 4.

Subsurface soil vapor samples will be placed into appropriate sample containers as described in Section 3. The samples will be handled, labeled, packaged, and shipped following the procedures outlined in Attachment A-3.

2.11 Air Monitoring

Certain intrusive SC activities have the potential to generate localized impacts to air quality, including: soil boring completion; subsurface soil sampling; excavation of test pits; and monitoring well installation. Some non-intrusive SC activities may also have the potential to generate impacts to air quality, including; monitoring well development; collection of groundwater samples; collection of monitoring well water level measurements; and specific capacity testing. Air monitoring will be conducted at the Site for VOCs and particulate matter less than 10 microns in diameter (PM_{10}) to monitor air emissions in the worker breathing zone and to provide for a measure of protection of the downwind communities from potential airborne releases of

constituents of concern during work activities as the Site. Air monitoring procedures are detailed in the CAMP (Appendix C).

3. Sample Handling and Documentation

3.1 Sample Containers and Preservations

Appropriate sample containers, preservation methods, and laboratory holding times for soil and groundwater samples are presented in the QAPP.

The analytical laboratory will supply appropriate sample containers in sealed cartons, as well as sample labels and preservatives. The analytical laboratory will also provide ARCADIS with analyte-free water to run field QA/QC samples. The field personnel will be responsible for properly labeling containers and preserving samples (as appropriate). Sample labeling procedures are presented in the QAPP.

3.2 Sample Labeling, Packing, and Shipping

Sample custody seals and packing materials for filled sample containers will be provided by the analytical laboratory. Appropriate sample containers, preservation methods, and laboratory holding times for each sample type will be applied as referenced in the QAPP. Unique sample identifications will be provided for each sample as referenced in the QAPP.

All samples will be packaged by the field personnel and transported as low-concentration environmental samples. The packaged samples will be either shipped via express overnight carrier (Federal Express or courier) hand delivered by sampling personnel to the laboratory within 24 to 48 hours of sample collection, or picked up at the site by a courier provided by the laboratory. General procedures for packing, handling, and shipping environmental samples are included in Attachment A-3.

3.3 Documentation

Field personnel will provide comprehensive documentation covering all aspects of field sampling, field analysis, and sample chain-of-custody. This documentation constitutes a record which allows reconstruction of all field events to aid in the data review and interpretation process. All 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 SC investigation include:

- Daily Production Documentation - A field notebook(s) consisting of a waterproof, bound notebook which will contain a record of all activities performed at the site. The field notebook(s) will be maintained by the field team leader and other team members to provide a daily record of significant events, observations, and measurements during the field investigation. Information pertinent to the field investigation and/or sampling activities will also be recorded in the field notebook(s). The books will be bound with consecutively numbered pages.

- Daily Pay Items Sheet – A standard ARCADIS form will be used to track field investigation costs as coded in the Revision 3 of the MGP Environmental Consulting Services Price Schedule.

- Sampling Information - Detailed notes will be made as to the exact site of sampling, physical observations, sample depths, and weather conditions. Groundwater sampling field logs (included in Attachment A-6) will be filled out during each sampling event and will contain sample location, water level data, well depths, physical observations of the water, and field parameter measurements (pH, conductivity, dissolved oxygen, temperature, oxidation/reduction potential, and turbidity). Water level readings will be measured to surveyed reference points, and will be documented in the field notebook or on the groundwater sampling field log in included in Attachment A-6.

- Sample Chain-of-Custody - Chain-of-custody forms (included in Attachment A-3) will provide the record of responsibility for sample collection, transport, and submittal to the analytical laboratory. Chain-of-custody forms will be filled out at each sampling site, at a group of sampling sites, or at the end of each day of sampling by one of the field personnel designated to be responsible for sample custody. In the event that the samples are relinquished by the designated sampling person to other sampling or field personnel, the chain-of-custody form will be signed and dated by the appropriate personnel to document the sample transfer. The original chain-of-custody form will accompany the samples to the laboratory and copies will be forwarded to the project files. 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 Equipment, Calibration, and Maintenance Logs - To document the calibration and maintenance of field instrumentation, calibration and maintenance logs will be maintained for each piece of field equipment (which is not factory calibrated). A calibration maintenance log is provided in Attachment A-9.

Original data recorded in field log books and Chain of Custody Records will be written with indelible ink. If an error is made on a document assigned to one individual, that individual will make all corrections simply by crossing a single line through the error and entering the correct information. The erroneous information will not be erased. Any subsequent error discovered on a document will be corrected by the person who made the entry. Subsequent corrections will be initialed and dated.

3.4 Management of Investigation-Derived Materials and Wastes

The handling of investigation-derived materials and wastes is discussed below.

3.4.1 Excess Soil and Groundwater

Soil cuttings and excess soil generated by sampling activities will be placed into new Department of Transportation- (DOT-) approved steel 55-gallon drums. Development water, purge water from the monitoring wells, and recirculation water generated during rock coring activities (if any) will be containerized in an onsite polyethylene storage tank or new closed-top DOT-approved steel 55-gallon drums. The waste materials will be disposed by ARCADIS in accordance with applicable regulations following completion of the SC field activities.

3.4.2 Disposable Equipment and Debris

Disposable equipment and debris, such as health and safety equipment, plastic sheeting, sampling equipment, and other equipment not reused in the SC will be collected in plastic bags during the sampling events and placed into new DOT-approved steel 55-gallon drums, which will be stored in a suitable onsite location. The waste materials will be disposed by ARCADIS in accordance with applicable regulations following completion of the SC field activities.

3.4.3 Decontamination Rinsate

Field sampling equipment will be decontaminated by following the procedures outlined in Section 4. Decontamination rinsate will be containerized at each sampling location

or group of locations. Upon completion of the SC field activities, the rinsate will be containerized in an onsite polyethylene storage tank or new closed-top DOT-approved steel 55-gallon drums for storage in a suitable onsite location prior to disposal by ARCADIS in accordance with applicable regulations.

4. Equipment Decontamination and Cleaning Procedures

4.1 General

This section presents procedures for decontamination of equipment used to collect soil and groundwater samples for the SC field sampling activities. The adequacy of cleaning procedures will be monitored through the collection of QA/QC rinse blank samples which will be submitted for laboratory analysis, as referenced in the QAPP.

4.2 Sampling Equipment Decontamination

Prior to collecting samples to be submitted for chemical analysis, equipment that is not dedicated (i.e., stainless steel bowls, spoons, trowels, hand augers, bailers, and filtering equipment) will be washed with potable water and a non-phosphate detergent (such as Alconox). Decontamination may take place at the sampling location as long as liquids are contained in pails and/or buckets, etc. The sampling equipment will then be rinsed with potable water, followed by a 10 percent “pesticide-grade” methanol rinse, and finally a distilled water rinse. When sampling for inorganic constituents in an aqueous phase, an additional rinse step will be added prior to the rinse with methanol. The rinse step will entail a rinse with a 10 percent “ultra pure-grade” nitric acid followed by a distilled water rinse. Between rinses, equipment will be placed on polyethylene sheets or aluminum foil if necessary. At no time will washed equipment be placed directly on the ground surface. 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. Decontamination water will be contained in a dedicated polyethylene tank or new closed-top Department of Transportation- (DOT-) approved steel 55-gallon drums located at the Site. Disposable equipment sealed in manufacturing packaging, such as tubing, will not be decontaminated before use.

4.3 Drilling and Excavation Equipment Cleaning

A decontamination pad will be lined with plastic sheeting on a surface sloped to a sump area. The sump area must also be lined and of sufficient volume to contain approximately 20 gallons of decontamination water. The excavator bucket, rear-end of the drill rig, and all other downhole equipment (i.e., augers, bits, rods, tools, split spoon samplers, and tremie pipe) associated with the excavation of test pits, drilling of the soil borings, and installation of the monitoring wells 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 dirt, grease, and oil before beginning work in the project area and between each sample location. If heavy accumulations of tars or oils are present on the equipment, 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 surface will be avoided. Decontamination water will be contained in a dedicated polyethylene tank or new closed-top DOT- approved steel 55-gallon drums located at the Site.

Following completion of the SC field sampling activities, the decontamination pad will be decommissioned. The decommissioning will be completed according to the following procedures:

- Transferring the bulk of the remaining liquids and solids into the DOT- approved steel 55-gallon drums or dedicated polyethylene tanks (to be provided by ARCADIS or the drilling subcontractor); and

- 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 DOT- approved steel 55-gallon drums used for disposal of personal protective equipment (PPE) and disposable equipment.

Unless sealed in manufacturers packaging, polyvinyl chloride (PVC) monitoring well casing screens will be decontaminated by the above procedures before installation.

5. Field Instruments

This section summarizes field-screening equipment that is anticipated to be used for the SC investigation.

5.1 Field Instrument Calibration and Preventative Maintenance

Field personnel will be responsible for assuring that a master calibration/maintenance log is maintained for each measuring device. In general, each calibration/maintenance log will include the following (where applicable):

- Name of device and/or instrument calibrated (i.e., HNU, Photovac, or Multi-RAE)
- Device/instrument serial/I.D. number
- Frequency of calibration
- Date(s) of calibration(s)
- Results of calibration(s)
- Name of person(s) performing calibration(s)
- Identification of calibration gas (i.e., isobutylene) (if any)
- Buffer solutions (pH meter only)

Equipment to be used each day shall be calibrated prior to the commencement of the day's activities or as suggested by the manufacturer. A calibration/maintenance log is presented in Attachment A-9. Copies of the equipment manuals will be maintained on Site by the field personnel.

5.2 Portable Photoionization Analyzer

The photoionization analyzer will be a Photovac MicroTIP (or equivalent), equipped with a 10.6 eV lamp. The Photovac is capable of ionizing and detecting compounds with an ionization potential of 10.6 eV or less. This accounts for up to 73 percent of the VOCs on the Target Compound List. Calibration, operation, and maintenance procedures are included as Attachment A-9 for the Photovac MicroTIP PID. The procedures to be followed will be dependent on the PID acquired for this project, as described in the equipment manual. The calibration and maintenance information will be recorded in field notebooks.

5.3 Dust Monitor

The dust monitor will be a MIE DataRAM (or equivalent) and will be calibrated at the start of each day of use. Calibration and maintenance of the dust monitor will be

conducted in accordance with the manufacturer's specifications. The calibration and maintenance information will be recorded in field notebooks.

5.4 pH Meter

The pH meter will be calibrated at the start of each day of use, and after very high or low readings as required by this plan. National Institute of Standards and Technology traceable standard buffer solutions that bracket the expected pH range will be used. The standards will most likely be a pH of 7.0 and 10.0 standard units. The pH calibration and slope knobs will be used to set the meter to display the value of the standard being checked. The calibration and maintenance information will be recorded in field notebooks.

5.5 Specific Conductivity Meter

Calibration checks using the appropriate conductivity standard for the meter will be performed at the start of each day of use, and after very high or low readings, as required by this plan. Readings must be to within five percent to be acceptable. The thermometer of the meter will be calibrated against the field laboratory thermometer on a weekly basis. The calibration and maintenance information will be recorded in field notebooks.

5.6 Water-Level Meter

The water-level cable will be checked once to a standard to assess if the meter has been correctly calibrated by the manufacturer or vendor. If the markers are incorrect, the meter will be sent back to the manufacturer or vendor. The calibration and maintenance information will be recorded in field notebooks.

5.7 Turbidity Meter

The turbidity meter will be calibrated daily prior to use. Calibration and maintenance will be conducted in accordance with the manufacturer's specifications. Calibration and maintenance information will be recorded in the field notebook.

Attachments

Attachment A-1

Attachment A-1 – Con Edison Utility Clearance Procedures

Utility Clearance Process for Intrusive Activities EH&S Remediation Program (Consolidated Edison Company of New York, Inc., 2003) attached subsequent to this page.

UTILITY CLEARANCE PROCESS FOR INTRUSIVE ACTIVITIES
E H&S REMEDIATION PROGRAM

1.0 INTRODUCTION

This document outlines the process that should be used to identify, locate and clear subsurface utilities as part of all Environmental Health and Safety Department's Remediation Section intrusive site investigations. The various activities that comprise this process are specified in efforts to eliminate or substantially reduce the risk of encountering a subsurface utility while performing intrusive activities. Where appropriate, reference is made to other existing safety procedures that should also be considered. **Note that modifications and additions to the text in this version of the process, relative to the topics outlined in Section 2.0, are italicized.**

Due to the potential presence of subsurface utilities and the inherent variable of their size, depth and layout, it is not possible to address all situations and circumstances that may be encountered during intrusive activities. However, adherence to the steps outlined here will effectively minimize physical impacts to subsurface utilities and prevent associated health and safety risks that might otherwise result from field investigation activities. The activities prescribed below should not be blindly followed. Rather, it is the intent of this document that **ALL FIELD PERSONNEL**:

1) Understand the terms of this process including all revised or added provisions;

2) Develop an awareness and be mindful of, the potential and actual risks associated with utilities and other related hazards at a site;

3) Become familiar with the location(s) and configuration(s) of all subsurface utilities at the site, as marked out and as delineated on available drawings;

4) Develop an awareness and understanding of the potential uncertainties associated with utility locations as marked out;

5) Maintain a high level of vigilance while implementing all components of intrusive fieldwork.

ALL FIELD PERSONNEL, including the Con Edison Project Manager (PM), Construction Management (CM), consultants and contractors should be familiar with the fundamental provisions of this utility clearance process PRIOR to engaging in any field activities.

The process described in the remainder of this document consists of the three (3) primary components summarized below. These components are designed for use in an integrated manner.

Process Narrative – The narrative provides detailed descriptions of the specific steps that should be taken prior to and during intrusive activities to minimize the potential of encountering subsurface utilities.

Utility Clearance Flow Chart: The key steps of the utility clearance process, as outlined in the narrative, are shown graphically on the flow chart provided in **Attachment A**. The flow chart serves as a guide and should not replace the narrative for developing an understanding of and/or implementing the process.

Utility Clearance Checklist - A key component of this process is the completion of the checklist provided in **Attachment B**. The checklist shall, be completed by the Con Edison PM. The intent of the checklist is to ensure that all appropriate steps of the process described herein have been completed. Secondly, it will be used to document that all reasonable steps were taken to prevent conditions that may be potentially harmful to the on-site workers and the surrounding community at large, and that might otherwise adversely impact the physical integrity of, or cause damage to, the utility. The completed checklist will be incorporated in the project files maintained by the Con Edison PM.

2.0 REVISIONS FROM PREVIOUS VERSION

This version (Revision 1) has been modified to incorporate additional provisions and or guidance based on lessons learned during implementation of the original version for intrusive activities at various sites. The key topics that have been added or modified are listed below and described in greater detailed in the referenced sections of this protocol.

- Use of private utility location contractors (Sections 4.2.1 and 4.2.2);
- Work around gas lines (Section 4.3 and 4.4); and
- Requirements for utility clearance in building basements (Section 4.4).

Modifications and additions to the text relative to the topics listed above are *italicized* (in addition to the website links in Section 4.1 which are also italicized).

3.0 APPLICABILITY

The utility clearance process shall be performed prior to and/or during the intrusive site investigation activities listed below.

- Excavation of Soil Borings
- Installation of Monitoring Wells
- Installation of Soil Gas Sampling Probe Points
- Excavation of Exploratory Test Pits/Trenches

4.0 SUBSURFACE UTILITY CLEARANCE PROCESS

The key activities that comprise the process are listed below and a detailed description of each is provided in the remainder of this document in the order in which they should be completed (as shown in the Utility Clearance Flow Chart in **Attachment A**).

- Obtain Plates, Drawings and Maps
- Notification to Con Edison Operating Groups and Submission of Site-Specific HASP for review and approval
- Code 753 Utility Mark-Out
- Site Walk
- Utility Clearance - Sample Location Confirmation
- Checklist Completion

It is noted that completion of some steps may not be warranted for all intrusive activities at all sites. The process is designed to be flexible and, thus, allows the Con Edison PM to incorporate those utility clearance activities that are appropriate for a set of site-specific conditions, knowledge of the site, previous work completed at a site, etc. Exceptions are summarized in Section 5.0 of this document. The key premise is that any deviations and the rationale for each are well documented and reflect sound judgment on the part of the Con Edison PM and other project personnel.

4.1 Obtain Plates, Drawings and Maps

Hard copies of available utility plates, drawings and/or maps should be obtained by the Con Edison PM. Drawings, plates, etc. should be reviewed as a preliminary step to determine the type and approximate size and location of utilities in the vicinity of the work site. The drawing title, most recent revision date shown on the drawings, approximate scale and source shall be documented in the appropriate space(s) on the Utility Clearance Checklist (**Attachment B**).

The source of the drawings may vary depending on whether the site is a Con Edison owned/operated facility, private/public property, or extends into a public street/sidewalk. The various sources for substation utility drawings are discussed below and listed in **Table 1**. Drawings for private properties and facilities, such as apartments, schools, churches, residences, etc., can typically be reviewed at, and/or obtained from, the property/facility manager and Department of Public Works and/or Department of Buildings in the municipality where the property is located.

NOTE: Copies of all drawings obtained during this step should be available at the site during all site walks/inspections and at all times during subsequent intrusive activities. The drawings should be reviewed immediately prior to implementing intrusive activities at each new site location where intrusive activities are to be performed.

Steam, Gas and Electric

All electric and gas plates are available on Con Edison's intranet by searching for 'maps' or accessing the Advanced Mapping System website listed below.

http://maps/AdvancedMappingHomePage.htm

Similarly, steam plates can be obtained by selecting "Active" and "Archived" Steam Plates from the website:

http://maps/steam.htm

Based on agreement between Transmission Operations and EH&S, Remediation personnel may access these intranet sites and print the plates using the facilities in the conference room in Building 97 in Astoria. In addition, a large format photocopier, which is also located in Building 97, is available for use by EH&S remediation. A log book, which is stored at the facility, should be completed each time the facilities (i.e., plotter, computer, and or photocopier) are used.

Conduit and Duct Occupancy (C&DO) utility plates should be obtained from the appropriate Con Edison engineering group(s) including, electric (e.g., distribution lines, transmission feeders, etc.) steam and gas by the Con Edison PM.

AFTER accessing the website and obtaining the required drawings, the appropriate party listed in **Table 1** may be contacted with inquiries regarding electric and steam plates or for questions regarding use of the Advanced Mapping System.

Sewer and Water

Drawings showing water and sewer utilities should be obtained from the New York City Department of Environmental Protection (NYCDEP). Drawings can be requested from the NYCDEP by completing the form provided in **Attachment C** and faxing or mailing it using the appropriate contact information listed on the request form. If you have questions you should contact the NYCDEP personnel at the telephone number listed in **Table 1**.

Subterranean Tunnels

Drawings showing locations and depths of tunnels including subways and automobile tunnels and related subsurface infrastructure should be obtained as appropriate by contacting the Metropolitan Transportation Authority as listed in **Table 1**. It is noted that if intrusive activities will be performed in the immediate vicinity of subsurface MTA structures, such as subway or automobile tunnels, a letter submitted to the MTA may be required to request a work permit from MTA. The letter should include a brief summary of the work and a map(s)/drawing(s) of the proposed work and will be submitted to:

Mr. Rajen Ydeshi
Outside Projects
New York City Transit
2 Broadway, 7th Floor
New York, New York 10004

Miscellaneous

Con Edison generally does not maintain plates and drawings showing detailed information of utility distribution on private property. However, as discussed above, facility managers, property owners, Department of Public Works and/or Department of Buildings of the municipality where the site is located, should be contacted in efforts to obtain available utility drawings for the facility. Contact information (e.g., telephone numbers, e-mail addresses, etc.) for municipalities can typically be obtained by accessing the municipality's website. The name, address and telephone numbers for the Department of Buildings in New York City are listed in **Table 1**.

4.2 Complete Utility Markouts

Due to the diversity and nature of sites investigated by the EH&S Remediation Group and the potential utilities at these sites, an effective mark out may require an M-scope survey by Con Edison, requesting a Code 753 utility survey and or a subsurface utility survey by a private utility-locating contractor. The applicability of each of these is discussed below.

4.2.1 Overview of Utility Markout Methods

Code 753

The Con Edison PM should instruct their consultant and/or contractor to request a Code 753 utility mark out as per the 16 New York City Rules and Regulations (NYCRR) Part 753. Consistent with the One-Call (also called Dig Safe New York) criteria, the request should be made at least 72 hours prior to initiating fieldwork. The telephone numbers of the various one-call systems are listed by region below.

New York City / Long Island:	(800) 272-4480
Westchester	(800) 962-7962

Confirmation that mark outs completed under Code 753, and as received by facsimile or telephone from the participating utility companies, should be documented on spaces provided on the Utility Clearance Checklist (**Attachment B**). The markouts should be maintained by the Con Edison PM or designated representative. If the physical markings on the street/sidewalk become faint or obscure they should be refreshed by over-painting with new paint as needed. When the utility markouts are being refreshed, typically by consultant, contractor, or other project personnel, a Con Edison representative or their designee **MUST** be present and observe this activity.

Con Edison M-Scope Survey

Con Edison engineering groups (see below for contacts) can conduct utility surveys using a 'M-Scope' on a case-by-case basis and will be limited to the engineering group' availability. This tool uses the magnetic susceptibility of subsurface features such as electrical conduits, electric cables, pipes, etc. This method of survey can be subject to interference by other conductive bodies at grade or in the subsurface, such as buried pieces of metal, rebar in concrete, iron-rich soil, etc., and may be ineffective or produce misleading results in these types of conditions. A utility survey using an M-Scope can be requested by contacting the appropriate party listed below. Note for markouts inside substations contact Mark Rimler at (212) 460-3921.

County	Contact Name	Telephone Number
Manhattan	Jane Shin	(212) 894-9345
Brooklyn & Queens	John Haas	(718) 348-6725
Bronx	Greg Kasbarian	(718) 904-4659
Westchester	Faney Bantin	(914) 789-6715
Staten Island	Joseph Nappi	(718) 890-6231

Private Utility Contractor

Prior to mobilizing to the site the following information MUST be provided to and reviewed by the Con Edison PM:

- *the name of the contractor;*
- *the name of technician(s) who will perform the utility surveys;*
- *for each technician, a summary of experience and training in conducting surveys in a setting similar that at the site (e.g., urban, inside buildings, etc.); and*
- *Summary of experience and training of each instrument.*

When using a private utility location contractor, the Con Edison PM shall diligently attempt to arrange for the facility or property manager and or engineer, who is most familiar with the utility layout and distribution in the building or on the property to participate in the site walk with the private utility locating contractor during on the first day of conducting the on-site utility survey.

Private utility contractors employ a variety of utility detection and location techniques, which may include:

- Ground Penetrating Radar (GPR)
- Magnetometer
- M-Scope
- Electrical Conductivity

- Electrical Resistance
- Acoustics

Use of multiple methods may permit the detection and surveying of conductive and non-conductive buried utilities.

*The utility location contractor **SHALL** specify which utility detection tool/techniques they plan to bring **AND** use at the site. In addition, they **SHALL** bring **ALL** support tools and equipment necessary to allow them access to manholes, vaults, circuit boxes, pipe clean-outs, etc.*

*At the commencement of a utility survey using a private utility location contractor **AND** prior to them deploying any survey equipment, the utility location contractor **SHALL**:*

1) *Review **ALL** utility drawings*
2) *Reconcile **ALL** drawings with markouts identified by the Code 753 survey at the property perimeter.*
3) *Determine presence and type nature of sub-slab utilities and diligently attempt to confirm their configuration during the utility survey.*
4) *Inspect the site to identify where **ALL** utility service enters and or leaves the property and or building. This **SHALL** include a thorough inspection of building basement(s); boiler and or machine room(s); externally-exposed utility infrastructure including manholes; vaults; electrical, gas, water valves and or meters; etc.*
5) *Visually identify, open and inspect **ALL** relevant utility access-ways including manholes, vaults, gas and or water valves boxes and telephone, cable and communication boxes.*
6) *Identify and document **ALL** apparent uncertainties such as manholes containing service lines that apparently go to the building or property, but that cannot be located within the basement of the building or on site.*

***NOTE**: In ALL cases, the private utility contractor shall diligently attempt to 'hook-onto' or 'tone' each conduit source (e.g., pertinent electrical conduits in basement, water and or gas valves in valve box, distribution lines in manhole, etc.). This may require opening manholes circuit electrical distribution 'trunk' boxes, moving equipment or stored materials at the facility or property to allow access. No project personnel shall enter a manhole or vault unless they are certified and trained in confined space access, have and know how to use **ALL** pertinent safety equipment, and approved by the Con Edison PM.*

In some situations, multiple metallic conduits may be in direct contact in the subsurface. In this circumstance the signal of the locating tool may be transferred from the conduit being 'toned'

to an adjacent conduit(s) and may produce a 'secondary' signal. In efforts to understand and identify this occurrence, the location of each apparent signal shall be visually/physically marked using pieces of tape, paint or similar method. The sources being 'toned' shall be numbered and the corresponding signals associated with each signal source shall be marked with the corresponding number a teach location where the signals from each source is detected. Accordingly, the resulting mark outs will show apparent multiple conduits for a single source.

4.2.2 Applicability of Utility Clearance Resources

The use of the various utility markout resources that may be employed at various sites is summarized in the table below and discussed in the remainder of this section.

Site Setting	Utility Survey by Con Edison	Utility Survey by Private Contractor	Code 753 (1)
Con Edison Facility	X	X (optional)	X[1]
Street / Sidewalk	X (optional)	X (optional)	X
Private Property	X (optional)	X	X[1]

(1) At larger Con Edison Properties (e.g., Astoria) or large private or publicly owned properties, a Code 753 survey may not be warranted.

Con Edison Facility

Utility markouts at Con Edison facilities should be coordinated by the Con Edison PM with support from the Construction Management (CM) inspector assigned to the project (if any) and/or facility personnel, as appropriate. At a minimum, an M-Scope survey should be completed. In some circumstances, an independent utility locating contractor should also be used. The decision to use a utility contractor will be made by the Con Edison PM. The use of an independent utility mark-out contractor is strongly recommended at sites where a variety of utilities are known or suspected to be present and which may not be readily identified or mapped

using M-Scope alone. A benefit of using a utility locator contractor is that, as described above, they can provide a greater array of tools to locate a variety of subsurface utilities that are non-conductive, such as concrete sewer lines, PVC pipes, etc. in addition to identifying/confirming the presence and location of conductive utilities.

Private Property (including Soil Gas Sampling Probes)

An independent utility locator should be used for utility markouts on private properties. It is noted that utility markouts in basements or slab-on-grade constructed buildings may be inconclusive due to the presence of rebar or welders-mesh commonly used as reinforcement in concrete. Accordingly, a thorough inspection of the basement floor and walls should be performed to identify where utilities enter and leave the building, as well as how the utility (elctric, water gas, steam, etc.) are distributed in the vicinity of the sample locations. Sub- or in-

floor utilities often enter along the perimeter of the floor, at support columns, and/or along dividing walls. The observation of utilities entering the floor may indicate utilities that lie within or immediately beneath the concrete basement slab. If the location of the utility layout of any such sub- or in-floor utility cannot be effectively determined, then any intrusive work must be discussed with the Con Edison PM and may require that no intrusive activities be performed at that location. *However, this action should only be considered after all applicable survey tools and methods have been diligently deployed and or implemented.*

Public Street / Sidewalk

A combination of Con Edison utility survey staff and independent utility locator contractors may be used for work areas located in and along roadways. Since Con Edison maintains utilities in streets and along sidewalks, in addition to the mark outs performed through the Code 753 survey, an M-scope survey may also be requested within a 10 foot radius of each proposed sample location. It is noted that due to often heavy work loads of the M-Scope survey staff, this option may not always be available or practicable and should be considered optional.

4.3 Site Walk

After completion of the activities outlined above, a site walk shall be conducted by the Con Edison PM with participation from Construction Management (if it will be providing field oversight), contractors (drillers, soil gas, excavators, private utility location contractor, etc.), Con Edison facility managers, NYSDEC (as deemed appropriate by the Con Edison PM), and private facility managers/property owners. A list of the names and phone numbers of each participant at the site walk will be maintained by the Con Edison PM. The key objectives of the site walk are to:

- Review the all planned locations where invasive activities will be performed,
- Adjust the positions of the locations away from utilities as marked out (as necessary)
- Collectively determine the appropriate utility clearance activities (e.g., test pits, etc.) that will be performed at each location (as described in Section 3.4) and document all decisions and /or concerns using the Utility Clearance Checklist (as described in Section 4.0) and in **Table 2**.

Other site conditions and project issues assessed during the site walk should include:

- Presence and location of overhead utilities and/or obstructions that might prevent the safe operation of drilling /excavating equipment;
- Presence of, or need for, appropriate grounding for electrical equipment at the site;
- Site access to equipment;

- Storage of equipment/supplies overnight (e.g., establish a staging area);
- Storage and management of investigative derived waste (IDW);
- Hours of on-site work;
- Permits needed, if any;
- Review roles and responsibilities of all project personnel who will be onsite;
- Review site and emergency contacts; and
- Review anticipated schedule of work *and contingency action as deemed appropriate.*

4.4 Utility Clearance - Sample Location Confirmation

The appropriate actions necessary to confirm the location and/or absence of utilities, which are agreed on during the site walk and as documented in the Utility Clearance Checklist and in **Table 2**, will be implemented at each sample location during the investigation. As discussed above, and consistent with the Utility Clearance Process Flow Chart, the actions will generally include one or more of the following:

- Moving the location outside the **tolerance zone**, if possible. If no ***tolerance zone*** is marked out during the utility survey (i.e., only a utility center line is marked), the **tolerance zone** will be defined in the field as: **the distance of one-half of the known diameter of the utility plus two feet on either side of the centerline as marked out.**
- Performing a utility clearance test pit at each location where intrusive work will be performed; and/or
- Performing a utility clearance test pit using non-mechanical means to expose and physically verify the exact location and configuration of all nearby utilities.

Brief descriptions of the activities that will be completed during the various investigation activities are discussed below.

NOTE: When working within 25 feet of high pressure gas lines (i.e., 125 psig or greater), ***Gas Emergency Response Center (ERC)*** **shall be contacted** ***[718-319-2330] and notified of the planned activities at least two days prior to start of intrusive work. If working within 5 feet of a transmission main or within 10 feet of the tolerance zone of a main*** **the gas line will be carefully excavated by hand in accordance with the Gas Operations Standard G-11863, titled "Inspection and Maintenance Requirements Associated with the Excavation Activities Near Gas Pipelines Operating at 125 psig and Above".**

Soil Borings / Monitoring Wells

All locations within the tolerance zone should be moved outside the zone, if possible. After moving the location, a utility clearance test pit should be excavated to a minimum of 5-feet below ground surface using non-mechanical methods, such as hand auger, post-hole digger and/or vacuum truck. The diameter of the test pit should be at least two inches wider than the outer diameter (OD) of the mechanized drilling equipment. The 5-foot depth is consistent with the concept that most utilities are typically installed within the top five feet of the subsurface.

NOTE: Utilities may be deeper than five feet due to buildup of surface grade on properties and or streets or right-of-ways. Although the original depth of utilities is anticipated to be within the upper five feet, utilities that are buried in areas that have been built up will presently be deeper by the thickness of the built-up material.

Intrusive investigation locations where physical space prohibits the relocation of proposed sample locations outside the tolerance zone, the adjacent utility(ies) will be exposed by excavating using non-mechanical methods to visually confirm its physical location and configuration. This confirmatory excavation will be completed in addition, a 5-foot excavation at the specific location being investigated (e.g., soil boring, monitoring well boring, etc.), as described above.

Soil Gas Sampling

At soil gas sample locations, test pits will also be excavated to one foot below grade or below the bottom of a concrete floor, if present, prior to installation of soil gas sample probes points. The one-foot depth specified is consistent with the concept that most utilities that could be impacted by the advancement and emplacement of the probe points, such as telephone lines, local electric (e.g., for outdoor lighting), cable television, in-ground sprinkler lines, etc., are typically installed from grade to a depth of one foot.

Basements / Indoor Soil Borings and Monitoring Wells

Prior to installing a soil boring, monitoring well or soil gas sample probe point in the concrete slab of a basement and after identifying that no utilities are present in the floor of the basement or foundation slab (as per Section 3.2.2), an electric powered diamond core drill, concrete saw or jack hammer will be used to advance through the concrete and expose the underlying soil. *If sub-slab utilities are suspected of being present, but not confirmed during the utility location survey, the concrete shall be cored or saw cut to an estimated depth of approximately 2/3 the thickness of the concrete (if known). If the thickness of the concrete thickness is not known, it shall be assumed to 8-inches thick. Coring shall proceed at 1-inch increments, with the removal of each one-inch 'plug' of concrete and visual inspection of the core hole to verify the absence of utilities. The remaining 1/3 of the concrete shall be broken using electric jackhammer,, hammer drill or using hand tools. Appropriate safety equipment shall be worn during concrete removal actions.*

At each location where soil borings and/or monitoring wells will be installed, a hand excavated test pit will then be advanced to a depth of five feet below the bottom of concrete slab. This test pit should be excavated using hand auger, post-hole digger and/or vacuum truck in tandem with a

non-conductive probe rod, which can be used to confirm the absence of utilities to a depth of five feet below the bottom of the concrete slab.

NOTE: The use of a jack-hammer to loosen compact soil during hand excavating a utility clearance test pit is strictly prohibited, except as noted above.

Exploratory Test Pit/Trench

Exploratory test pits/trenches will be performed to identify the presence or absence of subsurface structures related to former operating facilities at the site, such as gas holder foundations at former manufactured gas plant (MGP) sites, and should not be confused with **utility clearance test pits** discussed above. The **exploratory test pits** or **trenches** will typical have dimensions of approximately five feet wide by 10 feet deep by 10 to 20 long, accordingly, excavating them by hand is impracticable. The excavation of **exploratory test pits/trenches** must be approached with heightened awareness as the potential for damaging subsurface utilities, if present, is great.

In efforts to develop a reasonable degree of confidence that utilities will not be encountered during excavation of **exploratory test pits/trenches**, a focused utility survey will be conducted in the area immediately surrounding the test pit or the area defined by a boundary established by measuring two feet perpendicular from all sides of the proposed exploratory test pit boundaries. For example, if the surface dimensions of the exploratory test pit are 10 feet long by 5 feet wide, the surrounding area of the focused utility survey will have dimensions 14 feet long by nine (9) feet wide. It is suggested that the focused utility survey should be completed after all other on-site surveys have been completed. This will allow the surveyor(s) to develop a better understanding of the site-wide subsurface utility configuration.

Following completion of the focused utility survey, **utility clearance test pits** will be excavated by hand to confirm the presence of any and all utilities identified within five feet from the exploratory test pit/trench. After exposing the utilities, the excavator can proceed to excavate the **exploratory test pit/trench**, however, the operator should be experienced with digging in areas where underground utilities may be present and should use the utmost care when performing the excavation. Excavation should proceed slowly enough so that any obstruction/structure encountered can be evaluated and to confirm that the structure is not a utility.

5.0 CHECKLIST COMPLETION

The Utility Clearance Checklist (**Attachment B**), as well as the overall Utility Clearance Process to locate and clear utilities was designed to be dynamic. Accordingly the Utility Clearance Checklist should be updated throughout the process as each utility clearance activity is completed. During the site walk and after all utility-related issues at each location have been identified and addressed to the satisfaction of all project personnel, the relevant portions of the Utility Clearance Checklist will be completed by the Con Edison PM. It is noted that the Utility Clearance Checklist will be considered complete only after all proposed utility clearance actions identified during the site walk have been successfully implemented and all pertinent information and activities have been documented.

6.0 EXCEPTIONS TO REQUIREMENTS OF THE UTILITY CLEARANCE PROCESS

Due to the inherent diversity and conditions present at project sites, some general exceptions to the utility clearance process are identified below.

- Sites where extensive utility mapping has been completed and/or where extensive intrusive activities have already been performed.

- Locations where facility layout is well documented and understood.

- Sites or portions of large sites (e.g., Astoria facility) where utilities are known not to exist currently or to not have ever existed throughout the life of the facility, property or site.

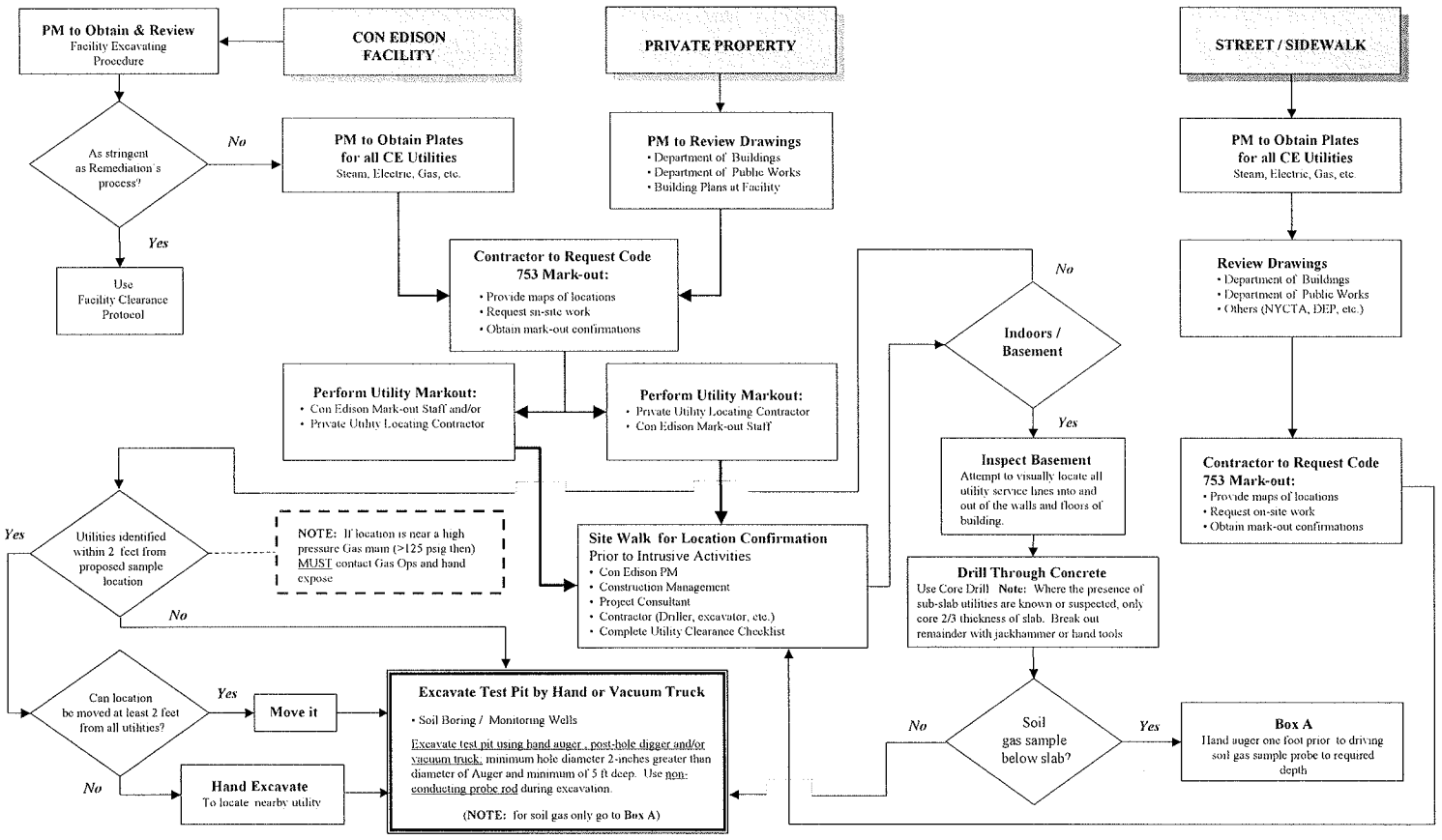
All circumstances where one or more steps of this process are not being implemented must be discussed with the Con Edison PM and must be duly documented. Regardless of whether or not exceptions are made during the utility clearance process, a Utility Clearance Checklist should always be completed for each site, in accordance with the terms outlined in Section 4.0 of this document.

ATTACHMENT A

Utility Clearance Process Flow Chart

Utility Clearance Process During Intrusive Activities
E H & S – Remediation Group

10/08/03
Rev. 1



ATTACHMENT B

Utility Clearance Process Checklist

CHECKLIST FOR INTRUSIVE FIELDWORK

PROJECT BACKGROUND INFORMATION

Site Name: _____ Job No. _____

Site Address: _____

Con Edison Project Manager: _____ Phone: _____

Con Edison Site Manager: _____ _____

Consultant Project Manager: _____ Phone: _____

Consultant Site Manager _____ Phone: _____

Subcontractor (driller, excavation, etc): _____

Subcontractor's Contact Person: _____ Phone _____

Meeting / Start Date _____ Time _____

HEALTH AND SAFETY PLAN REVIEW

Name: _____ Organization: _____ Date: _____

Name: _____ Organization: _____ Date: _____

Name: _____ Organization: _____ Date: _____

Health and Safety Form Completed: _____ Date _____

Site Drawings (yes/no/NA): _____ (Attach site figure with proposed boring locations)

CODE 753 UTILITY MARK-OUT REQUESTED? Y / N

Called by: _____ Organization: _____

Date: _____ Time _____ Initials _____

Reference # _____

Utility Drawings Received: _____ (Attach copy of utility maps)

UTILITY INVENTORY

Above Ground Services:

Utility	Utility Company Name	Depth (ft)	Phone	Date Notified	Notification Method	Marked
Electric		NA				Y / N
Telephone		NA				Y / N
Cable		NA				Y / N
Overhead Supports		NA				Y / N
Traffic light cables		NA				Y / N

Drawings/Plates Obtained (List) _____

Notes: _____

CHECKLIST FOR INTRUSIVE FIELDWORK

UTILITY INVENTORY (continued)

Below Ground Services:

Drawings/Plates Obtained (List) _____

Utility	Utility Company Name	Depth (ft)	Phone	Date Notified	Notification Method	Marked
Electric						Y / N
Telephone						Y / N
Cable						Y / N
Gas						Y / N
Water						Y / N
UST System						Y / N
Storm						Y / N
Sanitary						Y / N
Steam						Y / N
Pipeline Companies						Y / N
Other (Tunnels, etc.)						Y / N

PRIVATE UTILITY LOCATING SERVICE RETAINED? Y / N

Date _____ Time _____ Initials _____

Name of Locating Service: _____

Telephone #/ contact: _____

Name of Operator(s)/Type of sensing equipment used _____

METAL DETECTOR SURVEY

Drilling location cleared by _____ (Consultant/Contractor) with a metal detecto

Consultant / Contractor Name _____ By (initials): _____ Date: _____

INTRUSIVE SAMPLING LOCATIONS MARKED, M-SCOPED AND CLEARED

Locations Marked by: _____ Date(s): _____

_____ Date(s): _____

M-Scope performed by: _____ Date: _____

Conduct Site Walk and Complete Site Walk Table

ACKNOWLEDGEMENT

The parties listed on the attached Site Walk Sign-In Sheet have participated in a site walk at _____ to review proposed intrusive sampling locations and to evaluate the presence, configuration and identification of utilities at this site, as marked out. The parties have agreed with the proposed activities that will be completed prior to conducting intrusive work. The utility clearance activities will be completed as summarized in Table A (attached).

ADDITIONAL COMMENTS / NOTES: _____

Site Walk Sign-In Sheet

Project Name: _____

Date of Site Walk: _____

Name:	Organization:	Phone No.

Utility Clearance
Site Walk Summary Table

Sampling Location	Nearest Utility Distance	Nearest Utility Type	Depth	Clearance Required (Y/N)	Accepted Clearance Method	Rationale for Clearance Method	Depth of Clearance	Date Utility Cleared	Findings /Comments

Signature of Site Walk Participants - Remediation PM: _____ Date Site Walk Conducted:

Construction Management: _____

Consultant PM: _____

Contractor: _____

Vincent J. Soriano, Chief
New York City Department of Environmental Protection
Bureau of Water and Sewer Operations
Central Mapping and Records
59-17 Junction Boulevard, 12th Floor
Corona, New York 11368

UPDATED PROCEDURES FOR REQUESTING INFORMATION

Effective immediately, the guidelines listed below are to be followed when requesting information pertaining to the water and sewer system. Water information pertaining to water main size and location is processed by this office. Sewer information pertaining to requests for drainage plans (used in sewer design work, drainage work, a drainage plan will **not** tell you the location of the sewer), interceptors and schematic Inflow/Infiltration (I/I) maps are processed through this office. **Requests for information pertaining to the locations of sewers, which are derived from as built drawings, sewer house connections, and water house (tap) connections will not be processed by this office. You must contact the specific borough Permitting and Connection office. Also requests for flow tests are not processed in this office.** Requests for information can be mailed to the above address or faxed to (718) 595-5781. **Information is not given nor are requests taken over the telephone.** A taped message of instructions can be heard by dialing (718) 595-5779. Please do not leave requests at the end of this tape, as they will not be processed.

1) **All** requests must clearly clarify the locations and work that is being done. Specific limits or a clear site plan must be provided. Project limits marked or highlighted on a Hagstrom map, or references to address or block/lot will **not** be processed. Hagstroms are often illegible and our records are not filed by address and block and lot. You **must** submit a separate request for each borough. With the increasing amount of work being processed by the Records Unit a completed request form (a blank is attached) **must be attached to each request and be completely filled out, especially the description of work being done.**

2) **All** corporate requests **must be submitted on official company or agency letterhead.** Copies of letterhead submitted via fax are acceptable.

3) **All requests must be submitted to this office at least ten days before the work is to be started by your company/agency.** Complexity of a request, DEP emergencies to name two situations can cause a slight backlog and a delay in response time. There is also closer scrutiny in the information that is requested and released. While it is understood each job is important to the individual asking for the information, requests are processed in the order in which they are received. This office will make every attempt to meet your needs, but labeling a request an "emergency" or "need it ASAP" will not help the processing, and it is unfair to the other clients.

4) If you are faxing your request to our office please do not follow up with a hard copy request later on. With the amount of work performed, there have been instances where staff time is used processing the same request twice.

5) If you request to have your records picked up after the research is done rather than have them mailed, please check off the appropriate box on the request form. Our office will hold the package for TWO business days only, and then it will be automatically mailed out. However it is stressed for you to wait for someone from the Records Unit to call and tell you the information package is ready before you come down. This will save you a needless trip if the information is not yet available.

6) **Walk in requests are no longer accepted.**
7) Requests covering large areas can no longer be processed. We ask that you break them down and submit them separately for an area no larger than eight blocks. If you have numerous locations please prioritize them and submit the requests to us in the order for the areas you need first.

Please pass this along to colleagues in your company that might also make requests to this office. I thank you in advance for your cooperation.

Vincent J. Soriano

Vincent J. Soriano, Chief
BW&SO Mapping/Records

REV 7/02

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER AND SEWER OPERATIONS CENTRAL MAPPING AND RECORDS
59-17 JUNCTION BLVD. - 12TH FL. CORONA, N.Y. 11368 FAX: (718)595-5781

REQUEST FOR INFORMATION FORM

NAME _____

FIRM/AGENCY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

TELEPHONE # _____ FAX # _____

BOROUGH (Check one)

BRONX ( )
BROOKLYN ( )
MANHATTAN ( )
QUEENS ( )
STATEN ISLAND ( )

PURPOSE OF REQUEST FOR WATER RECORDS/WORK BEING DONE)

DRILLING/BORING/EXCAVATION( ) SURVEY( )
DESIGN( ) PLANNING/ANALYSIS( ) OTHER( ) _____

PURPOSE OF REQUEST FOR SEWER RECORDS

SEWER DESIGN( ) Provide latest adopted drainage plan unless otherwise noted for the following sewer type
STORM( ) SANITARY( ) COMBINED( )
INFLOW/INFILTRATION ANALYSIS( )
INTERCEPTOR INFORMATION( ) OTHER( ) _____

IF YOU HAVE BEEN RETAINED BY A CITY, STATE OR FEDERAL AGENCY INDICATE NAME BELOW

_____

AGENCY CONTRACT NUMBER _____

PROVIDE A BRIEF DESCRIPTION OF THE PROJECT YOU ARE WORKING ON THAT REQUIRES THE ABOVE INFORMATION. For example, designing a new 10" sanitary sewer, excavation, drilling contract, etc. NO REQUEST WILL BE PROCESSED WITHOUT AN EXPLANATION.

_____

_____

IN HOUSE STAFF ONLY
PROJECT FOLDER _____ DATE LOANED _____ DATE RETURNED _____

LOCATION STREET NAME	FROM	TO

PLEASE CALL TO HAVE INFORMATION PICKED UP IN PERSON( )
FOR OFFICE USE ONLY
DATE IN _____ DATE OUT _____ ASSIGNED TO _____
RECORDS SENT:

ATTACHMENT C

Instructions for Obtaining Drawings for Sewer and Water Utilities

From the NYC DEP

Steps for obtaining DEP water maps

1) Fill out a "Request for Information Form" for the NYC DEP Bureau of Water and Sewer Operations Central Mapping and Records. Specify the purpose of request and the street names. For faster result, indicate preference for picking up in person.
2) Fax the request form to NYC DEP at (718) 595-5781
3) If pick up requested, you will receive a phone call when the water maps are ready. The package can be picked up at 59-17 Junction Blvd., 12th Floor, Corona, NY 11368.
4) If not picked up after 2 business days, or if pick up was not requested, the package will be mailed to the address provided.

Note: These maps are based on the best information available for the water mains and appurtenances in the streets contiguous to the area specified. Water mains are normally installed at depths ranging from 42" to 48".

Steps for obtaining DEP sewer maps

1) Contact NYC DEP Queens borough office at 120-55 Queens Blvd., Kew Garden, NY 11424 at (718) 286-2600. [Teresa Lin]
2) Arrange an appointment or best time to stop by their office (1st Floor – Room 802). Office hours are Monday to Friday 8:00am – 4:00pm.
3) Prepare a sewer map request memo, using company letter head, justifying the reason for the request and signed by the project manager. Bring company ID card.
4) When arrive at the office, provide them with the request memo, then fill out a slip with applicant information, site location information, and the Index Map # from their hanging map for the specific streets locations.
5) Using the Index Map # or #s to get the index maps for sanitary, storm or combined sewers.
6) Find the streets on the index maps and record the stick numbers and/or file names marked on those streets.
7) Go to the map files room in the back of the office.
8) Look for the respective draws that hold each respective stick numbers. The maps are rolled tightly onto a specific numbered stick. Always look for the "Final Map". Photocopies can be made using their copying machine.
9) Roll the Map back tightly onto the respective stick and place it back to the correct drawer.
10) For the file names, look into the large drawers in the middle of the room. They should be in alphabetical order. Also, place the file back after use to the respective drawer.

Table 1 - Summary Table of Resources for Obtaining Subsurface Utility Plates and Drawings

Utility Type	County	Company	Organization	Name	Telephone Number
Electric	All	Con Edison	Electric Engineering	http://maps/AdvancedMappingSystem.htm[1]	
			For Questions contact:	John Ensemplare (Mgr. – B&Q)	(718) 802-5540
				Mike Mitchell (Mgr. – Manhattan)	(212) 460-1119
				Richard Mariani (Mgr. – Westchester)	(914) 925-6026
Gas	All	Con Edison	Gas Engineering	http://maps/steam.htm[1]	--
			For Questions contact:	Mike Verlizzo (Mgr.)	(718) 319-2357
Steam	All	Con Edison	Steam Engineering	http://maps/steam.htm[1]	--
			For Questions contact:	Tony Barbera	(212) 460-4843
Sewer /Water	NYC	NYC DEP /	Bureau of Water and Sewer Operations	Vincent Soriano/ Doug Greely	(718) 595-5330
Tunnels	Subway Crossing the East River	MTA	Outside Projects – Adjacent Work	Vasanth Battu/ Rajen Ydeshi / [If drilling in immediate vicinity of MTA structure, e.g., subway tunnel, car tunnel, etc., you will need submit a letter and plan drawing(s) to Mr. Ydeshi]	(646) 252-4473 (646) 252-3641
	Crossing the Hudson River	Port Authority of NY/NJ	Surveying	Richard Danko (rdanko@panynj.gov) Bill Kane (wkane@panynj.gov)	(201) 595-4841 (201) 595-4842

(1) "Maps" website listed is accessible on the Con Edison Intranet.

Attachment A-2

Attachment A-2 – Soil Boring, Rock Coring, and Sample Collection Procedures

I. Introduction

This attachment presents procedures for completing soil borings and rock coring, and collecting subsurface soil samples.

II. Equipment and Materials

In addition to drilling equipment, the following equipment and materials will be available (as required) during the soil boring and sampling activities:

- Photoionization detector (PID)
- Appropriate personnel protective equipment (PPE) (as required by the Health and Safety Plan)
- Aluminum or stainless steel tray
- Plastic sheeting
- Measuring tape
- Plywood
- Wooden core boxes
- Water level probe
- Appropriate sample containers
- Appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials
- Field book
- Camera
- Subsurface logs
- Chain-of-custody forms
- Indelible ink pens
- Site map with boring locations

III. Area Reconnaissance

Prior to commencing drilling activities, utility markout activities will be completed as detailed in the SC Work Plan and Attachment A-1. The drilling subcontractor will survey the project area to determine the presence of known utilities at the project area, especially in those areas where drilling is proposed.

IV. Soil Boring Activities

Soil borings will be completed using hollow stem auger (HSA) drilling methods or direct-push sampling methods to a depth of refusal (if encountered), to a confining layer, or to a maximum depth of 30 feet. Soil borings to be completed as monitoring wells will be completed to a depth of approximately 5 feet into saturated overburden. The first 5 feet of each soil boring (i.e., ground surface to 5 feet below ground surface) will be excavated by non-mechanical means (i.e., hand auger, post-hole digger, and/or vacuum truck). Subsequent to clearing the first 5 feet of each soil boring by non-mechanical means, soil samples will be collected continuously from each soil boring by advancing a 2-foot long, 2-inch outer diameter (OD) split-spoon device ahead of the

augers or a 4-foot long macrocore sampling device using direct push methods. A plywood sheet or tub may be placed around the auger or casing when drilling to contain cuttings.

Upon retrieval of each split-barrel sampler or macrocore sample, representative portions of each soil sample will be placed in the appropriate laboratory containers and a container for visual observations and headspace screening. The sample containers will be labeled with: 1) site; 2) boring number; 3) sample interval; 4) date; and 5) initials of sampling personnel. All soil samples will be screened for detectable organic vapors with a PID using the procedures described in Section V below. In addition, the onsite geologist will be onsite during the drilling operations to visually/manually characterize each soil sample including the following:

- Percent Recovery;
- Structure and degree of sample disturbance;
- Soil type
- Principal and minor components;
- Color;
- Moisture and organic content;
- Particle sizes, angularity and shape;
- Texture;
- Density/consistency;
- Plasticity of fines;
- Cohesiveness;
- Discoloration;
- Mottling/staining;
- Weathering;
- Presence/absence of MGP/non-MGP residuals and/or noticeable odors;
- Fill or geologic origin of deposit (local name of deposit, if known);
- Items that may indicate age of deposit (i.e., archaeological artifacts, newspapers, etc.);
- Fill component description (i.e., cinder, clay, metal, tires, etc.); and
- PID headspace screening results.

The descriptions will be recorded in a dedicated field notebook. The onsite geologist will also be responsible for recording the following information in the field notebook:

- Start and finish dates of drilling;
- Name and location of project;
- Project number, client, and project location;
- Sample number and depth;
- Blow counts and recovery;
- Type and size of samples;
- Depth to water;
- Type of drilling equipment;
- Size of casing;
- Documentation of any elevated organic vapor emissions;
- Names of contractor's drillers, inspectors, or people at the project area; and
- Weather conditions.

The drilling contractor will be responsible for obtaining accurate and representative samples, informing the onsite geologist of changes in drilling pressure and loss of circulation, and keeping a separate general log of soils encountered, including blow counts (i.e., the number of blows from a soil sampling drive weight [140 pounds] required to drive the split-barrel sampler in 6-inch increments) (if a split-barrel sampler is used).

V. Field Screening Procedures

Field screening will be conducted on the headspace of soil samples with a PID. A representative portion of the sample will be obtained and placed in either an approximately one pint glass "driller's jar" or a re-sealable Ziploc-type plastic bag. If a driller's jar is used, the top of the jar will be covered with aluminum foil. These samples will be screened as follows:

1. Samples will be taken to a warm workspace and allowed to equilibrate to room temperature for at least one hour.

2. Prior to measuring the soil vapor headspace concentration, the 8-ounce jar will be shaken.

3. The PID probe will be inserted into the headspace of the jar through the aluminum foil covering or into a small opening in the top of the bag; and

4. The initial (peak) readings will be recorded in the field note book.

The PID meter will be calibrated to isobutylene at a minimum frequency of once per day prior to collecting readings. The time, date, and calibration procedure must be clearly documented in the field notebook and/or the calibration log book. If at any time the PID results appear erratic or inconsistent with field observations, then the unit will be recalibrated. If calibration is difficult to achieve, then the PID's lamp should be checked for dirt or moisture and cleaned. During humid or wet conditions, the unit should be calibrated on a more frequent basis as determined by field personnel. In addition, a blank and field duplicate will be performed every 10 samples. Maintenance and calibration records will be kept as part of the field quality assurance program.

VI. Waste Management

Soil cuttings brought to the ground surface during the drilling activities will be containerized in labeled and dated new Department of Transportation- (DOT)- approved steel 55-gallon drums for subsequent off-site transportation and disposal by BBL.

VII. Procedures for Collecting Soil Samples for Laboratory Analysis

One subsurface soil sample will be collected from the sample interval immediately above the groundwater table and one subsurface soil sample will be collected from the sample interval exhibiting the highest PID measurement and/or the most visually impacted material (if encountered). If elevated PID measurements or visually impacted materials are not encountered at a soil boring location, a sample from the 5- to 7-foot sampling interval will be submitted for laboratory analysis. If more than one sample interval presents elevated PID readings and/or visual impacts, additional subsurface soil samples may be collected from the soil boring. Samples of "non-impacted' soil may also be collected below apparent "impacted" soil to aid in vertical delineation, if warranted.

Samples designated for laboratory analysis will be placed in the appropriate containers. Sample containers for volatile organic analysis will be filled first. The remaining soil will be homogenized by mixing in a stainless

steel bowl with a clean stainless steel trowel, and distributed to the appropriate sample containers. The soil samples will submitted for laboratory analysis for TCL VOCs, TCL SVOCs, and TAL inorganics (including cyanide). In addition, subsurface soil samples collected from soil borings completed within the Con Edison electrical substation parcel (Block 3827, Lot 30) will be submitted for laboratory analysis for PCBs and 50% of subsurface soil samples collected from soil borings completed within the remaining parcel will be submitted for laboratory analysis for PCBs.

VIII. Bedrock Coring Procedures

Should bedrock cores be needed, bedrock cores will be completed using an Hw-size core barrel, in accordance with ASTM D2113 Standard Practice for Diamond Core Drilling for Site Investigation. Rock cores will be obtained in the bedrock up to 10-foot lengths. Rock coring will be completed using water for cooling of apparatus (steel casing, core barrel, and the diamond bit) and to remove any cuttings that may clog the core barrel prior to its introduction into the corehole. Drill water will be recirculated through a large container (recirculation tub) to minimize water use at each location. Core samples will be placed in wood boxes and wood blocks will be labeled and placed at the end of each core run to indicate the run number. Missing sections of core will be shown by wood spacer blocks indicating the run number and footage of the missing core. The wooden core box will be labeled on the outside top and inside lid with the following information: site, date, job number, wooden box number (i.e., box 1 of 2), boring number, run number(s), and run interval(s). Additional information, such as actual recovery, rock quality degree (RQD), PID readings, and any comments, will also be recorded on the inside lid.

The geologist will be responsible for recording mechanical and geological characteristics of the rock core. The mechanical characteristics will include: penetration rates, RQD, percent recovery, water loss, and bit type and size. The retrieved rock cores will be characterized for color, rock type, grain size, bedding planes or foliation, mineralogy, fractures, nature of voids, vugs, or cavities, hardness, and degree of weathering.

IX. Survey

A field survey control program will be conducted using standard instrument survey techniques to document the soil boring/monitoring well locations to a site-specific Federal Energy Regulatory Commission (FERC) datum.

X. Equipment Cleaning

Equipment cleaning will occur prior to use on the site, between each drilling location, and upon completion of the drilling prior to leaving the site. All drilling equipment and associated tools including augers, drill rods, core barrels, sampling equipment, wrenches, and any other equipment or tools that may have come in contact with the soil will be cleaned with high-pressure/hot water cleaning equipment using a tap water source or manual scrubbing. The drilling equipment will be cleaned in an area designated by the on-site geologist. Cleaning water and residual materials will be collected and transferred to a central location for subsequent disposal. Equipment cleaning procedures are described in Section 4 of the FSP.

Attachment A-3

Attachment A-3 – Sample Packing, Handling, and Shipping Procedures

I. Introduction

This attachment presents procedures for sample handling, packaging, and shipping.

II. Equipment and Materials

- Indelible ink pens and black permanent markers
- Field book
- Chain of custody forms
- Sample labels and sample custody seals
- Clear packaging tape
- Duct tape
- Shipping labels
- Appropriate sample containers
- Sample cooler
- Ice
- Polyethylene bags (e.g., Ziploc-type bags)
- Bubble pack or vermiculite

III. Sample Handling Procedures

1. Fill in sample label (Exhibit A-3-1) with:

    a. Sample matrix (soil, groundwater, etc.);
    b. Project number and site name;
    c. Sample identification code and other sample identification information, if applicable;
    d. Analysis required;
    e. Date sampled;
    f. Time sampled;
    g. Name, affiliation, and contact phone number;
    h. Sample type (composite or grab); and
    i. Preservative added, if applicable.

2. Cover the label with clear packing tape to secure the label onto the container.

3. Check the caps on the sample containers to ensure that they are tightly sealed.

4. Mark the level of the sample in the container using an indelible ink marker or grease pencil.

5. Wrap the sample container cap with clear packing tape to prevent it from becoming loose.

6. Place a signed custody seal label (Exhibit A-3-2) over the cap such that the cap cannot be removed without breaking the custody seal.

7. Initiate chain-of-custody form (Exhibit A-3-3) by designated sampling personnel responsible for sample custody (after sampling or prior to sample packing). Note: If the designated sampling person relinquishes the samples to other sampling or field personnel for packing or other purposes, the samplers will complete the chain-of-custody form prior to transfer. The appropriate personnel will sign and date the chain-of-custody form to document the sample custody transfer.

IV. Sample Packing Procedures

1. Using duct tape, secure the outside and inside of the drain plug at the bottom of the cooler (if present) that is used for sample transport.

2. Place each sample container or package in individual polyethylene bags (Ziploc-type) and seal.

3. Place 1 to 2 inches of cushioning material at the bottom of the cooler (i.e., bubble pack or vermiculite).

4. Package the sealed sample containers upright in the cooler.

5. Repackage ice (if required) in small Ziploc-type plastic bags and place loosely in the cooler. Do not pack ice so tightly that it may prevent addition of sufficient cushioning material.

6. Fill the remaining space in the cooler with cushioning material.

7. Place the completed chain-of-custody forms in a large Ziploc-type bag and tape the forms to the inside of the cooler lid.

8. Close the lid of the cooler and fasten with duct tape.

9. Wrap strapping tape around both ends of the cooler at least twice.

10. Mark the cooler on the outside with the following information: shipping address, return address, "Fragile" labels (Exhibit A-3-4) on the top and on one side, and arrows indicating "This Side Up" (Exhibit A-3-4) on two adjacent sides.

11. Place custody seal evidence tape (Exhibit A-3-2) over front right and back left of the cooler lid and cover with clear plastic tape.

V. Sample Shipping Procedures

1. All samples will be hand delivered or delivered by an express carrier within 48 hours or less from the date of sample collection.

2. The following chain-of-custody procedures will apply to sample shipping:

   a. Relinquish the sample containers to the laboratory via express carrier. The signed and dated forms should be included in the cooler. The express carrier will not be required to sign the chain-of-custody forms. The sampler should retain the express carrier receipt or bill of lading.

   b. When the samples are received by the laboratory, the laboratory personnel shall complete the chain-of-custody forms by recording receipt of samples, measure and record the internal temperature of the

shipping container, and then check the sample identification numbers on the containers to the chain-of-custody forms.

Exhibit A-3-1

Sample Label

BBL®

an ARCADIS company

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

PROJECT #

SAMPLE I.D.

DATE

SAMPLE TYPE
☐ Soil/Sediment
☐ Water

COLLECTION MODE
☐ Composite
☐ Grab

TIME

ANALYSIS

SAMPLER(S)

PRESERVATIVE

Exhibit A-3-2

Custody Seal

BBL®

an ARCADIS company

CUSTODY SEAL

BBL

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

6723 Towpath Road, Box 66,
Syracuse, N.Y. 13214-0066
TEL (315) 446-9120

SEALED BY

_____

DATE_____**TIME**_____

Exhibit A-3-3

Chain of Custody Record

BBL®

an ARCADIS company

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

6723 Towpath Road, P.O. Box 66
Syracuse, New York 13214-0066
TEL: (315) 446-9120

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
SAMPLERS: *(Signature)*	

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	Number of Containers							REMARKS

Relinquished by: *(Signature)*	DATE	TIME	Received by: *(Signature)*	Relinquished by: *(Signature)*	DATE	TIME	Relinquished by: *(Signature)*
Relinquished by: *(Signature)*	DATE	TIME	Received by: *(Signature)*	Relinquished by: *(Signature)*	DATE	TIME	Relinquished by: *(Signature)*
Relinquished by: *(Signature)*	DATE	TIME	Received for Laboratory by: *(Signature)*	DATE	TIME	Remarks:	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

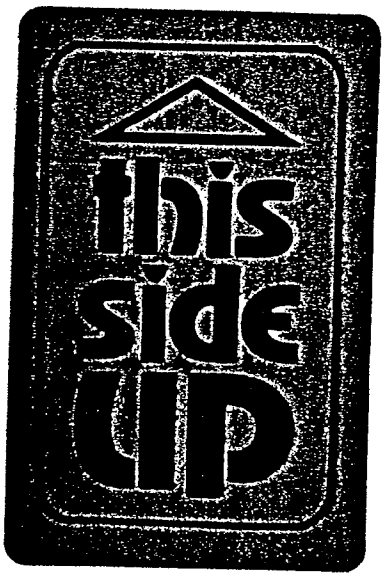
Exhibit A-3-4

Shipping Labels

BBL®

an ARCADIS company


fragile
HANDLE
WITH CARE


this
side
UP

Attachment A-4

Attachment A-4 – Test Pit Procedures

I. Introduction

This procedure presents protocols which will be used to excavate test pits at the Site. The procedures which will be utilized to excavate test pits are discussed below.

II. Equipment and Materials

The following equipment and materials will be available (as required) during the test pit excavation activities:

- Rubber-tired backhoe with bucket (supplied and operated by subcontractor)
- Appropriate personnel protective equipment (PPE) (as required by the Health and Safety Plan)
- Shovel
- Photoionization detector (PID)
- Camera
- Plastic sheeting
- Plywood
- Caution tape and stakes
- Measuring tape
- Field book
- Test pit log (Exhibit A-4-1)
- Indelible ink pens
- Site map with test pit locations

III. Area Reconnaissance

Prior to commencing test pit activities, utility markout activities will be completed as detailed in the SC Work Plan and Attachment A-1. Utility clearance borings will be excavated by non-mechanical means (i.e., hand auger, post-hole digger, and/or vacuum truck) to confirm the presence of all underground utilities identified within 5 feet from the proposed limits of each test pit location (if any). The excavation subcontractor will survey the project area to determine the presence of known utilities at the project area, especially in those areas where excavations are proposed.

IV. Test Pit Procedure

Test pits will be completed using a rubber-tired backhoe to a depth of refusal (if encountered), to the physical limits of the excavator, or until subsurface soil conditions become unstable (as determined by the onsite geologist). Subsurface soil samples will not be collected from the test pits for laboratory analysis. However, if obvious soil impacts and/or elevated headspace screening measurements are encountered, Con Edison will contact the New York State Department of Environmental Conservation (NYSDEC) to discuss requirements for collecting soil samples for laboratory analysis.

The test pits will be excavated with the backhoe in 2-foot intervals. The excavated soil will be staged on plastic sheeting or plywood adjacent to each test pit location. At each 2-foot interval, the onsite geologist will visually/manually characterize each soil interval including the following:

- Soil type
- Principal and minor components;
- Color;
- Moisture and organic content;
- Particle sizes, angularity and shape;
- Texture;
- Density/consistency;
- Plasticity of fines;
- Cohesiveness;
- Discoloration;
- Mottling/staining;
- Weathering;
- Presence/absence of MGP residuals and/or noticeable odors;
- Fill or geologic origin of deposit (local name of deposit, if known);
- Items that may indicate age of deposit (i.e., archaeological artifacts, newspapers, etc.);
- Fill component description (i.e., cinder, clay, metal, tires, etc.); and
- PID headspace screening results.

The descriptions will be recorded in a dedicated field notebook. The on-site geologist will also be responsible for recording the following information in the field notebook:

- Start and finish dates of excavations;
- Name and location of project;
- Project number, client, and project location;
- Depth to water (if any);
- Type of excavation equipment;
- Documentation of any elevated organic vapor emissions;
- Names of contractor's employees, inspectors, or people at the project area; and
- Weather conditions.

Excavated soil with obvious impacts (i.e., visible staining and/or NAPL) (if any) will be placed in new Department of Transportation- (DOT-) approved steel 55-gallon drums and/or a rolloff container prior to transportation for appropriate offsite disposal by BBL. Excavated soil that does not exhibit obvious impacts will be placed as backfill. In order to minimize the potential for backfilling activities to possibly redistribute impacted soil at the test pit locations (i.e., potential mixing of impacted soil with subsurface soil in the excavation), the following excavation/backfill techniques will be used to the extent possible:

- Soil will be excavated from each test pit in approximately 2-foot depth intervals and stockpiled adjacent to the test pit, separately for each 2-foot depth interval (i.e., 0 to 2 feet below grade, 2 to 4 feet below grade, and greater than 4 feet below grade); and

- Following completion of the test pit excavation, the test pits will be backfilled using the stockpiled soil in the reverse order that the soil was excavated. For example, if the test pit was excavated to a total depth of 5 feet below grade, soil from 4 to 5 feet below grade will be placed first, followed by soil from 2 to 4 feet and 0 to 2 feet below grade.

Following backfilling of the excavation, a labeled stake denoting the test pit number will be placed at the test pit location. Each test pit location will be photographed before, during, and after excavation. At the conclusion of the test pit activities, information recorded in the field book will be copied onto test pit logs. A sample test pit log is included as Exhibit A-4-1.

V. Survey

A field survey control program will be conducted using standard instrument survey techniques to document the test pit locations to a site-specific Federal Energy Regulatory Commission (FERC) datum.

VI. Equipment Cleaning

Equipment cleaning will occur prior to use on the site, between each test pit location, and upon completion of the test pits prior to leaving the site. The excavator bucket and any other equipment or tools that may have come in contact with the soil will be cleaned with high-pressure/hot water cleaning equipment using a tap water source or manual scrubbing. The drilling equipment will be cleaned in an area designated by the onsite geologist. Cleaning water and residual materials will be collected and transferred to a central location for subsequent disposal. Equipment cleaning procedures are described in Section 4 of the FSP.

Exhibit A-4-1

Test Pit Log

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BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Test Pit Log

Test Pit ID:

Client:		**Date/Day:**	
Project:		**Weather:**	
Location:		**Temperature:**	
Project #:		**Wind:**	
Logged By:		**Subcontractor:**	
Coordinates:		**Equipment:**	

Sketch of Test Pit Layout:

Plan View	Profile View

Test Pit Dimensions:		**Total Depth:**		**Depth to Water:**	

Depth Interval (feet)	PID Screening Result (ppm)	Description of Soil/Material	Sample(s) Collected

Notes:

Photograph Summary:

Attachment A-5

Attachment A-5 – Monitoring Well Installation and Development Procedures

I. Introduction

This attachment presents procedures for the installation and development of overburden, overburden/bedrock interface wells, and bedrock monitoring wells.

II. Overburden Monitoring Wells

Soil borings in overburden will be completed using 4¼-inch inside diameter hollow-stem auger (HSA) drilling methods prior to monitoring well completion. Soil samples will be collected following the procedures presented in Attachment A-2. Once the desired depth is reached, the drilling rods and core barrel will be removed, a two-inch diameter flush-joint threaded well screen and riser casing will be installed from the screened interval to just below grade for flush-mount wells. Well screen slot size will be 0.020 inches in width. Ten-foot-long screens will be placed to straddle the water table, if possible, without compromising the surface seal. A 2-foot long grouted sump may be attached to the bottom of the screen for potential collection of dense non-aqueous phase liquid (DNAPL), if present (or suspected).

A silica sand pack will be placed in the annular space in the screened interval and extend between 1 and 2 feet above the screen as augers are removed. A bentonite pellet or slurry seal will then be installed in the annular space a minimum of 2-feet above the sand pack to the annulus between the casing and the corehole wall for at least 2 feet. The pellet seal must be allowed to partially hydrate before placing grout above the seal. A cement-bentonite grout will then be added above the bentonite seal to approximately 1 foot below the ground surface. The grout will be placed with a tremie pipe from the bottom of the well up. The grout will be allowed to set for a minimum of 24 hours before wells are developed. A lockable cap will be placed on the riser casing and secured with a pad lock. A flush-mount curb box will be installed with the cover secured in a neat portland cement or concrete surface seal. The flush-mount curb box will be secured with a bolt-down cover.

A typical flush mount overburden monitoring well detail is shown on Exhibit A-5-1. The onsite geologist shall specify the monitoring well design to the drilling contractor before installation.

The onsite geologist is responsible for recording the construction details, as relayed by the drilling contractor and actual measurements. Both the onsite geologist and drilling contractor are responsible for tabulating all materials used. The following characteristics of each newly installed well will be recorded in the field log book:

- Date/time of construction;
- Drilling method and drilling fluid 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; and
- Detailed drawing of well (including dimensions).

An alternate monitoring well construction method can be used if the water table is within approximately 4.0 feet of the surface. If these conditions are encountered, the thickness of the sand and bentonite would be reduced as necessary and the depth of the protective casing would be modified as necessary.

III. Overburden/Bedrock Monitoring Wells

If saturated conditions are encountered just above bedrock, then a monitoring well may be installed at the overburden/bedrock interface and the screen will be placed to straddle the ground-water table. If the bedrock is sufficiently weathered or soft enough to be sampled with a split-spoon sampler, then the sampling/advancement of the borehole with HSA will continue. If refusal of the split spoon sampler or augers occurs, the boring can be advanced into the upper portion of the bedrock with a 4-inch nominal diameter tri-cone bit and rotary wash methods. Water used during advancement of the tri-cone bit will be containerized for subsequent disposal by BBL. The borehole should be advanced approximately 4 to 5 feet into bedrock so that the 10-foot long monitoring well screen will be placed across the water table surface.

Once the desired depth is reached, the drilling rods and core barrel will be removed, a two-inch diameter flush-joint threaded well screen and riser casing will be installed from the screened interval to just below grade for flush-mount wells. Well screen slot size will be 0.020 inches in width. Ten-foot-long screens will be placed to straddle the water table, if possible, without compromising the surface seal. A 2-foot long grouted sump may be attached to the bottom of the screen for potential collection of DNAPL, if present (or suspected).

Once the desired depth is reached, the drilling rods and tri-cone bit (if used) will be removed, and a 2-inch diameter PVC casing and a 10-foot long, 0.020-inch slotted PVC screen will be placed into the corehole. A silica sand pack will be placed in the annular space in the screened interval and extend between 1 and 2 feet above the screen. A bentonite pellet or slurry seal will then be installed in the annular space a minimum of 2-feet above the sand pack to the annulus between the casing and the corehole wall for at least 2 feet. A cement-bentonite grout will then be added above the bentonite seal to approximately 0.5 feet below the ground surface. A lockable cap will be placed on the riser casing and secured with a pad lock. A flush-mount curb box will be installed with the cover secured in a neat portland cement or concrete surface seal. The flush-mount curb box will be secured with a bolt-down cover.

The onsite geologist is responsible for recording the well construction details, as relayed by the drilling contractor and actual measurements. Both the on-site geologist and drilling contractor are responsible for tabulating all well materials used, such as footage of casing and bags of grout or cement.

IV. Bedrock Monitoring Wells

A bedrock monitoring well may be installed at locations where ground water is not encountered in the overburden. A typical shallow bedrock monitoring well detail is shown on Exhibit A-5-2.

Once the top of bedrock is determined by auger refusal, a permanent surface casing will be installed to minimize the possible introduction of constituents from the overburden into the bedrock during bedrock coring. The surface casing will be installed using one of two methods depending on site conditions.

If the depth to bedrock is minimal and the overburden materials not susceptible to significant collapse, the permanent casing can be installed as follows:

- Using 4-1/4-inch ID HSA, advance the augers to approximately 0.5 feet into the surface of the bedrock;
- Fill the augers with cement/bentonite grout and then withdraw the augers from the borehole, adding sufficient grout to the borehole to minimize collapse of the borehole wall;
- Install 4-inch diameter permanent casing to the total depth of the borehole (approximately 0.5 to 1.0 foot into the top of the bedrock);
- Top the grout off in the borehole. The grout in the casing can be diluted with water if desired, however, the grout at the base of the casing should not be disturbed; and
- Wait a minimum of 24 hours for the grout to set prior to drilling out the grout within the casing and initiating coring of the bedrock.

If the depth to bedrock is large and/or the overburden materials are likely to collapse into the borehole following auger removal, the permanent casing will be installed as follows:

- Using 8¼-inch ID HSA advance the augers to approximately 0.5 feet into the surface of the bedrock;
- Install the 4-inch diameter permanent casing into the auger string to the total depth of the borehole;
- Using a tremie pipe, tremie cement/bentonite grout into the annulus between the HSA and the 4-inch casing;
- Remove the HSA and maintain the level of grout in the borehole at grade. If desired dilute the grout in the casing with water, being careful not to disturb the grout at the base of the casing; and
- As above, wait a minimum of 24 hours prior to initiating coring through the permanent casing.

Coring of the bedrock through the casing will be completed as described in Attachment A-2.

Once the desired depth is reached, the drilling rods and core barrel will be removed, and a 2-inch diameter PVC casing and a 10-foot long, 10-slot PVC screen will be placed into the corehole. A silica sand pack will be placed in the annular space in the screened interval and extend between 1 and 2 feet above the screen. A bentonite pellet or slurry seal will then be installed in the annular space a minimum of 2-feet above the sand pack to the annulus between the casing and the corehole wall for at least 2 feet. A cement-bentonite grout will then be added above the bentonite seal to approximately 1 foot below the ground surface. A lockable cap will be placed on the riser casing and secured with a pad lock. A flush-mount curb box will be installed with the cover secured in a neat portland cement or concrete surface seal. The flush-mount curb box will be secured with a bolt-down cover.

The onsite geologist shall specify the monitoring well design to the drilling contractor before installation. The onsite geologist is responsible for recording the exact well details, as relayed by the drilling contractor, and measuring the actual details. Both the onsite geologist and drilling contractor are responsible for tabulating all well materials used, such as footage of casing and bags of grout or cement.

V. Well Development

Monitoring wells will be developed a minimum of 24 hours following installation to promote hydraulic connectivity with the surrounding formation. Prior to monitoring well development, each monitoring well will be checked for the presence of a floating non-aqueous phase liquid (NAPL) by checking the water table surface with an oil/water interface probe or a translucent bailer. If a separate phase is present, an attempt will be made to remove the NAPL prior to development. In addition, if a separate phase is present, efforts will be made to avoid significantly drawing the water table down in the well (and, thus avoid redistributing the separate phase to locations below the water table). These efforts will be contingent on the capacity of the formation to yield water to the monitoring well.

Development can be accomplished by surging and evacuating water by bailing, however, development using an inertial-type pump (Watera pump) is recommended. The well will be developed until turbidity is reduced to the goal of 50 nephelometric turbidity units (NTUs) or less, or until relatively constant pH and conductivity measurements are obtained. A turbidity meter with a scale of 0-1000 NTUs will be used to monitor improvement in well development with respect to turbidity.

Materials for well development include:

- Appropriate PPE (as required by the Health and Safety Plan)
- Appropriate Cleaning Equipment
- Bottom Loading Bailer
- Polypropylene Rope
- Plastic Sheeting
- Nephelometer
- pH/conductivity meter
- Thermometer
- Disposable Gloves
- Keys to wells
- PID to measure headspace vapors
- Pump/tubing/foot valve/surge block
- Generator

The procedures for monitoring well development using a pump are described below:

1. Don appropriate PPE (as required by the HASP).

2. Place plastic sheeting around the well.

3. Clean all equipment entering each monitoring well.

4. Open the well cover while standing upwind of the well; remove well cap. Insert PID probe approximately 4 to 6 inches into the casing or the well headspace and cover with gloved hand. Record the PID reading in the

field notebook. If the well headspace reading is less than 5 ppm, proceed; if the headspace reading is greater than 5 ppm, screen the air within the breathing zone. If the PID reading in the breathing zone is below 5 ppm, proceed. If the PID reading is above 5 ppm, move upwind from well for 5 minutes to allow the volatiles to dissipate. Repeat the breathing zone test. If the reading is still above 5 ppm, don the appropriate respiratory protection in accordance with the requirements of the HASP. Record all PID readings.

5. Lower a surge block into the screened portion of the well on a rigid pipe or high-density tubing and cycle up and down to force water in and out of the screen slots and formation. After surging the well, formation water will be removed by pumping or bailing. Surging and bailing will be performed for 30 to 60 minutes.

6. If well runs dry, shut off pump and allow well to recover.

7. Contain all water in appropriate containers.

8. When complete, secure the lid back on the well.

9. Place plastic sheeting and tubing in plastic bags for appropriate disposal and clean pump.

The procedures for developing a well using the bailer method are outlined below:

1. Don appropriate PPE (as required by the HASP).

2. Place plastic sheeting around the well.

3. Clean bailers and new rope.

4. Open the well cover while standing upwind of the well. Remove well cap and place on the plastic sheeting. Insert PID probe approximately 4 to 6 inches into the casing or the well headspace and cover with gloved hand. Record the PID reading in the field notebook. If the well headspace reading is less than 5 ppm, proceed; if the headspace reading is greater than 5 ppm, screen the air within the breathing zone. If the breathing zone reading is less than 5 ppm, proceed. If the PID reading in the breathing zone is above 5 ppm, move upwind from well for 5 minutes to allow the volatiles to dissipate. Repeat the breathing zone test. If the reading is still above 5 ppm, don appropriate respiratory protection in accordance with the requirements of the site HASP. Record all PID readings.

5. Determine depth of well by examining drilling log data and measuring a length of rope at least 10 feet greater than the total depth of the well.

6. Secure one end of the rope to the well casing and secure the other end to the bailer. Test the knots and make sure the rope will not loosen. Check bailers to be sure all parts are intact and will not be lost in the well.

7. Lower bailer into well until bailer reaches the bottom of the well.

8. Surge/purge by raising and lowering the bailer at 2-foot intervals at least 10 times.

9. Contain all water in appropriate containers.

10. Lower bailer back into the well and repeat surging/purging at an interval 2 feet above the previous interval.

11. Repeat Steps 8 and 9 until entire screen has been surged/purged and the purge water is relatively clear of silt.

12. Upon completing well surging, remove bailer and remove the rope from the bailer and the well.

13. Secure lid on well.

14. Place plastic sheeting and polypropylene rope in plastic bags for appropriate disposal and clean bailer.

All development water will be contained in new closed topped DOT-approved steel 55-gallon drums to be provided by BBL or the drilling subcontractor.

VI. Survey

A field survey control program will be conducted by a licensed surveyor using standard instrument survey techniques to document the well location, ground elevation, inner casing elevation, and outer casing elevation of the wells relative to a site-specific datum.

Exhibit A-5-1

Typical Flush Mount Monitoring Well

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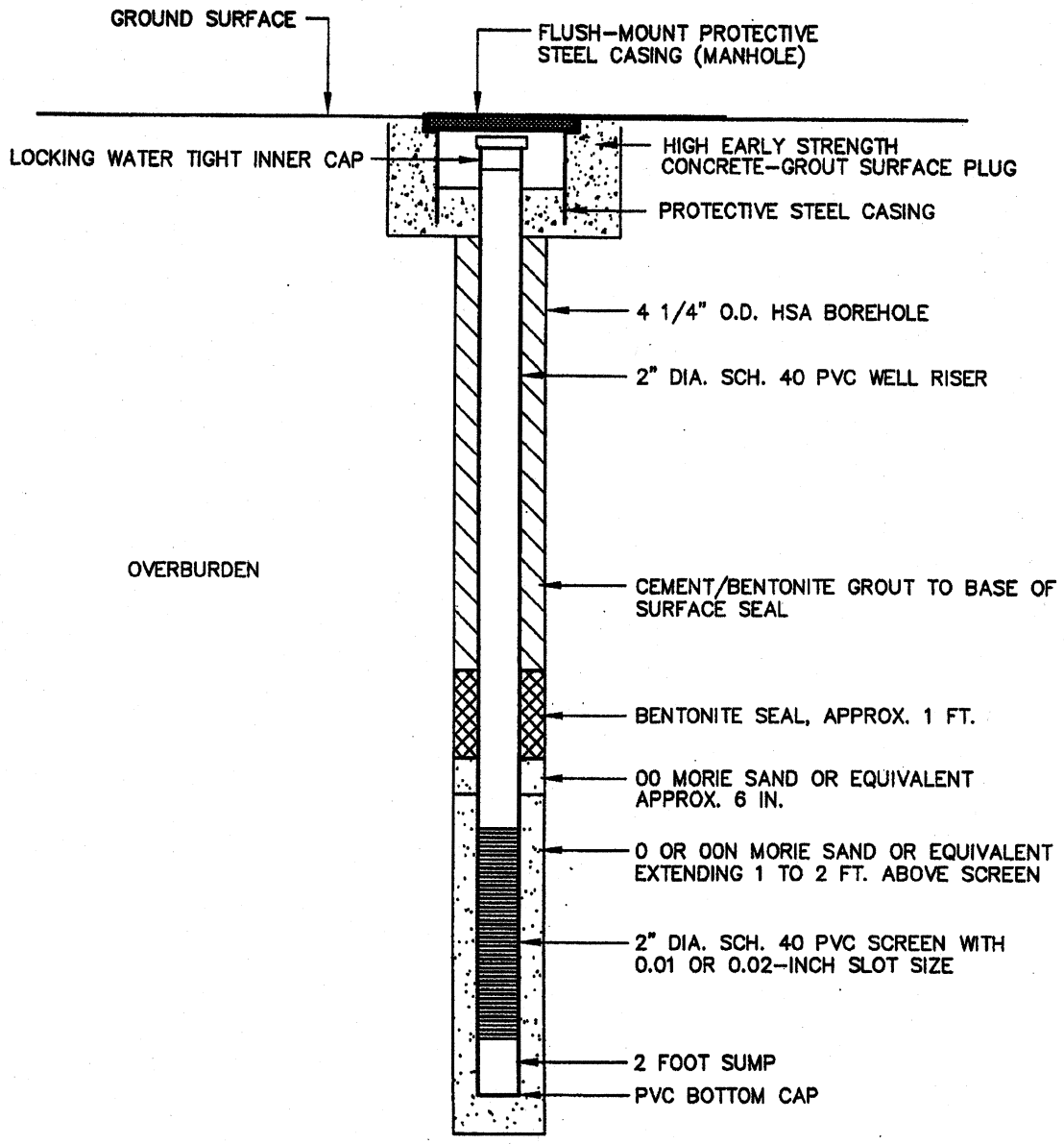


(DRAWING NOT TO SCALE)

PROPOSED SINGLE-CASED MONITORING WELL CONSTRUCTION SCHEMATIC

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

FIGURE

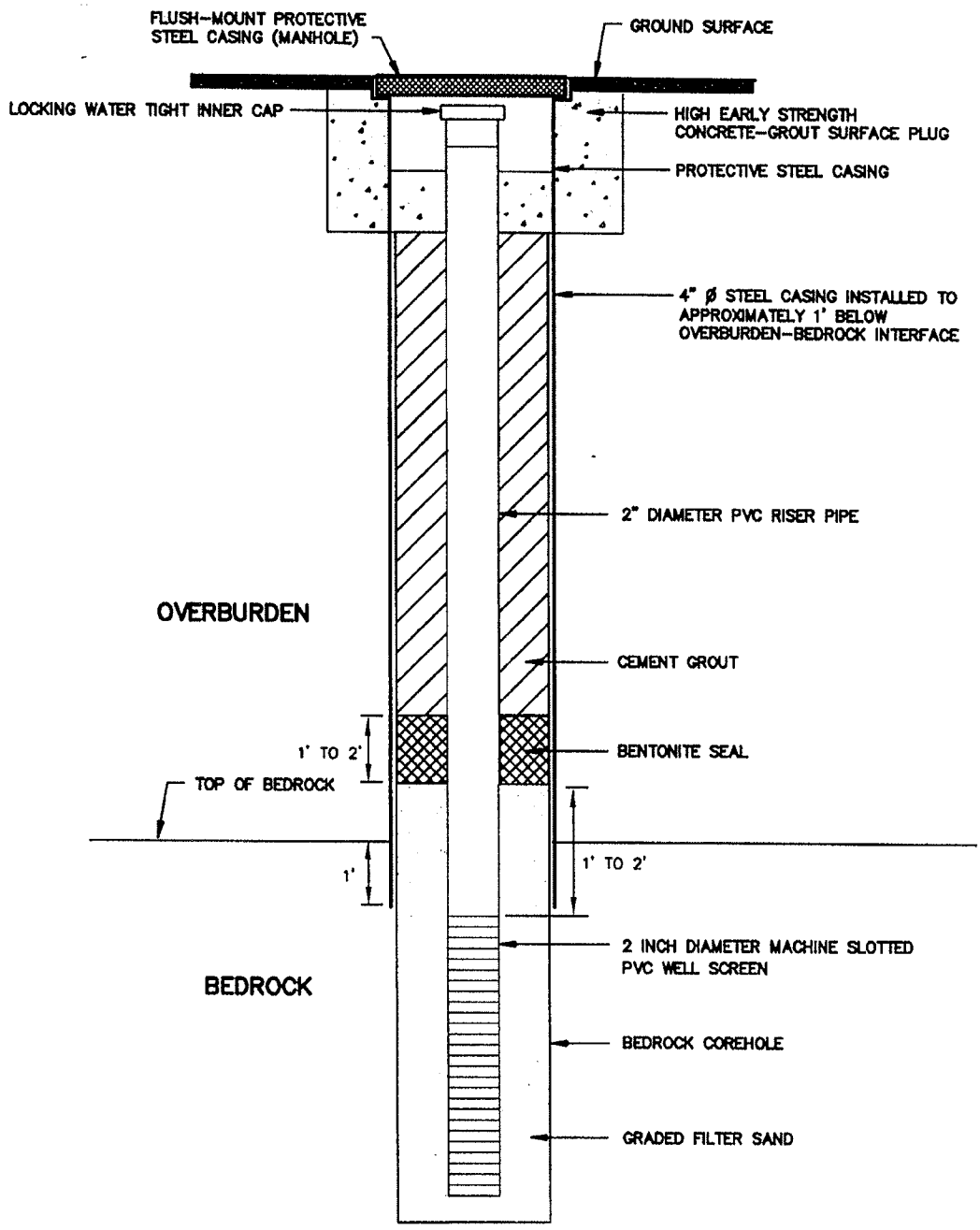
X: NONE
L: ON=*, OFF=REF*
2/15/05 SYR-S4-RCB
13055001/13055805.DWG

Exhibit A-5-2

Typical Shallow Bedrock Monitoring Well

BBL®

an ARCADIS company



NOT TO SCALE

FLUSH-MOUNT SHALLOW BEDROCK MONITORING WELL CONSTRUCTION DETAIL

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE

P: STD-PCP/AP
5/23/00 DIV54 RCB
36458001/36458W03.dwg

Attachment A-6

Attachment A-6 – Fluid Level Measurement and Sampling Procedures for Monitoring Wells

I. Introduction

This attachment describes the procedures to be used to measure water levels in monitoring wells and collect groundwater samples. No wells will be sampled until well development has been performed in accordance with Attachment A-5. During precipitation events, groundwater sampling will be discontinued until precipitation ceases. When a round of water levels is taken for the purpose of generating water elevation data, the water levels will be taken consecutively at one time prior to sampling or other activities.

II. Materials

The following materials, as required, shall be available during groundwater sampling:

- Sample pump
- Sample tubing
- Power source (i.e. generator)
- Photoionization detector (PID)
- Appropriate PPE (as required by the Health and Safety Plan)
- Plastic sheeting
- Dedicated or disposable bailers
- Polypropylene rope
- Buckets to measure purge water
- Water level probe
- 6' rule with gradation in hundredths of a foot
- Conductivity/temperature meter
- pH meter
- Turbidity meter
- DO meter
- ORP meter
- Hacksaw
- Appropriate water sample containers
- Appropriate blanks (trip blank supplied by the laboratory)
- Appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials
- Groundwater sampling logs (Exhibit A-6-1)
- Chain-of-Custody forms
- Indelible ink pens
- Site map with well locations and groundwater contours maps
- Peristaltic pump and dedicated tubing
- Keys to wells

III. Procedures

The procedures to measure water levels and sample monitoring wells will be as follows:

1. Review materials check list (Part II) to ensure the appropriate equipment has been acquired.

2. Identify the site name and well ID on sampling log sheets, along with date, arrival time, and weather conditions. Identify the personnel and equipment utilized and other pertinent data requested on the groundwater sampling field log (Exhibit A-6-1).

3. Label the sample containers as described in Section 3.0 and Attachment A-3. Cover the sample label with clear packaging tape to secure the label to the container.

4. Don safety equipment, as required in the Health and Safety Plan.

5. Place plastic sheeting adjacent to well to use as a clean work area.

6. Establish the background reading with the PID and record the reading on the groundwater sampling field log (Exhibit A-6-1). If the well headspace reading is less than 5 ppm, proceed; if the well headspace reading is greater than 5 ppm, screen the air within the breathing zone. If the PID reading in the breathing zone is below 5 ppm, proceed. If the PID reading is above 5 ppm, move upwind from the well for 5 minutes to allow the volatiles to dissipate. Repeat the breathing zone test. If the reading is still above 5 ppm, don appropriate respiratory protection in accordance with the requirements of the HASP.

7. Remove lock from well and if rusted or broken replace with a new brass lock (with similar key).

8. Unlock and open the well cover while standing upwind of the well. Remove well cap and place on the plastic sheeting. Insert PID probe in the breathing zone above the well casing following instructions in the Health and Safety Plan.

9. Set out on plastic sheeting the dedicated or disposable sampling device and meters.

10. Prior to sampling, measure the depth to groundwater in each monitoring well and the depth to the bottom of each monitoring well. The depth to groundwater (and depth to the bottom of the well) will be determined using an electric water level probe. If a reference point on the well casing is not found, initiate a reference point by notching the inner casing (or outer if necessary) with a hacksaw. All downhole measurements will be taken from one reference point established at each well. Measurements will be recorded to the nearest hundredth of a foot, along with the height of the inner and outer casings from the reference point to ground level. The measurements and reference point will be recorded on a sampling log sheet. Clean the well probe before and after each use with a soapy (Alconox) water wash and a tap water rinse. [Note: water levels will be measured at all wells prior to initiating any sampling activities].

11. When checking the depth to groundwater in each well, check the water level probe for evidence of LNAPL. If LNAPL is determined not to be present at the well, the well will be purged. If LNAPL is found in the well, a groundwater sample will not be collected.

12. Pump, safety cable, tubing, and electrical lines will be lowered slowly into the well to a depth corresponding to the center of the saturated screen section of the well, or at a location determined to either be a preferential flow path, or zone where contamination is present. The pump intake must be kept at least two feet above the bottom of the well to prevent mobilization of any sediment present in the bottom of the well.

13. Measure the water level again with the pump in well before starting the pump. Start pumping the well at 200 to 500 milliliters per minute. Ideally, the pump rate should cause little or no water level drawdown in the well (less than 0.3 feet and the water level should stabilize). The water level should be monitored every three to five minutes (or as appropriate) during pumping. Care should be taken not to cause 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 collection of samples.

14. During purging of the well, monitor the field indicator parameters (pH, conductivity, dissolved oxygen, temperature, oxidation/reduction potential, turbidity, etc.) every three to five minutes (or as appropriate). Groundwater samples will be collected for laboratory analysis following the stabilization of field parameters and the reduction of turbidity levels in the groundwater to less than 50 nephelometric turbidity units (NTUs). For the purpose of the SC investigation, the field parameters will be considered to have stabilized after three consecutive readings are within the following values:

    - pH: ± 0.1;
    - Conductivity: ± 3%;
    - Oxidation/Reduction Potential (ORP): ± 10 mV;
    - Dissolved Oxygen: ± 10%; and
    - Turbidity: less than 50 NTU.

    If the field parameters have not stabilized after a reasonable effort has been made during the well purging, a sample will be collected based on the judgment of the field personnel. If the field parameters have stabilized, but the turbidity of the groundwater is not less than the 50 NTU goal, the pump flow rate will be decreased to no more than 100 mL/min, and additional purging will be conducted. The purging will continue until the 50 NTU turbidity goal is achieved or, if not possible, until reasonable effort has been made to reduce the turbidity to less than 50 NTUs.

15. After the appropriate purge volume of groundwater in the well has been removed, obtain the groundwater sample for analysis from the sampling device. Groundwater samples will be placed directly into the appropriate containers. When sampling for volatiles, collect water samples directly from a bottom-loading bailer into 40-mL vials with Teflon-lined septa. The bailer will be slowly lowered into the screened portion of the well to retrieve a filled bailer from the well causing minimal disturbance to the water and any sediments in the well. Groundwater sample containers will be collected in the following order:

    a. VOCs
    b. SVOCs
    c. metals and cyanide
    d. others

16. Secure the caps on the sample containers. Place the sample containers on ice in an insulated transport container provided by the laboratory.

17. After all sampling containers have been filled, remove an additional volume of groundwater. Check the calibration of the meters and then measure and record on the field log physical appearance, pH, conductivity, dissolved oxygen, temperature, and turbidity.

18. If using a dedicated bailer, replace dedicated bailer in the well and replace the well cap and lock well.

19. Record the time sampling procedures were completed on the field logs.

20. Place all disposable sampling materials (plastic sheeting, disposable bailers, and health and safety equipment) in appropriately labeled containers.

21. Complete the procedures for packaging, shipping, and handling (see Attachment A-3).

22. If new locks were installed, forward copies of the keys to the Project Manager (PM) at the end of the sampling activities.

Exhibit A-6-1

Groundwater Sampling Log

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Site

Event

GROUND-WATER SAMPLING LOG

Sampling Personnel: Well ID:

Client / Job Number: Date:

Weather: Time In: Time Out:

Well Information

Depth to Water:	(feet)	(from MP)
Total Depth:	(feet)	(from MP)
Length of Water Column:	(feet)	
Volume of Water in Well:	(gal)	
Three Well Volumes:	(gal)	

Well Type:	Flushmount		Stick-Up
Well Material:	Stainless Steel		PVC
Well Locked:		Yes	No
Measuring Point Marked:		Yes	No
Well Diameter:	1"	2"	Other:

Purging Information

Purging Method:	Bailer	Peristaltic	Grundfos	Other:
Tubing/Bailer Material:	St. Steel	Polyethylene	Teflon	Other:
Sampling Method:	Bailer	Peristaltic	Grundfos	Other:
Duration of Pumping:	(min)			
Average Pumping Rate:	(ml/min)	Water-Quality Meter Type:		
Total Volume Removed:	(gal)	Did well go dry:	Yes	No

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Unit Stability			
pH	DO	Cond.	ORP
± 0.1	± 10%±	3.0%	± 10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)									
Rate (mL/min)									
Depth to Water (ft.)									
pH									
Temp. (C)									
Conductivity (mS/cm)									
Dissolved Oxygen									
ORP (mV)									
Turbidity (NTU)									
Notes:									

Sampling Information

Analyses	#	Laboratory
Sample ID:	Sample Time:	
MS/MSD: Yes	No	
Duplicate: Yes	No	
Duplicate ID	Dup. Time:	
Chain of Custody Signed By:		

Problems / Observations

Attachment A-7

Attachment A-7 – Specific Capacity Testing Procedures

I. Introduction

Specific capacity tests will be conducted to estimate the transmissivity of the geologic formation immediately surrounding the screened or open interval of monitoring wells. This test consists of pumping water from a well at a constant rate and quantifying the pumping rate and the magnitude of groundwater drawdown inside the well after a known pumping duration.

The transmissivity of the geologic formation is calculated based on the following:

- Observed test pumping rates;
- Drawdown measured immediately before the end of pumping;
- Pumping duration;
- The effective radius of the monitoring well; and
- The estimated storativity of the aquifer.

II. Materials

- Appropriate PPE (as required by the Health and Safety Plan);
- A pump (preferably submersible) equipped with a discharge line capable of pumping at a controlled rate between less than one gallon and 10 gallons per minute;
- A power source for the pump;
- A calibrated in-line totalizing flow meter or two graduated buckets;
- An electronic water-level indicator and extra batteries;
- Waterproof marker;
- Engineers rule;
- Cleaning supplies including non-phosphate laboratory grade detergent (Alconox or equivalent), solvents (pesticide grade methanol or hexane), brushes, buckets, tap water, aluminum foil, plastic sheeting, etc.
- Garbage bags;
- Disposable gloves;
- Flashlight;
- Stopwatch; and
- Field notebook.

III. Procedures

1. Identify the site name and well ID in the field notebook along with the date, time, personnel, and weather conditions.

2. Make sure that all equipment that enters the well is cleaned before use (i.e., pump, cable, water level probe, etc.). Use new, clean materials when cleaning is not appropriate (polypropylene rope, disposable gloves, etc.). Document cleaning procedures in field notebook.

3. Place cleaned equipment and instruments on plastic sheeting near the well.

4. Measure the static water level of the well with a water level indicator to the nearest 0.01 feet relative to a specified datum at the top of the well casing. Record the water level and the time of measurement in the field notebook.

5. Calculate the depth to water corresponding to a drawdown of two feet. Ideally, the drawdown during a specific capacity test should not exceed three feet. Excessive drawdown may cause inefficient flow to the well and may cause an error to the transmissivity calculation.

6. Lower the pump to approximately five feet below the static water level, or within no less than one foot of the bottom of the well (to minimize sediment mobilization). Once the pump is in place, the water level in the well should be monitored until it has returned to within 0.01 feet of the static water level.

7. Hold the water level probe in the well just above the surface of the static water level. If an in-line totalizing flow meter is used, record the pre-test volume measurement in the field notebook. If no in-line flow meter is available, place the end of the discharge line from the pump in one of the two calibrated buckets. Record the total capacity of each bucket.

8. Simultaneously start the pump and the stop watch. Record the start time.

9. Immediately begin monitoring the water level in each well. If the drawdown rapidly approaches or passes the maximum suggested drawdown of two feet, reduce the pumping rate until the drawdown is approximately 0.5 to 1.0 feet. All pumping rate adjustments should be completed within one or two minutes of the beginning of pumping, after which, no adjustment should be made other than minor adjustments that may be necessary to maintain a steady pumping rate.

10. Continue to pump for at least 20 minutes, recording the water level every two minutes and field parameters every five minutes throughout the test. If an in-line flow meter is used, record the volume measurement on the totalizer gauge approximately every two minutes during the test. If calibrated buckets are used to measure the pumping rate, record the time which the bucket reaches its known, recorded volumetric capacity. Transfer the discharge line to the other empty bucket and record the time when it becomes full. Repeat this process for the duration of the test.

11. Pumping should continue for no less than 20 minutes. A longer pumping period may provide a slightly more reliable transmissivity estimate. Immediately prior to termination of pumping, record the final water level measurement plus the time of measurement.

12. Calculate and record the total volume of groundwater removed from the well during the test, and the total duration of the test. Divide the total volume (in gallons) by the total pumping duration (in minutes) to calculate and record the average test pumping rate (in gallons per minute).

13. Reduce the data obtained from the specific capacity test using the specific capacity test reduction spreadsheet program (QSTRANS) developed by BBL. QSTRANS iteratively solves for the value of transmissivity in the equation (Walton 1962):

    $$Q/s = T / [264 \log(Tt/2693rw2S) - 65.5]$$

    where:
    Q = Average test pumping rate in gallons per minute;
    s = Groundwater drawdown (in feet) within well after a known duration of pumping (t);

(Q/s = Specific capacity of the well in gallons per minute per foot;)
T = Transmissivity of the geologic formation surrounding the intake of the well (in square feet per minute);
S = Estimated storativity of the aquifer (unitless);
rw = Effective radius of the well (feet); and
t = Time between the start of pumping and the time when drawdown is measured (minutes).

For confined aquifers an estimated storativity of 0.0001 should be used. For a specific capacity test of less than one hour duration within an unconfined aquifer, an estimated storativity of 0.01 should be used.

To calculate the estimated hydraulic conductivity for the formation surrounding the well, the estimated transmissivity is divided by the thickness of the water-bearing zone adjacent to the intake of the monitoring well.

Attachment A-8

Attachment A-8
Ambient Air Sampling and Analysis

I. Scope and Application

This Standard Operating Procedure (SOP) describes the procedures to collect ambient air samples for the analysis of volatile organic compounds (VOCs) using United States Environmental Protection Agency (USEPA) Method TO-15 (TO-15). The TO-15 method uses a 6-liter SUMMA® passivated stainless steel canister. An evacuated SUMMA® canister (less than 28 inches of mercury) will provide a recoverable whole-gas sample of approximately 5.5 liters when allowed to fill to a vacuum of 2 inches of mercury. The whole-air sample is then analyzed for VOCs using a quadrupole or ion-trap gas chromatograph/mass spectrometer (GS/MS) system to provide compound detection limits of 0.5 parts per billion volume (ppbv).

The following sections list the necessary equipment and provide detailed instructions for placing the sampling device and collecting ambient air samples for VOC analysis.

II. Personnel Qualifications

Field sampling personnel will have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, site-specific training, first aid, and cardiopulmonary resuscitation (CPR), as needed. Field sampling personnel will be well versed in the relevant SOPs and possess the required skills and experience necessary to successfully complete the desired field work. Personnel responsible for leading ambient air sample collection activities must have previous ambient air sampling experience.

III. Equipment List

The equipment required for ambient air sample collection is presented below:

- 6-liter, stainless steel SUMMA® canisters (order at least one extra, if feasible);
- Flow controllers with in-line particulate filters and vacuum gauges (flow controllers are pre-calibrated by the laboratory to a specified sample duration [e.g., 2-hour]). Confirm with lab that flow controller comes with in-line particulate filter and pressure gauge (order an extra set for each extra SUMMA® canister, if feasible);
- Appropriate-sized open-end wrench (typically 9/16-inch);
- Chain-of-custody (COC) form;
- Field notebook;
- Sampling summary form;

- Camera; and

- Ladder or similar to hold canister above the ground surface (optional).

IV. Cautions

Care must be taken to minimize the potential for introducing interferences during the sampling event. As such, care must be taken to keep the canister away from public roadways to prevent collection of automobile source pollutants (unless this is the objective of the study). Care must also be taken to keep the canister away from heavy pedestrian traffic areas (e.g., main entranceways, walkways). If the canister is not to be overseen for the entire sample duration, precautions should be taken to maintain the security of the sample (e.g., do not place in areas regularly accessed by the public, fasten the sampling device to a secure object using lock and chain, label the canister to indicate it is part of a scientific project, place the canister in secure housing that does not disrupt the integrity/validity of the sampling event). Sampling personnel should not handle hazardous substances (such as gasoline), permanent marking pens, or smoke cigarettes before and/or during the sampling event.

Care should also be taken to ensure that the flow controller is pre-calibrated to the proper sample collection time (confirm with laboratory). Sample integrity is maintained if the sampling event is shorter than the target duration, but sample integrity can be compromised if the event is extended to the point that the canister reaches atmospheric pressure.

V. Health and Safety Considerations

Field sampling equipment must be carefully handled to minimize the potential for injury and the spread of hazardous substances.

VI. Procedures

Preparation of SUMMA®-Type Canister and Collection of Sample

1. Record the following information in the field notebook (contact the local airport or other suitable information source [e.g., weatherunderground.com] to obtain the following information):

    - ambient temperature;
    - barometric pressure; and
    - relative humidity.

2. Choose the sample location in accordance with the sampling plan. If a breathing zone sample is required, place the canister on a ladder, tripod, or other similar stand to locate the canister orifice 3 to 5 feet above ground. If the canister will not be overseen for the entire sampling period, secure the canister as appropriate (e.g., lock and chain).

3. Record SUMMA® canister serial number and flow controller number in the field notebook and COC. Assign sample identification on canister ID tag and record in the field notebook, sampling summary form, and COC.

4. Remove the brass dust cap from the SUMMA® canister. Attach the flow controller with in-line particulate filter and vacuum gauge (leave swage-lock cap on the vacuum gauge during this procedure) to the SUMMA® canister with the appropriate wrench. Tighten with fingers first, then gently with the wrench.

5. Open the SUMMA® canister valve to initiate sample collection. Record the date and local time (24-hour basis) of valve opening in the field notebook, sampling summary form, and COC.

6. Record the initial vacuum pressure in the SUMMA® canister in the field notebook and COC. If the initial vacuum pressure does not register less than -28 inches of Hg, then the SUMMA® canister is not appropriate for use and another canister should be used.

7. Take a photograph of the SUMMA® canister and surrounding area.

Termination of Sample Collection

1. Arrive at the SUMMA® canister location at least 10 to 15 minutes prior to the end of the sampling interval.

2. Stop collecting the sample when the canister vacuum reaches approximately 2 inches of Hg (leaving some vacuum in the canister provides a way to verify if the canister leaks before it reaches the laboratory) or when the desired sample time has elapsed.

3. Record the final vacuum pressure. Stop collecting the sample by closing the SUMMA® canister valve. Record the date and local time (24-hour basis) of valve closing in the field notebook, sampling summary form, and COC.

4. Remove the particulate filter and flow controller from the SUMMA® canister, re-install brass plug on canister fitting, and tighten with wrench.

5. Package the canister and flow controller in the shipping container supplied by the laboratory for return shipment to the laboratory. The SUMMA® canister does not require preservation with ice or refrigeration during shipment.

6. Complete the appropriate forms and sample labels as directed by the laboratory (e.g., affix card with string).

7. Complete COC and place requisite copies in shipping container. Close shipping container and affix custody seal to container closure. Ship to laboratory (via overnight carrier [e.g., Federal Express]) for analysis.

VII. Waste Management

Other than temporarily staging excavated soil on plastic for locations with no concrete slab, no specific waste management procedures are required.

VIII. Data Recording and Management

Measurements will be recorded in the field notebook at the time of measurement, with notations of project name, sample date, sample start and finish times, sample location (e.g., GPS coordinates if available), canister serial number, flow controller number, initial vacuum reading, and final vacuum reading. Field sampling summary forms and COC records will be transmitted to the Project Manager.

IX. Quality Assurance

Ambient air sample analysis will be performed using USEPA Method TO-15. This method uses a quadrupole or ion-trap GC/MS with a capillary column to provide optimum detection limits. The GC/MS system requires a 1-liter gas sample (which can easily be recovered from a 6-liter canister) to provide a 0.5 ppbv detection limit. The 6-liter canister also provides several additional 1-liter samples in case subsequent re-analyses or dilutions are required. This system also offers the advantage of the GC/MS detector, which confirms the identity of detected compounds by evaluating their mass spectra in either the SCAN or SIM mode.

Administering Tracer Gas

When collecting subsurface vapor samples, a tracer gas serves as a quality assurance/quality control device to verify the integrity of the vapor probe seal. Without the use of a tracer, verification that a soil vapor sample has not been diluted by surface air is difficult.

Depending on the nature of the contaminants of concern, a number of different compounds can be used as a tracer. Typically, sulfur hexafluoride (SF6) or helium are used as tracers because they are readily available, have low toxicity, and can be monitored with portable measurement devices. Butane and propane (or other gases) could also be used as a tracer in some situations. The protocol for using a tracer gas is straightforward: simply enrich the atmosphere in the immediate vicinity of the area where the probe intersects the surface with the tracer gas, and measure a vapor sample from the probe for the presence of high concentrations (> 10%) of the tracer. A cardboard box, plastic pail, or even a plastic bag can serve to keep the tracer gas in contact with the probe during the testing.

There are two basic approaches to testing for the tracer gas:

1. Include the tracer gas in the list of target analytes reported by the laboratory; or

2. Use a portable monitoring device to analyze a sample of soil vapor for the tracer prior to and after sampling for the compounds of concern. (Note that the tracer gas samples can be collected via syringe, Tedlar bag, etc. They need not be collected in SUMMA® canisters or minicans.)

The advantage of the second approach is that the real time tracer sampling results can be used to confirm the integrity of the probe seals prior to formal sample collection.

Because minor leakage around the probe seal should not materially affect the usability of the soil vapor sampling results, the mere presence of the tracer gas in the sample should not be a cause for alarm. Consequently, portable field monitoring devices with detection limits in the low ppm range are more than adequate for screening samples for the tracer. If high concentrations (> 10%) of tracer gas are observed in a sample, the probe seal should be enhanced to reduce the infiltration of ambient air.

During the initial stages of a subsurface vapor sampling program, tracer gas samples should be collected at each of the sampling probes. If the results of the initial samples indicate that the probe seals are adequate, the project manager can consider reducing the number of locations at which tracer gas samples are used. At a minimum, at least 10% of the subsequent samples should be supported with tracer gas analyses. When using permanent soil vapor probes as part of a long-term monitoring program, annual testing of the probe integrity is recommended. Where temporary probes are used, tracer gas should be used at every sampling location, every time.

Project Analyte List

I. TO-15 Analyte List (at a minimum, the following analytes will be reported by the laboratory)

Analyte	Reporting Limit (ppbv)	Analyte	Reporting Limit (ppbv)
Dichlorodifluoromethane	0.5	Toluene	0.5
Chloromethane	0.5	1,2-Dibromomethane	0.5
Dichlorotetrafluoroethane	0.5	Tetrachloroethene	0.5
Vinyl Chloride	0.5	Chlorobenzene	0.5
Bromomethane	0.5	Ethylbenzene	0.5
Chloroethane	0.5	Styrene	0.5
Trichlorofluoromethane	0.5	1,1,2,2-Tetrachloroethane	0.5
1,1-Dichloroethene	0.5	m,p-Xylene	0.5
Methylene Chloride	0.5	o-Xylene	0.5
Trichlorotrifluoroethane	0.5	1,3,5-Trimethylbenzene	0.5
1,1-Dichloroethane	0.5	1,2,4-Trimethylbenzene	0.5
Cis-1,2-Dichloroethene	0.5	1,3-Dichlorobenzene	0.5
Chloroform	0.5	1,4-Dichlorobenzene	0.5
1,2-Dichloroethane	0.5	1,2-Dichlorobenzene	0.5
1,1,1-Trichloroethane	0.5	1,2,4-Trichlorobenzene	0.5
Benzene	0.5	Hexachlorobutadiene	0.5
Carbon Tetrachloride	0.5	Naphthalene	0.5
1,2-Dichloropropane	0.5	1,1,2-Trichloroethane	0.5
Cis-1,3-Dichloropropene	0.5	Trichloroethene	0.5
Trans-1,3-Dichloropropene	0.5		
n-alkanes:		**Other:**	
n-butane	0.5	Isopropyl benzene	0.5
pentane	0.5		
n-hexane	0.5		
n-heptane	0.5		
n-octane	0.5		
nonane	0.5		
n-decane	0.5		
n-undecane	0.5		
n-dodecane	0.5		

II. The Following will be Reported as Tentatively Identified Compounds (TICs):

Branched alkanes:	**Other:**
Isopentane	indane
2,3-Dimethylpentane	indene
2-Methylpentane	1,2,3-trimethylbenzene
	thiopenes
	isooctane

Attachment A-9

Photovac MicroTIP Photoionization Detector Calibration, Operation, and Maintenance Procedures

BBL®
an ARCADIS company

Attachment A-9 – Photovac MicroTIP Photoionization Detector Calibration, Operation and Maintenance Procedures

I. Introduction

The MicroTIP measures relative total concentrations of organic and inorganic vapors in the field and will be calibrated daily prior to use. The MicroTIP does not carry an Intrinsic Safety Rating and will be used in a controlled environment only. The MicroTIP will be used to screen soil samples, the head space of soil/water samples, and to monitor the breathing and work zones as specified in the Health and Safety Plan.

II. Materials

- Photovac MicroTIP (PID);
- Isobutylene calibration gas tank with pressure regulator and up to four other selected span gases;
- Zero span gas (clean outdoor air or zero grade gas);
- Gas sampling bag with plastic tubing to connect PID probe to calibration gas;
- Flow regulator; and
- Calibration and maintenance log (Exhibit A-8-1).

III. Calibration Procedures

1. Turn on the MicroTIP and monitor the ambient air. If there is any doubt of the air quality, then zero grade gas will be obtained.

2. Connect the regulator to the span gas cylinder. Hand-tighten the fittings.

3. Open the valve on the gas bag by turning the valve stem fully counterclockwise.

4. Attach the gas bag to the regulator. Hand-tighten the fittings.

5. Turn the regulator knob counterclockwise half a turn to start the gas flow.

6. Fill the gas bag half full and then close the regulator fully clockwise to turn off the flow of gas.

7. Fill the gas bag, and then turn the valve clockwise.

8. Press "CAL" and expose MicroTIP to zero gas. Press "ENTER" and MicroTIP sets its zero point.

9. MicroTIP then asks for the Span Gas concentration. Enter the known Span Gas concentration and then expose the MicroTIP to the Span Gas.

10. Press "ENTER" and MicroTIP sets its response factor.

11. When MicroTIP's display reverts to normal, the MicroTIP is calibrated and ready to use. Remove the Span Gas from the inlet.

12. After seven hours of use, recharge the battery pack. Record the time the battery pack was charged on the MicroTIP Calibration and Maintenance Log.

13. Record the date, time, your initials, calibration gas, and concentration on the Calibration and Maintenance Log (Exhibit A-8-1).

IV. Operation Procedures

1. Use the health and safety equipment as required by the Health and Safety Plan.

2. Calibrate the instrument as described above.

3. Measure and record the background PID reading.

4. If the PID will be used for more than seven hours during optimal weather conditions (50º or greater), or during extreme cold or precipitation, have a fully charged battery available for use.

5. In the event of precipitation, fully cover the instrument, leaving the probe accessible for measurements.

6. Measure and record PID reading.

V. Maintenance Procedures

1. At the end of each day or when the battery is fully discharged, recharge batteries overnight.

2. Store the instrument in the protective case when not in use.

3. Keep records of operation, maintenance, calibration problems, and repairs.

4. A replacement instrument will be available on site or ready for overnight shipment, if necessary.

5. The MicroTIP will be sent back to the manufacturer for service if needed.

Exhibit A-9-1

Calibration and Maintenance Log

BBL®
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Blasland, Bouck, and Lee, Inc.

Calibration and Maintenance Log

Project: _____ **Project No.:** _____

Location: _____ **BBL Personnel:** _____

Work Description: _____

Date	Time	Initials	Monitoring Equipment	Parameter	Source Concentration	Instrument Reading	Comments

Appendix B

Quality Assurance Project Plan

ARCADIS

Imagine the result

Consolidated Edison Company of New York, Inc.

Quality Assurance Project Plan (QAPP)

Former Woodworth Avenue Works Site
(Site No. V00564)

Yonkers, New York

January 2009

ARCADIS

Quality Assurance Project Plan

Former Woodworth Avenue
Works Site

Prepared for:
Consolidated Edison Company
of New York, Inc.

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Our Ref.:
0430.43017 #10

Date:
January 2009

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Distribution List

Organization	Individual
Consolidated Edison Company of New York, Inc.	Charles Leary
ARCADIS Inc. (Environmental Consultant)	Michael Jones
New York State Department of Environmental Conservation	Jamie Folsom
Analytical Laboratory	TBD

1. Introduction

1.1 Project Organization

Investigations performed as part of the Site Characterization (SC) for the Consolidated Edison of New York, Inc. (Con Edison) Former Woodworth Avenue Manufactured Gas Plant (MGP) site (the Site) located in Yonkers, New York, will require integration of personnel from the organizations identified below, collectively referred to as the "project team." A detailed description of the responsibilities of each member of the project team is presented below.

1.1.1 Overall Project Management

On behalf of Con Edison, ARCADIS will have overall responsibility for the SC investigation activities. ARCADIS will perform related sampling activities, evaluate data, and prepare the deliverables as specified in the SC Work Plan. Project direction will be provided by Con Edison, with oversight by the New York State Department of Environmental Conservation (NYSDEC). A list of key project management personnel conceptualized for this project is provided below.

Company/ Organization	Title	Name	Phone Number
NYSDEC	Project Manager	Jamie Folsom	518.402.9564
NYSDOH	Project Manager	Carl Obermeyer	845-794-2045
Con Edison	Project Manager	Charles Leary	718-204-4347
ARCADIS	Project Officer	Margaret Carrillo-Sheridan, P.E.	315.671.9167
	Project Manager	Michael Jones	315.671.9211
	Field Manager	Craig Massaro	201.264.8598
	Quality Assurance Coordinator	TBD	TBD
Laboratory (TBD)	Project Manager	TBD	TBD
	Quality Assurance Manager	TBD	TBD

1.1.2 Task Managers

The staff performing the investigations and site activities will be directed by representatives of the project team. The personnel responsible for each of the Site activities are listed below.

Company/Organization	Title	Name	Phone Number
ARCADIS	Field Task Manager	Rolando Arco	212.682.9271
	Survey Task Manager	Rolando Arco	212.682.9271
	Health and Safety Officer	Charles Webster	315.671.9297
	Database Administrator	TBD	
	Data Validator	Dennis Capria	315.671.9299

1.2 Team Member Responsibilities

The responsibilities of the various team members are summarized below by organization.

1.2.1 Consolidated Edison Company of New York, Inc.

Project Manager and Coordinator

Responsibilities and duties include:

- Providing overall direction of site actions
- Directing ARCADIS
- Reviewing ARCADIS work products, including data, memoranda, letters, reports, and other documents transmitted to the NYSDEC

1.2.2 ARCADIS

Project Officer

Responsibilities and duties include:

- Overseeing ARCADIS preparation of work products
- Providing ARCADIS approval for major project deliverables

Project Manager

Responsibilities and duties include:

- Managing and coordinating the project as defined in the SC Work Plan, with an emphasis on adhering to the objectives of the Site activities
- Maintaining communication with Con Edison
- Reviewing documents prepared by ARCADIS
- Assuring that corrective actions are taken for deficiencies cited during any audits of Site activities

Task Managers

The SC investigation components will be managed by various Task Managers, as set forth in Section 2.1.2. Duties of each Task Manager include, as appropriate:

- Managing relevant day-to-day activities
- Developing, establishing, and maintaining files on relevant Site activities
- Reviewing data reductions from the relevant Site activities
- Performing final data review of field data reductions and reports on relevant Site activities

- Assuring that corrective actions are taken for deficiencies cited during audits of relevant Site activities
- Performing overall quality assurance/quality control (QA/QC) of the relevant portions of the Site activities
- Reviewing relevant field records and logs
- Instructing personnel working on relevant Site activities
- Coordinating field and laboratory schedules pertaining to relevant Site activities
- Requesting sample bottles from laboratory
- Reviewing field instrumentation, maintenance, and calibration to meet quality objectives
- Preparing reports pertaining to relevant Site activities
- Maintaining field and laboratory files of notebooks/logs, data reductions, and calculations and transmit originals to the Project Manager

Field Personnel

Responsibilities and duties include:

- Performing field procedures associated with the investigations as set forth in the SC Work Plan
- Performing oversight during completion of soil borings, excavation of test pits, and installation of monitoring wells
- Performing field analyses and collecting quality assurance samples
- Calibrating, operating, and maintaining field equipment
- Reducing field data

- Maintaining sample custody
- Preparing field records and logs

Quality Assurance Coordinator (QAC)

Responsibilities and duties include:

- Reviewing laboratory data packages
- Overseeing and interfacing with the analytical laboratory
- Coordinating field QA/QC procedures with Task Managers (including audits of field activities), concentrating on field analytical measurements and practices to meet data quality objectives (DQOs)
- Reviewing field reports
- Performing and reviewing audit reports
- Preparing interim QA/QC compliance reports
- Preparing a QA/QC report in accordance with United States Environmental Protection (USEPA) guidelines, which includes an evaluation of field and laboratory data and data usability reports

1.2.3 Analytical Laboratories

General responsibilities and duties of the analytical laboratories include:

- Performing sample analyses and associated laboratory QA/QC procedures
- Supplying sampling containers and shipping cartons
- Maintaining laboratory custody of sample
- Strictly adhering to protocols in this QAPP

Project Manager

Responsibilities and duties include:

- Serving as primary communication link between ARCADIS and laboratory technical staff
- Monitoring workloads and ensure availability of resources
- Overseeing preparation of analytical reports
- Supervising in-house chain-of-custody (COC)

Quality Assurance Manager

Responsibilities and duties include:

- Supervising personnel reviewing and inspecting project-related laboratory activities
- Conducting audits of laboratory activities

1.2.4 NYSDEC

Project Manager

Responsibilities and duties include:

- Providing NYSDEC review and approval of the SC Work Plan, supporting documents, and future deliverables
- Monitoring progress of Site activities

2. Project Background

2.1 Site Description

The Site is located on the west side of Woodworth Avenue between Babcock Place and Ashburton Avenue in the city of Yonkers, New York. As shown on Figure 2-Current Site Layout, the Site is bifurcated into western and eastern sections by rail lines of the Metro-North Commuter Railroad. Surrounding land use zoning includes Wholesale Business and Commercial Storage/Light Manufacturing.

As defined in the VCA (NYSDEC No. V00564), the Site is approximately 4.3 acres in size and is comprised of three blocks and seven lots (shown on Figure 2), designated by the City of Yonkers Assessor's Office as follows:

Tax Block/Lot	Land Use	Current Description	Current Property Owner
Block 2618,Lot 1	Industrial	Greyston Bakery, Commercial Bakery	104 Ashburton Avenue, LLC
Block 2618, Lot 2	Vacant	Bus turnaround	Yonkers CDA
Block 2618, Lot 200	Vacant	Vacant	State of New York
Block 7000, Lot 1	Railroad	Metro-North Railroad	MTA Metro-North
Block 2100, Lot 1	Industrial	Pollack Paint Inc.	Insl-X Products Corp.
Block 2100, Lot 4	Industrial	Steven's Paints	Stevens Paint Corp.
Block 2100, Lot 10	Industrial	A&D Carting Inc.	Stevens Paint Corp.

Both portions of the Site are separated from the rail lines by concrete retaining walls. The majority of the Site is either covered by buildings or paved with asphalt, with the exception of the slope along the northern edge of the Site.

2.2 Site History

This section provides a brief summary of the historical use of the Site with emphasis on the former MGP operations. The layout of historical MGP structures at the site is shown on Figure 3. A comprehensive discussion of the Site historical use including historical maps and photographs is provided in the Historical Information Report (Retec, 2003).

According to the Atlas of New York and Vicinity (Beers, 1868), the Yonkers Gas Company occupied two parcels between Woodworth Avenue and the Hudson River Railroad. The location of the Hudson River Railroad appears to correspond to the present day location of the Metro-North Rail Line. One gasholder (Gas Holder No. 1 on Figure 3) and four unidentified buildings are depicted on the 1868 Atlas. The Hudson River shoreline is located west and adjacent to the rail line. However, a pier into the Hudson River is present directly west of the gas plant.

The 1881 Atlas of Westchester County, New York (Bromley, 1881) indicates that the gas plant has expanded to the north and west. A second gas holder (Gas Holder No. 2 on Figure 3) and unidentified building have been added in the eastern portion of the site. Babcock Place is shown as the northern property boundary. An unidentified building is located west of the rail line. The rail line has expanded to three tracks and is now part of the New York Central and Hudson River Railroad. Additional filling of the Hudson River has occurred northwest of the site.

The 1886 Sanborn map indicates additional expansion of the gas plant operations. The gas plant is identified as the Yonkers Gas Light Company. MGP structures located on the portion of the site east of the rail line include two gas holders, valve and meter shop, and pipe shop, coke shed, coal shed, office, superintendent's dwelling, tool house, pump room, engine room and retorts. MGP structures located west of the rail line include a purifying house, dry houses and oil tank. A tar barrel storage area is also depicted west of the rail line. The configuration of the Hudson River shoreline appears to be the same as depicted in 1881.

The 1898 Sanborn map depicts further expansion of gas plant operations. A third gas holder is shown located east of the rail line. A new purifying house was constructed north of the original purifying house. A lard oil tank and store house is depicted west of the rail line.

The 1917 Sanborn map depicts the gas plant, now identified as the Westchester Lighting Company, at its most developed stage. According to the history report, the Yonkers Gas Light Company merged with the Westchester Lighting Company, a Con Edison predecessor company, in 1900. Additional structures depicted on the 1917 Sanborn map in the portion of the site located west of the rail line include three circular and two rectangular oil tanks located adjacent to Ashburton Avenue and a coal pile located on the northern portion of the site. Additional structures located east of the rail line include a concrete retaining wall and a meter and stove storage house. The 1917 Sanborn also indicates the original gas holder has been converted to a tar tank.

The Westchester Lighting Company continued to operate the Site as a gas plant until 1928 and continued to own the Site after gas manufacturing operations ceased. According to Retec, the MGP plant was dismantled in 1930 and demolished in 1931.

The 1951 and 1956 Sanborn maps show both portions of the Site as vacant land, with the exception of a machine shop/warehouse located on Woodworth Avenue. In 1957 an auto repair and gasoline station occupied the southeastern corner of the Site, while the western portion of the site was used for parking. The 1991 Sanborn map shows the Metro-North substation at its current location, while the western portion of the Site was occupied by an auto repair facility and buildings of an unidentified commercial or light manufacturing use.

2.3 Previous Investigations

Based on available information, no previous investigation efforts have been conducted to evaluate the eastern portion of the Site. The western portion of the site has been previously characterized by several investigations conducted by Ecosystems Strategies, Inc. (Ecosystems) and others, in connection with the VCP for the Greyston Bakery. Remedial efforts implemented in connection with the construction of the Bakery included the installation of a NAPL recovery system (consisting of a funnel and gate system and collection sump as shown on Figure 2), a sub-slab depressurization system, and a clay liner across soil areas that are not covered by the building or asphalt. Investigation activities conducted in connection with the VCP for the Greyston Bakery include:

Ecosystems Strategies Inc. Phase I/Phase II investigation (Ecosystems 1989)

Ecosystems conducted a Phase II ESA at the Site in 1989. A copy of the Phase II ESA report was not available for review by ARCADIS, but its findings were summarized in the Historical Investigation Report (Retec 2003). According to Retec, five monitoring wells were installed at the Site. Collected groundwater samples contained volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs) at concentrations that exceeded regulatory criteria.

Ecosystems Strategies, Inc. Draft Remediation Services Report (Ecosystems, 2004)

This report contains information about Site investigations conducted after 1989.

Malcolm Pirnie, another consultant, collected groundwater samples from the above-mentioned monitoring wells in 1995. Four of the five groundwater samples contained "dissolved hydrocarbons at levels exceeding NYSDEC groundwater protection standards." These wells were subsequently destroyed during construction of the Greyston Bakery.

In 1999, Ecosystems conducted a follow up subsurface investigation at the Site. Soil samples collected during this investigation were found to contain VOCs and PAHs at levels exceeding NYSDEC guidance values. Both light and dense non-aqueous phase liquids (LNAPL and DNAPL, respectively) were encountered in the northeast corner of the parcel. As such, the northeast corner of the parcel was designated as area of concern No. 1 (AOC # 1). The former location of the MGP crude oil tanks (shown on Figure 3) was designated as AOC # 2.

Ecosystems collected additional groundwater samples during April 2000, which yielded similar laboratory results. Collected groundwater samples continued to indicate the presence of dissolved benzene, toluene, ethylbenzene, xylenes (BTEX) and methyl-ether-butylene (MTBE) at concentrations that exceeded regulatory criteria.

A funnel and gate NAPL collection system was installed by Ecosystems in AOC 1 during construction of the Greyston Bakery. The collection system consists of an L-shaped hydraulic barrier constructed of sheet piling driven to 28 feet below ground surface (bgs), and one 4"-diameter recovery well screened from 13 to 20 feet bgs. The hydraulic barrier is 40 feet long in the north-south direction and approximately 25 feet long in the east-west direction. The approximate location of the NAPL barrier is shown on Figure 2.

<u>Ecosystems Strategies, Inc. Operations and Maintenance Report (Ecosystems, 2007)</u>

This report documents the ongoing groundwater sampling program at the Site. The program includes gauging and sampling three monitoring wells constructed after completion of the Greyston Bakery. The report also includes gauging the NAPL recovery well and removing NAPL on an as needed basis. Five sampling events have been conducted by Ecosystems between May 2005 and August 2007, confirming the presence of VOCs and PAHs at concentrations that exceed regulatory criteria. NAPL in the recovery well is described as "petroleum." This report also indicates that the current collection system has not been effective in recovering LNAPL or DNAPL.

2.4 Current Status

As a result of suspected environmental impacts at the Site, Con Edison has entered into a Voluntary Cleanup Agreement (VCA) between Con Edison and the NYSDEC. The SC investigation will be conducted to evaluate potential environmental impacts at the Site and evaluate potential remedial activities to address Site concerns.

3. Project Description

This section presents a description of the investigation activities to be conducted during the SC investigation. Sampling activities associated with the SC investigation will be conducted under the following tasks:

- Soil Vapor investigation
- Soil investigation
- Groundwater investigation

Sampling protocols to be followed during the investigation activities are detailed in the FSP. Samples collected during the investigation will be analyzed in accordance with USEPA Compendium Method TO-15 for evaluating soil vapor and ambient air, and USEPA SW-846 Test Methods for Evaluating Solid Waste, with NYSDEC Analytical Services Protocol (ASP) (latest revision). Table 1 presents a list of the sample quantities and constituents that will be analyzed for samples collected as part of the SC investigation. Health and safety protocols to be followed by field personnel during the completion of the investigation activities will be discussed in the Health and Safety Plan (HASP) that will be prepared and submitted to the NYSDEC prior to commencing field activities by ARCADIS.

A brief description of the objectives for each task associated with the SC investigation is presented below. A more detailed description can be found in the SC Work Plan.

3.1 Soil Vapor Investigation

The objective of the soil vapor investigation is to evaluate the potential for offsite migration of MGP-related soil vapor.

3.2 Soil Investigation Objectives

The objectives of the soil investigation are to:

- Determine if MGP-related chemical constituents are present in overburden soil and shallow groundwater at the Site at concentrations that exceed applicable and appropriate NYSDEC standards, criteria, and guidance values

- Determine if MGP-related and/or non-MGP-related by-product residuals (such as coal tar, non-aqueous phase liquid [NAPL] petroleum, solvents, etc.) are present in overburden soil and shallow groundwater in the eastern half of the Site

- Assess the horizontal and vertical distribution of MGP-related and/or non-MGP-related residuals in the western half of the Site

- Determine the potential for MGP-related and/or non-MGP-related residuals and chemical constituents to migrate into the upper bedrock

- Provide sufficient data to evaluate the necessity for further investigation and/or remedial action

In addition to the objectives outlined above, the information obtained as part of the SC investigation will be used to characterize subsurface materials at the site, including the distribution, saturated thickness, and relative permeability of subsurface soil.

3.3 Groundwater Investigation Objectives

The objectives of the groundwater investigation are to:

- Determine the direction and gradient of groundwater flow beneath the Site

- Evaluate, to the extent practicable, whether groundwater flow may be a pathway for offsite migration of identified chemical constituents (if present)

- Gather sufficient analytical data to evaluate the necessity for further investigation and/or remedial action

- Determine if MGP-related constituents are present in groundwater beneath the Site by collecting and analyzing groundwater samples (petroleum impacts are present in groundwater at the Site, as described above)

- Determine the potential presence of NAPL in subsurface materials, and, if present, quantify relevant physical properties of the NAPL

3.4 Approach

The SC will consist of a soil vapor, soil, and groundwater investigation to address the SC objectives. Samples collected during the SC investigation will be analyzed in accordance with the methods presented in this QAPP. A detailed description of the soil and groundwater investigation activities to be completed is presented in the SC Work Plan.

3.5 Project Schedule

A conceptual project duration schedule is presented in the SC Work Plan.

4. Quality Objectives and Criteria for Measurement Data

The DQO process, as described in the USEPA EPA QA/G-4 QAPP instructions document, 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 investigation will be conducted at the Former Woodworth Avenue MGP Site to evaluate if MGP constituents of concern 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. An additional objective is to attempt to differentiate MGP-related impacts from previously documented impacts.

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 SC investigation. The decision in this case is to determine if MGP constituents of concern 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 constituents of concern 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 located on the west side of Woodworth Avenue between Babcock Place and Ashburton Avenue in the city of Yonkers, New York. The study boundaries will include subsurface soils and groundwater within this area. This QAPP focuses on the Former Woodworth Avenue MGP Site and does not present any evaluation of potential issues associated with previously documented petroleum releases on the western portion of the Site.

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 constituents of concern (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 investigation.

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 and the appropriate government agencies.

Step 7: Design Optimization

The overall quality assurance objective is to develop and implement procedures for field sampling, 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.

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.

4.1 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 used during the investigation. Field parameters (i.e., pH, turbidity, temperature, and specific conductivity) 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, three levels of data reporting have been defined. They are as follows:

Level 1 – Minimal Reporting: Minimal or "results only" reporting is used for analyses that, either due to their nature (i.e., field monitoring) or the intended data use (i.e., preliminary screening), do not generate or require extensive supporting documentation.

Level 2 – Modified Reporting: Modified reporting is used for analyses that are performed following standard USEPA-approved methods and QA/QC protocols and that, based on the intended data use, require some supporting documentation but not, however, full "CLP-type" reporting.

Level 3 – Full Reporting: Full "CLP-type" reporting is used for those analyses that, based on intended data use, require full documentation. This reporting level would include ASP Superfund and Category B reporting.

The analytical methods to be used during the SC investigation will be USEPA SW-846 methods with NYSDEC ASP (latest revision), QA/QC requirements, and Category B reporting deliverables.

4.2 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 and the FSP.

5. Special Training Requirements/Certification

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

6. Documentation and Records

6.1 General

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.

6.2 Sample Designation System

6.2.1 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 include two letters indicating the sample type and two digits indicating the sequential sample number collected from the location.

The samples types will be designated using the following codes:

- Soil Boring – “SB”
- Groundwater – “GW”
- Soil Vapor – “SV”
- Trip Blank – “TB”
- Equipment Blank – “EB”
- Waste Characterization – “WASTE”

The two-digit sample number beginning with “01” will be assigned in the field and incremented by one as samples are collected from one to the next.

Where necessary, the code system will be supplemented to accommodate additional sample identification information. For example, the code for soil samples will include a qualifier to identify the depth interval from which the sample was collected [i.e., (0-6"), (4-6'), etc.].

Additional sample volumes collected for matrix spike (MS) and matrix spike duplicate (MSD) analysis will be noted on the COC forms, and the associated additional sample containers will be labeled with the appropriate suffix (MS or MSD). Rinse blanks will use to same coding scheme noted above, substituting the location code with the prefix "RB" (e.g., the first rinse blank associated with soil collection would be named RBSB01). Field duplicates will be labeled as ordinary field samples with a unique identification number (e.g., the first field duplicate associated with soil collection would be named DUPSB01). Duplicate samples will not be identified and the laboratory will analyze them as "blind" quality control samples.

6.2.2 Field Documentation

Field personnel will provide 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

- Daily Pay Items Sheet – A standard ARCADIS form will be used to track field investigation costs as coded in the Revision 3 of the MGP Environmental Consulting Services Price Schedule.

- Sampling Information - Detailed notes will be made as to the exact sampling location, physical observations, and weather conditions (as appropriate)

- Sample COC – COC forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. COC forms will be filled out at each sampling site, at a group of sampling sites, 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. A sample COC form is included in Attachment B-1

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 Equipment, Calibration, and Maintenance Logs:- 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

6.3 Laboratory Documentation Files

6.3.1 Laboratory Project Files

The laboratory will establish a file for pertinent data. The file will include COC forms, raw data, chromatographs, correspondence, faxed information, and phone logs. The laboratory will retain project files and data packages for a period of 5 years.

6.3.2 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 personal notebook pages by the analyst. These notes will be dated and will also identify the analyst, the instrument used, and the instrument conditions.

Laboratory notebooks 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 on the pages are correct, then the laboratory group leader will initial and date the pages. Corrective action will be taken for incorrect entries before the laboratory group leader signs.

6.3.3 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.

6.4 Data Reporting Requirements

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

6.4.1 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). Completed forms and data sheets will be transmitted within 48 hours to the task manager for review and to back up the information being collected. The original field logs, documents, and data reductions will be kept in the project file at the ARCADIS office in New York City, New York, once field work is completed.

6.4.2 Laboratory Data Reporting

The laboratory is responsible for preparing NYSDEC ASP (latest revision) Category B data packages for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), Target Analyte List (TAL) volatile organic compounds (VOCs), Target Analyte List (TAL) inorganic constituents, and total cyanide data reduced data packages, and case narratives for other analyses.

Data reports for parameters 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 contractor sample identification
- Analytical methods used
- 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
- Detection limits

Sample results on the report forms will be collected for dilutions. Soil samples will be reported on a dry weight basis. Unless otherwise specified, results will be reported uncorrected for blank contamination.

The data for VOCs, SVOCs, inorganic constituents, and total cyanide analyses will be expanded to include supporting documentation necessary to provide a Category B package. This additional documentation will include, but is not limited to, raw data required to recalculate any result, including printouts, chromatograms, and quantitation reports. The report also will include standards used in calibration and calculation of analytical results; sample extraction, digestion, and other preparation logs; standard preparation logs, instrument run logs; and moisture content calculations.

6.5 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) Agreements/Proposals (filed chronologically)
2) Change Orders/Purchase Orders (filed chronologically)
3) Invoices (filed chronologically)
4) Project Management (filed by topic)
5) Correspondence (filed chronologically)
6) Notes and Data (filed by topic)
7) Public Relations Information (filed by topic)

8) Regulatory Documents (filed chronologically)

9) Marketing Documents (filed chronologically)

10) Final Reports/Presentations (filed chronologically)

11) Draft Reports/Presentations (filed chronologically)

12) Documents Prepared by Others (filed chronologically)

Final reports (including QAPPs and QA reports) are filed in folder no.10 - Final Reports/Presentations. Analytical laboratory documentation (when received) and field data are filed in folder no. 6 - Notes and Data. Filed materials may be removed and signed out by authorized personnel on a temporary basis only.

7. Sampling Process Design

The sampling process for the SC investigation has been designed to satisfy the requirements of the VCA for the Site. The goal of the sampling process is to collect sufficient data to document whether or not a significant human health or environmental risk exists and to support the selection of an approach for Site remedial action (if necessary). Information regarding the sampling design and rationale and associated sampling locations can be found in the SC Work Plan.

8. Sampling Method Requirements

Soil and samples will be collected as described in the SC Work Plan and the FSP. The FSP also contains procedures that will be followed to install soil vapor monitoring probes and sample soil vapor locations; complete soil borings and collect soil samples; install and develop monitoring wells; excavate test pits; measure water levels; collect groundwater samples; perform field measurements; and handle, package, and ship collected samples.

9. Sample Handling and Custody Requirements

9.1 Sample Containers and Preservation

Appropriate sample containers, preservation methods, and laboratory holding times for SC investigation samples are shown in Table 2.

The analytical laboratory will supply appropriate sample containers and preservatives, as necessary. The bottles will be purchased pre-cleaned according to USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9240.05A requirements. The field personnel will be responsible for properly labeling containers and preserving samples (as appropriate). Sample labeling procedures are discussed in Section 9.2.2. The laboratory will also provide analyte-free water for the field QA/QC samples.

9.2 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.

9.2.1 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.

9.2.2 Sample Labeling

Blank sample labels will be affixed to sample bottles prior to use and all sampling information will be recorded at the time of sampling. The following information is required on each sample label:

- Project
- Date collected

- Time collected
- Location
- Sampler
- Analysis to be performed
- Preservative (if any)
- Sample number

9.2.3 Field COC Forms

Completed COC forms will be required for samples to be analyzed. COC forms will be initiated by the sampling crew in the field. The COC forms will contain the unique sample identification number, sample date and time, sample description, sample type, 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., Federal Express), hand delivered to a mobile or permanent laboratory, or placed in secure storage.

Sample labels will be completed for each sample using waterproof ink. The labels will include sample information such as: sample number and location, type of sample, date and time of sampling, sampler's name or initials, preservation, and analyses to be performed. The completed sample 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 facility or 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.

9.3 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) 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 onsite in new Department of Transportation- (DOT-) approved closed-top steel 55-gallon drum(s) or an onsite polyethylene storage tank, and will be disposed of appropriately based on analytical results. Equipment will be decontaminated, as appropriate, as discussed in FSP. All soil cuttings associated with drilling of soil borings will also be collected and temporally stored onsite in new DOT-approved steel 55-gallon drums, and disposed of properly following receipt of analytical results.

9.4 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 sealed.
- Wrap the sample container cap with clear packing tape to prevent it from becoming loose.
- Complete the COC form with the required sampling information and ensure that the recorded information matches the sample labels. NOTE: 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 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. 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, lock, and secure with duct 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.

Samples will be packaged by the field personnel and transported as low-concentration environmental samples. The samples will be hand-delivered or delivered by an express carrier within 48 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 custody seals and packing materials for filled sample containers 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 eliminate the possibility of container breakage.

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

9.5 Laboratory Custody Procedures

9.5.1 General

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 use COC guidelines described in the USEPA guidance documents. 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 documenting and maintaining sample integrity.

9.5.2 Sample Receipt and Storage

Immediately upon sample receipt, the laboratory sample custodian will verify the cooler seal, open the cooler, and compare the contents against the field COC. If a sample container is missing, a sample container is received broken, 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 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.

9.5.3 Sample Analysis

Analysis of an acceptable sample will be initiated by worksheets that contain pertinent information for analysis. The analyst will sign and date the laboratory COC form when removing the samples from storage.

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 rinse 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. Every SDG must include a minimum of one site-specific MS/MSD pair, which shall be received by the laboratory at the start of the SDG assignment.

Each SDG will therefore be self-contained for all of the required quality control samples. All parameters within an SDG will be extracted and analyzed together in the laboratory. At no time will the laboratory be allowed to run any sample (including QC samples) at an earlier or later time than the rest of the SDG. An entire SDG for any single parameter will be analyzed on a single instrument within the laboratory. These rules for analysis will ensure that the quality control samples for an SDG are applicable to the field samples of the same SDG, and that the best possible comparisons may be made.

Information regarding the sample, analytical procedures performed, and the results of the testing will be recorded on laboratory forms or personal notebook pages by the analyst. These notes will be dated, and also identify the analyst, the instrument used, and the instrument conditions.

9.5.4 Sample Storage Following Analysis

Samples will be maintained by the laboratory for at least one month after the final report is delivered to ARCADIS. After this period, the laboratory will be responsible for the eventual and appropriate disposal of the samples. The analytical laboratory will inform ARCADIS before any samples are disposed. 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.

10. Analytical Method Requirements

10.1 Field Parameters and Methods

Groundwater level measurements will be conducted using an electronic water-level or oil/water interface probe. Field measurements for water-quality parameters (pH, turbidity, temperature, and specific conductivity) will be conducted using a multi-parameter field meter (e.g., Horiba U-22®, or similar). Specific field measurement protocols are provided in the FSP. Field instruments will be calibrated daily following the manufactures recommended procedures.

10.2 Laboratory Parameters and Methods

The methods listed below include the range of analyses expected to be performed. The associated laboratory SOPs can be found in Attachment B-2 (to be identified following identification of the selected analytical laboratory). In addition, the following QAPP tables summarize general analytical requirements.

Table	Title
Table 1	Sample Quantities and Quality Control Frequencies
Table 2	Sample Containers, Preservation Methods, and Holding Times
Table 3	Analytical Quality Control Limits
Table 4	Parameters, Methods, and Target Reporting Limits for Groundwater and Soil/Sediment
Table 5	Parameters, Methods, and Target Reporting Limits for Soil Vapor
Table 6	Electronic Data Deliverable Format

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. USEPA SW-846 methods with NYSDEC ASP (latest revision), QA/QC, and reporting deliverables requirements will be used for analytes.

10.2.1 Groundwater Sampling

Groundwater samples will be analyzed for:

- TCL VOCs according to NYSDEC ASP (USEPA SW-846 Method 8260B)
- TCL SVOCs according to NYSDEC ASP (USEPA SW-846 Method 8270C)
- PP Inorganic Constituents according to NYSDEC ASP (USEPA SW-846 Methods 6010/7470/7471)
- Total and amenable Cyanide according to NYSDEC ASP (USEPA SW-846 Method 9012)

10.2.2 Soil Sampling

Soil samples will be analyzed for:

- TCL VOCs according to NYSDEC ASP (USEPA SW-846 Method 8260B)
- TCL SVOCs according to NYSDEC ASP (USEPA SW-846 Method 8270C)
- PP Inorganic Constituents according to NYSDEC ASP (USEPA SW-846 Methods 6010/7470/7471)
- Total and amenable Cyanide according to NYSDEC ASP (USEPA SW-846 Method 9012)

10.2.3 Soil Vapor Sampling

Soil vapor samples will be analyzed for:

- TAL VOCs according to USEPA Compendium Method TO-15Isopentane, 2,3-Dimethylpentane, 2-Methylpentane, 1,2,3-trimethylbenzene, indane, indene, thiopenes, isooctane

10.2.4 Waste Characterization Sampling

Waste characterization samples will be analyzed for:

- TCLP VOCs according to NYSDEC ASP (USEPA SW-846 Method 1311/8260)

- TCLP SVOCs according to NYSDEC ASP (USEPA SW-846 Method 1311/8270)
- TCLP Inorganic Constituents according to NYSDEC ASP (USEPA Method SW-846 s
- (Including Cyanide) 1311/6010/7470/7471/9012)
- Corrosivity according to NYSDEC ASP (USEPA SW-846 Method 9045)
- Ignitability according to NYSDEC ASP (USEPA SW-846 Method 1030)
- Reactivity according to NYSDEC ASP (USEPA SW-846 Chapter 7.3)
- PCBs

10.2.5 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, and USEPA Methods for Chemical Analysis of Water and Waste with NYSDEC ASP (latest revision), QA/QC, and reporting deliverables requirements. Detailed information regarding QA/QC is provided in NYSDEC ASP (latest revision).

11. Quality Control Requirements

11.1 Quality Assurance Indictors

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. These procedures are presented or referenced in the following sections of the QAPP. Specific quality control checks are discussed in Section 11.2.

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

- Representativeness
- Comparability
- Completeness
- Precision
- Accuracy

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

11.1.1 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.

11.1.2 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 with NYSDEC ASP (latest revision), QA/QC requirements, and Category B reporting deliverables, and through use of QA/QC procedures and appropriately trained personnel.

11.1.3 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 11.6.

11.1.4 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, laboratory duplicates, and field duplicates. Checks for field measurement precision will include obtaining duplicate field measurements. Further discussion of precision quality control checks is provided in Section 11.4.

11.1.5 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 11.5.

11.2 Field Quality Control Checks

11.2.1 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.

11.2.2 Sample Containers

Certified-clean sample containers in accordance with the NYSDEC ASP (latest revision) (Eagle Picher pre-cleaned containers or equivalent) will be supplied by the laboratory.

11.2.3 Field Duplicates

Field duplicates will be collected from the different site materials to verify the reproducibility of the sampling methods. 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 and soil 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 1 provides an estimated number of field duplicates to be prepared for each applicable parameter and matrix.

11.2.4 Rinse Blanks

Rinse blanks are used to monitor the cleanliness of the sampling equipment and the effectiveness of the cleaning procedures. Rinse blanks will be prepared and submitted for analysis at a ratio of one per 20 field samples, or once per week of sampling, whichever is more frequent. Rinse blanks will be prepared by filling sample containers with analyte-free water (supplied by the laboratory) which has been routed through a cleaned sampling device. When dedicated sampling devices or sample containers are used to collect the samples, rinse blanks will not be necessary. Table 1 provides an estimated number of rinse blanks for environmental media samples to be collected during the SC investigation.

11.2.5 Trip Blanks

Trip blanks will be used to assess whether site samples have been exposed to non-site-related volatile constituents during storage and transport. Trip blanks will be analyzed at a frequency of once per day, for each cooler containing samples to be analyzed for volatile organic constituents. A trip blank will consist of a container filled with analyte-free water (supplied by the laboratory) which remains unopened with field samples throughout the sampling event. Trip blanks will only be analyzed for VOCs. Table 1 provides an estimated number of trip blanks collected for each matrix and parameter during the SC investigation.

11.2.6 Zero Span Gasses

A photoionization detector (PID) will be used during the SC investigation to screen soil samples and to monitor air in the worker breathing zone as described in the HASP. The PID will be calibrated daily prior to use. Background ambient air will be the "zero gas" used to calibrate the PID to a reading of 0.0 parts per million (ppm). Isobutylene will be used to calibrate the span of the PID at 100 ppm. Detailed procedures for calibrating the PID are presented in the FSP.

11.3 Analytical Laboratory Quality Control Checks

11.3.1 General

Internal laboratory quality control checks will be used to monitor data integrity. These checks will include method blanks, MS/MSDs, spike blanks, internal standards, surrogate samples, calibration standards, and reference standards. Project quality control limits for duplicates and MSs are identified in Table 3. Laboratory control charts will be used to determine long-term instrument trends.

11.3.2 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 series associated with no more than 20 samples.

11.3.3 MS/MSDs

MS/MSDs will be used to measure the accuracy of analyte recovery from the sample matrices and will be site-specific. 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 1 presents an estimated number of MS and MSD analyses for each applicable parameter.

11.3.4 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 gas chromatography (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.

11.3.5 Laboratory Duplicates

For inorganics, laboratory duplicates will be analyzed to assess laboratory precision. Laboratory duplicates are defined as a separate aliquot of an individual sample that is analyzed as a separate sample. Table 1 presents an estimated number of laboratory duplicates for each applicable parameter.

11.3.6 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.

11.3.7 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.

11.3.8 Reference Standards/Control Samples

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.

11.4 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 1.

The precision of data will be measured by calculation of the relative percent difference (RPD) by the following equation:

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

Where:

A = Analytical result from one of two duplicate measurements

B = Analytical result from the second measurement

Precision objectives for MSD and laboratory duplicate analyses are identified in the NYSDEC ASP (latest revision) and contained in Table 3.

11.5 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. Where available and appropriate, quality assurance Performance Standards will be analyzed periodically to assess laboratory accuracy. Accuracy will be calculated in terms of percent recovery as follows:

$$\%Recovery = \frac{(A - x)*100}{B}$$

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 MS recoveries and surrogate recovery objectives are identified in the NYSDEC ASP (latest revision) and contained in Table 3.

11.6 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.

$$\text{Completeness} = \frac{\text{Number valid results x 100}}{\text{Total number of results generated}}$$

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.

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

12.1 General

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.

12.2 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.

Field forms will be kept for each field instrument. Each field form 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.

12.2.1 Equipment Maintenance

Measuring and test equipment to be used in support of the SC investigation 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-/subcontractor-owned or leased equipment maintenance shall be in accordance with the manufacturer's instructions.

12.3 Laboratory Instruments and Equipment

12.3.1 General

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.

12.3.2 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.

All 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.

12.3.3 Equipment Monitoring

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

13. Instrument Calibration and Frequency

13.1 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 17.4 of this QAPP.

13.2 Laboratory Instruments and Equipment

When analyses are conducted according to the USEPA SW-846 methods, the calibration procedures and frequencies specified in the applicable method will be followed. Records of calibrations will be filed and maintained by the laboratory. These records will be subject to QA audit. For all instruments, the laboratory will maintain trained repair staff with in-house spare parts or will maintain service contracts with vendors.

All standards used in the calibration of equipment are traceable, indirectly or directly, to National Institute of Standards and Technology (NIST). All standards received shall be logged into standard receipt logs maintained by the individual analytical groups. Each group shall maintain a standards log which tracks the preparation of standards used for calibration and QC purposes.

14. Inspection/Acceptance Requirements for Supplies and Consumables

Supplies to be used in the field and laboratory will be available when needed. They will be free of target chemicals and interferences. Reagents will be tested prior to use with Site samples. 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 onsite are noted in the various field SOPs that are included in the FSP.

15. Data Acquisition Requirements for Non-Direct Measurements

At this point in time, Con Edison has not generated any data in connection with the Site. However, historical background information concerning the activities at the Site and previous site investigations will be used as guidance in determining sampling locations for the SC investigation.

16. Data Management

The purpose of the data management is to ensure that the necessary data are accurate and readily accessible to meet the analytical and reporting objectives of the project. The field investigations will encompass a large number of samples and analytes from a large geographic area. Due to the large amount of resulting data, the need arises for a structured, comprehensive, and efficient program for management of data.

The data management program established for the project includes field documentation and sample QA/QC procedures, methods for tracking and managing the data, and a system for filing site-related information. More specifically, 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.

The data management plan has five elements: 1) sample designation system; 2) field activities; 3) sample tracking and management; 4) data management system; and 5) document control and inventory.

16.1 Sample Designation System

A concise and easily understandable sample designation system is an important part of the project sampling activities. It provides a unique sample number 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 sampled collected, as outlined in Section 6.2.1.

16.2 Field Activities

Field activities designed to gather the information necessary to make decisions during the SC investigation 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.

16.2.1 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 logs
- COC forms
- Instrument calibration records

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 investigation. 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 ARCADIS Database Administrator.

Information recorded will include but not be limited to: geologic descriptions of materials sampled (if applicable), locations sampled, the sampling methodologies used, blind duplicate and MS/MSD sample identification numbers, equipment decontamination procedures, personnel involved in the activity, and any other noteworthy events that occurred.

COC Forms

COC forms are used as a means of documenting and tracking 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 field office. All field personnel will be briefed on the proper use of the COC procedure. COC procedures and a sample form are included in 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 13.1. 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.

16.2.2 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 field office or locked in the field vehicle. Access to these files will be limited to the field personnel who utilize them.

16.3 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 9.2.3. The completed COC forms associated with samples collected will be faxed to the QAC. Copies of completed COC forms will be maintained in the field office. The laboratory shall verify receipt of the samples electronically (via email) on the following day.

When analytical data are received from the laboratory, the QAC 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 QAC.

16.4 Document Control and Inventory

ARCADIS maintains project files in its Syracuse, New York office. Each client project is assigned a file/job number. Each file is then broken down into the following subfiles:

1) Agreements/Proposals (filed chronologically)

2) Change Orders/Purchase Orders (filed chronologically)

3) Invoices (filed chronologically)

4) Project Management (filed by topic)

5) Correspondence (filed chronologically)

6) Notes and Data (filed by topic)

7) Public Relations Information (filed by topic)

8) Regulatory Documents (filed chronologically)

9) Marketing Documents (filed chronologically)

10) Final Reports/Presentations (filed chronologically)

11) Draft Reports/Presentations (filed chronologically)

12) Documents Prepared by Others (filed chronologically)

Originals, when possible, are placed in the above-referenced files. These are the central files and will serve as the site-specific files for the Site investigation(s).

17. Assessment and Response Actions

17.1 General

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

17.2 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 audit summaries will contain an evaluation of field activities to verify that activities are performed according to established protocols. The QAC will review field reports and communicate concerns to the ARCADIS Project Manager and/or Task Managers, as appropriate. In addition, the ARCADIS QAC will review the rinse 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 QAC will periodically confirm that work is being performed consistent with this QAPP, the SC Work Plan, and the FSP.

17.3 Laboratory Audits

The laboratory will perform internal audits consistent with NYSDEC ASP (latest revision).

Internal laboratory audits are conducted by the laboratory QAC. 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 QAC 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 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 onsite 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.

17.4 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.

17.4.1 Field Procedures

When conducting the field work, if a condition is noted by the field crew that would have an adverse effect 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, QAC, and Project Manager.

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

- Protocols as defined by the QAPP, SC Work Plan, and/or the 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

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

17.4.2 Laboratory Procedures

In the laboratory, when a condition is noted to have an adverse effect 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 appropriate Project Manager and QAC.

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 QAC 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.

18. Reports to Management

18.1 Internal Reporting

The analytical laboratory will submit analytical reports to ARCADIS for review. If required, ARCADIS will, in turn, submit the reports 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. The ARCADIS Quality Assurance Manager will incorporate results of the data validation reports (if required) and assessments of data usability into a summary report (if required) that will be submitted to the ARCADIS Project Manager and appropriate Task Managers. If required, this report will be filed in the project file at the ARCADIS office in Syracuse, New York 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

18.2 SC Reporting

Upon sample transport to the laboratory, a copy of the chain-of-custody will be forwarded to the ARCADIS Project Manager. Upon receipt of the ASP - Category B Data Package from the laboratory, the ARCADIS Quality Assurance Manager will determine if the data package has met the required data quality objectives. The analytical data package will be submitted to the ARCADIS Project Manager and the analytical data will be incorporated into the SC Report in a tabulated format.

19. Data Reduction and Review

19.1 General

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

- Reduction, or manipulation mathematically, or otherwise into meaningful and useful forms
- Review
- Organization, interpretation, and reporting
- Data validation

19.2 Field Data Reduction and Review

19.2.1 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, 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.

19.2.2 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 QAC. Logs and documents will be checked for:

- General completeness
- Readability
- Usage of appropriate procedures

- Appropriate instrument calibration and maintenance
- Reasonableness in comparison to present and past data collected
- Correct sample locations
- Correct calculations and interpretations

19.3 Laboratory Data Reduction and Review

19.3.1 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 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. Unless otherwise specified, values will be reported uncorrected for blank contamination.

19.3.2 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 QAC will review the final data reports, and the Laboratory Director 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 17. 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. This form will be submitted to the ARCADIS Project Manager.

19.3.3 Data Validation and Verification

Data generated for health and safety and engineering design/control purposes will be subjected to the data validation and verification procedures outlined in Section 20. Data generated for disposal purposes will not be reviewed.

20. 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 producing a NYSDEC data usability summary report (DUSR) for each individual SDG using the most recent versions of the USEPA's Function Guidelines (USEPA, 1999; 2002) and USEPA Region II SOPs for data validation available at the time of project initiation, where appropriate. 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. Deviations from the analytical method or any special reporting requirements apart from that specified in this QAPP will be detailed on COC forms.

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
- Verify that parameters were analyzed according to the methods specified

- 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 duplicate and MS recoveries are acceptable)

- 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, investigate the specific data of concern. Calculations will be traced back to raw data; if calculations do not agree, the cause will be determined and corrected

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 data validation report addressing the following topics as applicable to each method:

- Assessment of the data package

- Description of any protocol deviations

- Failures to reconcile reported and/or raw data

- Assessment of any compromised data

- Overall appraisal of the analytical data

- Table of site name, sample quantities, matrix, and fractions analyzed

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. Qualified data can provide useful information.

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

Data validation reports will be kept in the project file at the ARCADIS office in Syracuse, New York.

21. 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
- Reanalysis of sample from extract (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 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

22. References

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The Sanborn Library, LLC. Sanborn Fire Insurance Maps, Bronx, New York. (1896, 1898, 1917, 1942, 1951, 1956, 1957, 1978, 1989, 1990, and 1991).

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United States Environmental Protection Agency (USEPA). *Interim Guidance and Specifications for Preparing Quality Assurance Project Plans*. QAMS-005/80. Office of Research and Development. (December 1980).

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USEPA. *EPA Requirements for Quality Assurance Project Plans for Environmental Operations*. EPA-QA/R-5. Office of Environmental Information. (March, 2001).

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USEPA. *Guidance for Quality Assurance Project Plans*. EPA-QA/G-5. Office of Environmental Information. (December, 2002).

USEPA. *Test Methods for Evaluating Solid Waste*. SW-846 3rd Edition, Update 3. Office of Solid Waste (December 1996)

Tables

TABLE 1
SAMPLE QUANTITIES AND QUALITY CONTROL FREQUENCIES

QUALITY ASSURANCE PROJECT PLAN
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE WORKS SITE

Parameter	Estimated Environmental Sample Quantity	Field QC Analyses						Laboratory QC Sample				Total
		Trip Blank		Rinse Blank		Field Duplicate		Matrix Spike		Matrix Spike Duplicate		
		Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	
Soil Sampling												
TCL VOCs (SW-846 8260B)	110	NA	NA	1/20	6	1/20	6	1/20	6	1/20	6	134
TCL SVOCs (SW-846 8270C)	110	NA	NA	1/20	6	1/20	6	1/20	6	1/20	6	134
TAL Inorganics (SW-846-6010/7470/7471)	110	NA	NA	1/20	6	1/20	6	1/20	6	1/20	6	134
Total Cyanide (SW-846-9012)	110	NA	NA	1/20	6	1/20	6	1/20	6	1/20	6	134
Groundwater Sampling												
TCL VOCs (SW-846 8260)	14	1/cooler	3	1/20	1	1/20	1	1/20	1	1/20	1	21
TCL SVOCs (SW-846 8270)	14	NA	NA	1/20	1	1/20	1	1/20	1	1/20	1	18
TAL Inorganics (SW-846-6010/7470/7471)	14	NA	NA	1/20	1	1/20	1	1/20	1	1/20	1	18
Total Cyanide (SW-846-9012)	14	NA	NA	1/20	1	1/20	1	1/20	1	1/20	1	18
Soil Vapor Sampling												
TAL VOCs (USEPA TO-15)	5	NA	NA	NA	NA	1/20	1	NA	NA	NA	NA	6
Helium (D1946)	4	NA	NA	NA	NA	1/20	1	NA	NA	NA	NA	5
Waste Characterization Sampling (Soil Sample)												
PCBs (SW-846 8082)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
TCLP VOCs (SW-846 1311/8260)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
TCLP SVOCs (SW-846 1311/8270)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
TCLP Inorganics (SW-846 1311/6010/7470/7471)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
Total Cyanide (SW-846-9012)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
Reactivity (SW-846 Chapter 7.3)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
Ignitability (SW-846 Method 1030)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
Corrosivity (SW-846 Method 9045)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
Waste Characterization Sampling (Wastewater Sample)												
PCBs (SW-846 8082)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
TCLP VOCs (SW-846 1311/8260)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
TCLP SVOCs (SW-846 1311/8270)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
TCLP Inorganics (SW-846 1311/6010/7470/7471)												
Total Cyanide (SW-846 9012)	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1

Notes:

1. Sample counts are an approximation; the final number of samples will be determined in the field pursuant to discussion and agreement with NYSDEC.
2. Rinse blanks not required when dedicated sampling equipment is used.
3. 1/20 - One QC sample collected per every 20 environmental samples.
4. 1/cooler - One trip blank per cooler containing TCL VOC groundwater samples.
5. Freq - Frequency.
6. NA - Not Applicable.
7. No. - Number.
8. QC - Quality Control.
9. VOCs - Volatile Organic Compounds.
10. SVOCs - Semivolatile Organic Compounds.
11. TAL - Target Analyte List.
12. TCL - Target Compound List.

TABLE 2
SAMPLE CONTAINERS, PRESERVATION METHODS, AND HOLDING TIMES

QUALITY ASSURANCE PROJECT PLAN
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE WORKS SITE

Parameter	Method[1]	Bottle Type	Preservation	Holding Time[2]
Soil				
Volatile Organic Compounds	8260B	1 - 4 oz wide mouth glass jar with Teflon®-lined lid	Cool to 4°C, minimize headspace	10 days to analysis
Semivolatile Organic Compounds	8270C	1 - 8 oz glass jar with Teflon®-lined lid	Cool to 4°C	5 days to extraction 40 days to analysis
Inorganics (except mercury)	6010	1 - 8 oz glass jar with Teflon®-lined lid	Cool to 4°C	180 days to analysis
Mercury	7470/7471			28 days to analysis
Total Cyanide	9012		Cool to 4°C	12 days to analysis
Water				
Volatile Organic Compounds	8260B	2 - 40 ml glass vials with Teflon®-lined lid	HCl to pH<2, Cool to 4°C	10 days to analysis
Semivolatile Organic Compounds	8270C	2 - 1 liter amber glass bottle with Teflon®-lined lid	Cool to 4°C	5 days to extraction 40 days to analysis
Inorganics (except mercury)	6010	1 liter plastic bottle with Teflon®-lined lid	HNO_3 to pH<2, Cool to 4°C	180 days to analysis
Mercury	7470/7471		Cool to 4°C	26 days to analysis
Total Cyanide	9012	1 liter plastic bottle with Teflon®-lined lid	Adjust to pH>12 with NaOH, cool to 4ºC	12 days to analysis
Soil Vapor				
Volatile Organic Compounds	TO-15	1-6 liter SUMMA Cansiter	NA	NA
Helium	D1946	1-6 liter SUMMA Cansiter	NA	NA

Notes:
1. USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste. SW-846 3rd ed. Washington, D.C. 1996.*
2. All holding times are measured from date of collection.
3. Bottle type may vary depending on the selected analytical laboratory.
3. NA - Not Applicable.

TABLE 3
ANALYTICAL QUALITY CONTROL LIMITS [1]

QUALITY ASSURANCE PROJECT PLAN
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE WORKS SITE

	Accuracy - % Recovery			Precision - RPD		
Parameter	**Surrogate**	**MS/MSD**	**LCS**	**MS/MSD**	**Lab Duplicate**	**Field Duplicate**
Soil						
Volatile Organics	60-140	60-140	70-140	25	--	100
Semi-volatile Organics	20-140	20-140	40-120	40	--	100
Inorganics	--	75-125	75-125	--	20	100
Groundwater						
Volatile Organics	75-115	60-145	70-140	20	--	50
Semi-volatile Organics	20-140	20-130	40-120	40	--	50
Inorganics	--	75-125	75-125	--	20	50

Note:

1. The listed QC limits are based on SW-846 guidance and are advisory. The actual limits are determined based on laboratory performance. Frequent failure to meet the QC limits; however, warrants investigation of the laboratory.

TABLE 4
PARAMETERS, METHODS, AND TARGET REPORTING LIMITS
FOR GROUNDWATER AND SOIL/SEDIMENT

QUALITY ASSURANCE PROJECT PLAN
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE WORKS SITE

Analyte	Water (ug/L)			Soil/Sediment[2] (ug/kg)		
	NYS GW STD./G.V.[3]	Laboratory MDL	Laboratory RL	TAGM G.V.[4]	Laboratory MDL	Laboratory RL
Volatile Organic Compounds 8260 [1]						
1,1,1-Trichloroethane	5	TBD	5	800	TBD	5
1,1,2,2-Tetrachloroethane	5	TBD	5	600	TBD	5
1,1,2-Trichloro-1,2,2-trifluoroethane	5	TBD	5	6,000	TBD	5
1,1,2-Trichloroethane	1	TBD	5	--	TBD	5
1,1-Dichloroethane	5	TBD	5	200	TBD	5
1,1-Dichloroethene	5	TBD	5	400	TBD	5
1,2,4-Trichlorobenzene	5	TBD	5	3,400	TBD	5
1,2-Dibromo-3-chloropropane	0.04	TBD	5	--	TBD	5
1,2-Dibromoethane	0.0006	TBD	5	--	TBD	5
1,2-Dichlorobenzene	3	TBD	5	7,900	TBD	5
1,2-Dichloroethane	0.6	TBD	5	100	TBD	5
1,2-Dichloropropane	1	TBD	5	--	TBD	5
1,3-Dichlorobenzene	3	TBD	5	1,600	TBD	5
1,4-Dichlorobenzene	3	TBD	5	8,500	TBD	5
2-Butanone	50	TBD	10	300	TBD	10
2-Hexanone	50	TBD	10	--	TBD	10
4-Methyl-2-pentanone	--	TBD	10	1,000	TBD	10
Acetone	50	TBD	20	200	TBD	20
Benzene	1	TBD	5	60	TBD	5
Bromodichloromethane	50	TBD	5	--	TBD	5
Bromoform	50	TBD	5	--	TBD	5
Bromomethane	5	TBD	5	--	TBD	5
Carbon disulfide	60	TBD	10	2,700	TBD	10
Carbon tetrachloride	5	TBD	5	600	TBD	5
Chlorobenzene	5	TBD	5	1,700	TBD	5
Chloroethane	5	TBD	5	1,900	TBD	5
Chloroform	7	TBD	5	300	TBD	5
Chloromethane	5	TBD	5	--	TBD	5
cis-1,2-Dichloroethene	5	TBD	5	--	TBD	5
cis-1,3-Dichloropropene	0.4	TBD	5	--	TBD	5
Cyclohexane	--	TBD	10	--	TBD	10
Dibromochloromethane	50	TBD	5	--	TBD	5
Dichlorodifluoromethane	5	TBD	5	--	TBD	5
Ethylbenzene	5	TBD	5	5,500	TBD	5
Isopropylbenzene	5	TBD	5	--	TBD	5
Methyl acetate	--	TBD	10	--	TBD	10
Methyl t-butyl ether (MTBE)	10	TBD	5	--	TBD	5
Methylcyclohexane	--	TBD	10	--	TBD	10
Methylene chloride	5	TBD	5	100	TBD	5
Styrene	5	TBD	5	--	TBD	5
Tetrachloroethene	5	TBD	5	1,400	TBD	5
Toluene	5	TBD	5	1,500	TBD	5
trans-1,2-Dichloroethene	5	TBD	5	300	TBD	5
Volatile Organic Compounds 8260 [1]						
1,1,1-Trichloroethane	5	TBD	5	800	TBD	5
1,1,2,2-Tetrachloroethane	5	TBD	5	600	TBD	5
1,1,2-Trichloro-1,2,2-trifluoroethane	5	TBD	5	6,000	TBD	5

TABLE 4
PARAMETERS, METHODS, AND TARGET REPORTING LIMITS
FOR GROUNDWATER AND SOIL/SEDIMENT

QUALITY ASSURANCE PROJECT PLAN
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE WORKS SITE

Analyte	Water (ug/L)			Soil/Sediment[2] (ug/kg)		
	NYS GW STD./G.V.[3]	Laboratory MDL	Laboratory RL	TAGM G.V.[4]	Laboratory MDL	Laboratory RL
1,1,2-Trichloroethane	1	TBD	5	--	TBD	5
1,1-Dichloroethane	5	TBD	5	200	TBD	5
1,1-Dichloroethene	5	TBD	5	400	TBD	5
1,2,4-Trichlorobenzene	5	TBD	5	3,400	TBD	5
1,2-Dibromo-3-chloropropane	0.04	TBD	5	--	TBD	5
1,2-Dibromoethane	0.0006	TBD	5	--	TBD	5
1,2-Dichlorobenzene	3	TBD	5	7,900	TBD	5
1,2-Dichloroethane	0.6	TBD	5	100	TBD	5
1,2-Dichloropropane	1	TBD	5	--	TBD	5
1,3-Dichlorobenzene	3	TBD	5	1,600	TBD	5
1,4-Dichlorobenzene	3	TBD	5	8,500	TBD	5
2-Butanone	50	TBD	10	300	TBD	10
2-Hexanone	50	TBD	10	--	TBD	10
4-Methyl-2-pentanone	--	TBD	10	1,000	TBD	10
Acetone	50	TBD	20	200	TBD	20
Benzene	1	TBD	5	60	TBD	5
Bromodichloromethane	50	TBD	5	--	TBD	5
Bromoform	50	TBD	5	--	TBD	5
Bromomethane	5	TBD	5	--	TBD	5
Carbon disulfide	60	TBD	10	2,700	TBD	10
Carbon tetrachloride	5	TBD	5	600	TBD	5
Chlorobenzene	5	TBD	5	1,700	TBD	5
Chloroethane	5	TBD	5	1,900	TBD	5
Chloroform	7	TBD	5	300	TBD	5
Chloromethane	5	TBD	5	--	TBD	5
cis-1,2-Dichloroethene	5	TBD	5	--	TBD	5
cis-1,3-Dichloropropene	0.4	TBD	5	--	TBD	5
Cyclohexane	--	TBD	10	--	TBD	10
Dibromochloromethane	50	TBD	5	--	TBD	5
Dichlorodifluoromethane	5	TBD	5	--	TBD	5
Ethylbenzene	5	TBD	5	5,500	TBD	5
Isopropylbenzene	5	TBD	5	--	TBD	5
Methyl acetate	--	TBD	10	--	TBD	10
Methyl t-butyl ether (MTBE)	10	TBD	5	--	TBD	5
Methylcyclohexane	--	TBD	10	--	TBD	10
Methylene chloride	5	TBD	5	100	TBD	5
Styrene	5	TBD	5	--	TBD	5
Tetrachloroethene	5	TBD	5	1,400	TBD	5
Toluene	5	TBD	5	1,500	TBD	5
trans-1,2-Dichloroethene	5	TBD	5	300	TBD	5

See Notes on Page 4.

TABLE 4
PARAMETERS, METHODS, AND TARGET REPORTING LIMITS
FOR GROUNDWATER AND SOIL/SEDIMENT

QUALITY ASSURANCE PROJECT PLAN
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE WORKS SITE

Analyte	Water (ug/L)			Soil/Sediment[2] (ug/kg)		
	NYS GW STD./G.V.[3]	Laboratory MDL	Laboratory RL	TAGM G.V.[4]	Laboratory MDL	Laboratory RL
Volatile Organic Compounds 8260 [1] (Cont'd.)						
trans-1,3-Dichloropropene	0.4	TBD	5	--	TBD	5
Trichloroethene	5	TBD	5	700	TBD	5
Trichlorofluoromethane	5	TBD	5	--	TBD	5
Vinyl chloride	2	TBD	5	200	TBD	5
Xylenes (total)	5	TBD		1,200	TBD	
Semivolatile Organic Compounds 8270 [2]						
1,1'-Biphenyl	5	TBD	10	--	TBD	330
2,2'-oxybis(1-Chloropropane)	5	TBD	10	--	TBD	330
2,4,5-Trichlorophenol	--	TBD	10	100	TBD	330
2,4,6-Trichlorophenol	--	TBD	10	--	TBD	330
2,4-Dichlorophenol	5	TBD	10	400	TBD	330
2,4-Dimethylphenol	50	TBD	10	--	TBD	330
2,4-Dinitrophenol	10	TBD	50	800	TBD	1700
2,4-Dinitrotoluene	5	TBD	10	--	TBD	330
2,6-Dinitrotoluene	5	TBD	10	1,000	TBD	330
2-Chloronaphthalene	10	TBD	10	--	TBD	330
2-Chlorophenol	--	TBD	10	800	TBD	330
2-Methylnaphthalene	--	TBD	10	36,400	TBD	330
2-Methylphenol	--	TBD	10	330	TBD	330
2-Nitroaniline	5	TBD	50	800	TBD	1700
2-Nitrophenol	--	TBD	10	330	TBD	330
3,3'-Dichlorobenzidine	5	TBD	10	--	TBD	330
3-Nitroaniline	5	TBD	50	800	TBD	1700
4,6-Dinitro-2-methylphenol	--	TBD	50	--	TBD	1700
4-Bromophenyl-phenylether	--	TBD	10	--	TBD	330
4-Chloro-3-methylphenol	--	TBD	10	330	TBD	330
4-Chloroaniline	5	TBD	10	330	TBD	330
4-Chlorophenyl-phenylether	--	TBD	10	--	TBD	330
4-Methylphenol	--	TBD	10	900	TBD	330
4-Nitroaniline	5	TBD	50	--	TBD	1700
4-Nitrophenol	--	TBD	50	800	TBD	1700
Acenaphthene	20	TBD	10	50,000	TBD	330
Acenaphthylene	--	TBD	10	41,000	TBD	330
Acetophenone	--	TBD	10	--	TBD	330
Anthracene	50	TBD	10	50,000	TBD	330
Atrazine	7.5	TBD	10	--	TBD	330
Benzaldehyde	--	TBD	10	--	TBD	330
Benzo(a)anthracene	0.002	TBD	10	330	TBD	330
Benzo(a)pyrene	ND	TBD	10	330	TBD	330
Benzo(b)fluoranthene	0.002	TBD	10	1,100	TBD	330
Benzo(g,h,i)perylene	--	TBD	10	50,000	TBD	330
Benzo(k)fluoranthene	0.002	TBD	10	1,100	TBD	330

See Notes on Page 4.

TABLE 4
PARAMETERS, METHODS, AND TARGET REPORTING LIMITS
FOR GROUNDWATER AND SOIL/SEDIMENT

QUALITY ASSURANCE PROJECT PLAN
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE WORKS SITE

Analyte	Water (ug/L)			Soil/Sediment[2] (ug/kg)		
	NYS GW STD./G.V.[3]	Laboratory MDL	Laboratory RL	TAGM G.V.[4]	Laboratory MDL	Laboratory RL
Semivolatile Organic Compounds 8270 [2] (Cont'd.)						
bis(2-Chloroethoxy)methane	5	TBD	10	--	TBD	330
bis(2-Chloroisopropyl)ether	--	TBD	10	--	TBD	330
bis(2-Ethylhexyl)phthalate	5	TBD	10	50,000	TBD	330
Butylbenzylphthalate	50	TBD	10	50,000	TBD	330
Caprolactam	--	TBD	50	--	TBD	1700
Carbazole	--	TBD	10	--	TBD	330
Chrysene	0.002	TBD	10	400	TBD	330
Dibenz(a,h)anthracene	--	TBD	10	330	TBD	330
Dibenzofuran	--	TBD	10	6,200	TBD	330
Diethylphthalate	50	TBD	10	7,100	TBD	330
Dimethylphthalate	50	TBD	10	2,000	TBD	330
Di-n-butyl phthalate	50	TBD	10	8,100	TBD	330
Di-n-octyl phthalate	50	TBD	10	50,000	TBD	330
Fluoranthene	50	TBD	10	50,000	TBD	330
Fluorene	50	TBD	10	50,000	TBD	330
Hexachlorobenzene	0.04	TBD	10	410	TBD	330
Hexachlorobutadiene	0.5	TBD	10	--	TBD	330
Hexachlorocyclopentadiene	5	TBD	10	--	TBD	330
Hexachloroethane	5	TBD	10	--	TBD	330
Indeno(1,2,3-cd)pyrene	0.002	TBD	10	3,200	TBD	330
Isophorone	50	TBD	10	4,400	TBD	330
Naphthalene	10	TBD	10	13,000	TBD	330
Nitrobenzene	0.4	TBD	10	330	TBD	330
N-Nitrosodiphenylamine	50	TBD	10	--	TBD	330
N-Nitrosos-di-n-propylamine	50	TBD	10	--	TBD	330
Pentachlorophenol	1	TBD	50	1,000	TBD	330
Phenanthrene	50	TBD	10	50,000	TBD	330
Phenol	1	TBD	10	330	TBD	330
Pyrene	50	TBD	10	50,000	TBD	330
Inorganics 6010 [1]						
Aluminum	--	TBD	100	--	TBD	10,000
Antimony	3	TBD	60	--	TBD	6,000
Arsenic	25	TBD	10	7,500	TBD	1,000
Barium	1,000	TBD	20	300,000	TBD	2,000
Beryllium	3	TBD	5	160	TBD	500
Cadmium	5	TBD	5	1,000	TBD	500
Calcium	--	TBD	500	--	TBD	50,000
Chromium	50	TBD	10	10,000	TBD	1,000
Cobalt	--	TBD	50	30,000	TBD	5,000
Copper	200	TBD	20	25,000	TBD	2,000
Iron	300	TBD	100	2,000,000	TBD	10,000
Lead	25	TBD	3	--	TBD	500

See Notes on Page 4.

TABLE 4
PARAMETERS, METHODS, AND TARGET REPORTING LIMITS
FOR GROUNDWATER AND SOIL/SEDIMENT

QUALITY ASSURANCE PROJECT PLAN
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE WORKS SITE

Analyte	Water (ug/L)			Soil/Sediment[2] (ug/kg)		
	NYS GW STD./G.V.[3]	Laboratory MDL	Laboratory RL	TAGM G.V.[4]	Laboratory MDL	Laboratory RL
Inorganics 6010 [1] (Cont'd.)						
Magnesium	35,000	TBD	5,000	--	TBD	50,000
Manganese	300	TBD	15	--	TBD	1,000
Nickel	100	TBD	40	13,000	TBD	4,000
Potassium	--	TBD	5,000	--	TBD	200,000
Selenium	10	TBD	5	2,000	TBD	500
Silver	50	TBD	10	--	TBD	1,000
Sodium	20,000	TBD	5,000	--	TBD	50,000
Thallium	0.5	TBD	10	--	TBD	1,000
Vanadium	--	TBD	50	150,000	TBD	5,000
Zinc	2,000	TBD	20	20,000	TBD	2,000
Inorganics 7470/7471 [1]						
Mercury	0.7	TBD	0.3	100	TBD	0.5
Inorganics 9010 [1]						
Cyanide	200	TBD	10	--	TBD	1,000

Notes:

1. USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste SW-846 3rd ed., Washington, D.C. 1996.*
2. The target reporting limits are based on wet weight. The actual reporting limits will vary based on sample weight and moisture content.
3. Water guidance values (GV) are as presented in the NYSDEC, Division of Water, Technical and Operation Guidance Series (TOGS) document titled, *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* (TOGS 1.1.1), dated June 1998, last revised April 2000.
4. Soil/Sediment guidance values (GV) are as presented in the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) titled, *Determination of Soil Cleanup Objectives and Cleanup Levels*, HWR-94-4046 (TAGM 4046) dated January 24, 1994.
5. TBD - To be determined. The method detection limit (MDL) will be determined by the selected laboratory.

TABLE 5
PARAMETERS, METHODS, AND TARGET REPORTING LIMITS FOR SOIL VAPOR

QUALITY ASSURANCE PROJECT PLAN
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE WORKS SITE

Analyte	Soil Vapor (ppbv)	
	Laboratory MDL	Laboratory RL
Volatile Organic Compounds TO-15		
1,1,1-Trichloroethane	TBD	0.5
1,1,2,2-Tetrachloroethane	TBD	0.5
1,1,2-Trichloroethane	TBD	0.5
1,1-Dichloroethane	TBD	0.5
1,1-Dichloroethene	TBD	0.5
1,2,4-Trichlorobenzene	TBD	0.5
1,2,4-Trimethylbenzene	TBD	0.5
1,2-Dibromomethane	TBD	0.5
1,2-Dichlorobenzene	TBD	0.5
1,2-Dichloroethane	TBD	0.5
1,2-Dichloropropane	TBD	0.5
1,3,5-Trimethylbenzene	TBD	0.5
1,3-Dichlorobenzene	TBD	0.5
1,4-Dichlorobenzene	TBD	0.5
Benzene	TBD	0.5
Bromomethane	TBD	0.5
Carbon Tetrachloride	TBD	0.5
Chlorobenzene	TBD	0.5
Chloroethane	TBD	0.5
Chloroform	TBD	0.5
Chloromethane	TBD	0.5
Cis-1,2-Dichloroethene	TBD	0.5
Cis-1,3-Dichloropropene	TBD	0.5
Dichlorodifluoromethane	TBD	0.5
Dichlorotetrafluoroethane	TBD	0.5
Ethylbenzene	TBD	0.5
Hexachlorobutadiene	TBD	0.5
Isopropyl benzene	TBD	0.5
m,p-Xylene	TBD	0.5
Methylene Chloride	TBD	0.5
Naphthalene	TBD	0.5
n-butane	TBD	0.5
n-decane	TBD	0.5
n-dodecane	TBD	0.5
n-heptane	TBD	0.5
n-hexane	TBD	0.5
n-octane	TBD	0.5
nonane	TBD	0.5
n-undecane	TBD	0.5
o-Xylene	TBD	0.5
pentane	TBD	0.5
Styrene	TBD	0.5

TABLE 5
PARAMETERS, METHODS, AND TARGET REPORTING LIMITS FOR SOIL VAPOR

QUALITY ASSURANCE PROJECT PLAN
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE WORKS SITE

Analyte	Soil Vapor (ppbv)	
	Laboratory MDL	Laboratory RL
Volatile Organic Compounds TO-15		
Tetrachloroethene	TBD	0.5
Toluene	TBD	0.5
Trans-1,3-Dichloropropene	TBD	0.5
Trichloroethene	TBD	0.5
Trichlorofluoromethane	TBD	0.5
Trichlorotrifluoroethane	TBD	0.5
Vinyl Chloride	TBD	0.5
Tentatively Identified Compounds (TICs)		
1,2,3-trimethylbenzene	TBD	
2,3‑Dimethylpentane	TBD	
2-Methylpentane	TBD	
indane	TBD	
indene	TBD	
isooctane	TBD	
Isopentane	TBD	
thiopenes	TBD	

Notes:

1. USEPA Compendium Method TO-15, entitled Determination of VOCs In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS).
2. TBD - To be determined. The method detection limit (MDL) will be

TABLE 6
ELECTRONIC DATA DELIVERABLE (EDD) FORMAT

QUALITY ASSURANCE PROJECT PLAN
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
FORMER WOODWORTH AVENUE WORKS SITE

Field Name	Maximum Length	Data Type	Comments
FIELD SAMPLE ID	50	TEXT	From the chain of custody. Add "RE" or "DL" to differentiate reanalyses and dilutions.
SDG	50	TEXT	
LAB SAMPLE ID	50	TEXT	
MATRIX	10	TEXT	SOIL and WATER
SAMPLE TYPE	10	TEXT	FB, RB, TB, FD, FS for Field Blank, Rinse Blank, Trip Blank, Field Duplicate and Field Sample, respectively. DEFAULT TO FS
DATE COLLECTED	--	DATE/TIME	MM/DD/YY
TIME COLLECTED*	--	DATE/TIME	Military time
DEPTH START	--	NUMBER	
DEPTH END	--	NUMBER	
DEPTH UNITS	25	TEXT	FEET, INCHES, METERS, etc.
ANALYTICAL METHOD	50	TEXT	
CAS NUMBER	25	TEXT	
ANALYTE	100	TEXT	
RESULT VALUE	--	NUMBER	For non-detected results, enter Reporting Limit ("U" must be present in Lab Qualifier field).
LAB QUALIFIER	10	TEXT	"U" for non-detected, others as defined by laboratory.
REPORTING LIMIT	--	NUMBER	
RESULT UNIT	25	TEXT	
DILUTION FACTOR	--	NUMBER	
REPORTABLE RESULT	--	YES/NO	DEFAULT TO YES
FILTERED?	--	YES/NO	
DATE ANALYZED	--	DATE/TIME	MM/DD/YY
TIME ANALYZED*	--	DATE/TIME	Military time
DATE EXTRACTED*	--	DATE/TIME	MM/DD/YY
LABORATORY NAME*	50	TEXT	

Notes:

1. This definition is for an "Excel-type" spreadsheet. Fields flagged with an "*" are optional and may be left blank if not available electronically from the laboratory.
2. Depth-related fields may be left blank for samples and matrices for which they are not applicable.

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Attachment B-1

Chain-of-Custody Form

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

6723 Towpath Road, P.O. Box 66
Syracuse, New York 13214-0066
TEL: (315) 446-9120

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
SAMPLERS: *(Signature)*	

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	Number of Containers							REMARKS

Relinquished by: *(Signature)*	DATE	TIME	Received by: *(Signature)*	Relinquished by: *(Signature)*	DATE	TIME	Relinquished by: *(Signature)*
Relinquished by: *(Signature)*	DATE	TIME	Received by: *(Signature)*	Relinquished by: *(Signature)*	DATE	TIME	Relinquished by: *(Signature)*
Relinquished by: *(Signature)*	DATE	TIME	Received for Laboratory by: *(Signature)*	DATE	TIME	Remarks:	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

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Attachment B-2

Laboratory Standard Operating Procedures (To Be Provided By Selected Laboratory)

Appendix C

Community Air Monitoring Plan

ARCADIS
Infrastructure, environment, facilities

Consolidated Edison Company of

New York, Inc.

Community Air Monitoring Plan (CAMP)

Former Woodworth Avenue Site
(Site No. V00564)

Yonkers, New York 10701

January 2009

ARCADIS

Table of Contents

Attachments

1. Introduction

This *Community Air Monitoring Plan* (CAMP) has been prepared by ARCADIS-U.S. (ARCADIS) to support Site Characterization (SC) activities proposed for the Consolidated Edison Company of New York, Inc. (Con Edison) former Woodworth Avenue Manufacturing Gas Plant Works site (the Site) located in the City of Yonkers, Westchester, New York. The details of the SC activities are presented in the *Site Characterization Work Plan* (SC Work Plan) (ARCADIS April 2008). This CAMP fulfills the general requirements set forth by the New York State Department of Health (NYSDOH) *Generic Community Air Monitoring Plan*, dated December 2002 (included as Attachment C-1), and the New York State Department of Environmental Conservation's (NYSDEC's) *Technical and Administrative Guidance Memorandum* (TAGM) 4031, "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites" (included as Attachment C-2). The intent of this CAMP is to provide a measure of protection for downwind communities from potential airborne releases of constituents of concern during subsurface work activities at the Site. As such, this CAMP identifies potential air emissions, and describes air monitoring procedures, monitoring schedule and data collection and reporting requirements for the SC activities.

1.1 Site Description

The former Woodworth Avenue MGP site is an approximately 4.3 acre property located on the west side of Woodworth Avenue between Babcock Place and Ashburton Avenue in the city of Yonkers, Westchester County, New York. A Site location map is shown on Figure 1 to the SC Work Plan. The Site is bifurcated into western and eastern sections by rail lines of the Metro-North Commuter Railroad. The Site and surrounding area are zoned industrial by the City of Yonkers. Surrounding land use zoning includes Wholesale Business and Commercial Storage/Light Manufacturing. The Greyston Bakery (constructed on the western portion of the site during 2004) is a non-profit commercial bakery operated by the Greyston Foundation that employees economically disadvantaged people and has been identified as an important structure as part of the City of Yonkers Alexander Street Urban Renewal Plan and the Alexander Street Master Plan. Remedial activities have previously been implemented in the western portion of the site in connection with the construction of the bakery building under the New York State Brownfield Cleanup Program (BCP Site No. V00361). The layout of the Site is shown on Figure 2 to the SC Work Plan.

Currently the Site is comprised of three blocks and seven lots (shown on Figure 2), designated by the City of Yonkers Assessor's Office as follows:

Tax Block/Lot	Land Use	Current Description	Current Property Owner
Block 2618,Lot 1	Industrial	Greyston Bakery, Commercial Bakery	104 Ashburton Avenue, LLC
Block 2618, Lot 2	Vacant	Bus turnaround	Yonkers CDA
Block 2618, Lot 200	Vacant	Vacant	State of New York
Block 7000, Lot 1	Railroad	Metro-North Railroad	MTA Metro-North
Block 2100, Lot 1	Industrial	Pollack Paint Inc.	Insl-X Products Corp.
Block 2100, Lot 4	Industrial	Steven's Paints	Stevens Paint Corp.
Block 2100, Lot 10	Industrial	A&D Carting Inc.	Stevens Paint Corp.

Historical MGP operations were conducted at the former Woodworth MGP site until 1928. Fuel oil used to support the gas manufacturing at the Site was stored in aboveground storage tanks located on the western portion of the Site. Manufactured gas produced at the Site was stored in three aboveground gas holders located at the former gas holder site. Based up on historic information provided by The Retec Group, Inc., the former MGP plant was dismantled in 1930 and demolished in 1931. As mentioned above the future use of the Site is included as part of the City of Yonkers Alexander Street Urban Renewal Plan and the Alexander Street Master Plan. Based on available information, no previous investigation efforts have been conducted to evaluate the eastern portion of the Site. The western portion of the site has been previously characterized by several investigations conducted by Ecosystems Strategies, Inc. (Ecosystems) and others, in connection with the VCP for the Greyston Bakery.

1.2 Summary of SC Activities

The proposed SC activities for the Site include groundwater monitoring well installation and development, test pit excavation, subsurface soil sampling using a conventional drill rig, groundwater sampling, and specific capacity testing. A more detailed description of the SC activities is presented in the SC Work Plan.

1.3 Potential Air Emissions Related to SC Activities

Certain intrusive SC activities to be conducted at the Site have the potential to generate localized impacts to air quality, including: soil boring completion; subsurface soil sampling; excavation of test pits; and monitoring well installation. Some non-intrusive SC activities to be conducted may also have the potential to generate impacts to air quality, including: monitoring well development; collection of groundwater samples; collection of monitoring well water level measurements; and specific capacity testing.

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 for the specific purpose of protecting the community from Site activity impacts (and verification thereof) will take place during both intrusive and non-intrusive site activities.

Odor and dust control measures will be available at the Site during the intrusive SC activities and will be used when necessary. The following dust and odor suppression measures may be used during these activities, depending upon specific circumstances and air monitoring results:

- Water spray;
- Polyethylene sheeting (for covering drummed drill cuttings, soil stockpiles, etc.); and
- Odor suppression foam.

Polyethylene sheeting will be used to control nuisance odors and volatile organic compound (VOC) emissions, as needed. Also, dust emissions at the Site will be controlled by spraying water on exposed dry surface soil areas (e.g., stockpiled drill cuttings, etc.) and by covering soil stockpiles with polyethylene sheeting. Odor and dust control measures will be implemented based on visual or olfactory observations, and the results of airborne particulate and VOC monitoring (described in Section 2). If NYSDEC personnel or members of the surrounding community report visual or olfactory observations of dust or odors, appropriate control measures will be implemented, as necessary, including the addition of water and potentially the use of odor suppression foam

2. Air Monitoring Procedures

Real-time air monitoring will be implemented at the Site for VOCs, and particulate matter less than 10 microns in diameter (PM_{10}). Particulate monitoring will not be performed, however, during non-intrusive activities and precipitation events. Upwind and downwind monitoring locations will be determined through visual observation (wind vane, windsock, or similar technique). Monitoring will occur at each sampling location and will include the use of hand-held direct-reading survey instruments.

2.1 Monitoring Location Selection

VOC and PM_{10} monitoring activities will be determined daily based on visual observation of a wind direction. A single upwind location will be selected daily where both VOC and PM_{10} will be recorded. This upwind location will be established at the start of the workday, each day before the start of SC activities. Monitoring activities will continue in a downwind direction throughout the day. If wind direction shifts radically during the workday (i.e., greater than approximately +/- 60 degrees from original upwind direction), new upwind and downwind monitoring locations will be established. Any location changes will be documented in the field logbook.

2.2 VOC Monitoring

As required by the NYSDOH guidance for community air monitoring, VOCs will be monitored continuously during ground intrusive Site activities (i.e., soil boring completion, subsurface soil sampling, test pit excavation, and monitoring well installation) with instrumentation that is equipped with electronic data-logging capabilities. Because real-time monitors for polycyclic aromatic hydrocarbons (PAHs) are not available, the real-time VOC monitors will also serve as surrogate indicators for emissions (if any) of PAHs at the Site. A real-time VOC monitor equipped with either a photoionization detector (PID) or a flame ionization detector (FID) will be used to conduct the monitoring for VOCs and PAHs. A MiniRAE 2000 (or equivalent) will be used to conduct the real-time VOC monitoring. Attachment C-3 provides detailed information on the MiniRAE 2000. All 15-minute readings will be recorded in the field logbook, as well as any instantaneous readings taken to facilitate activity decisions.

During non-intrusive site activities (i.e., monitoring well development, collection of groundwater samples from monitoring wells, collection of monitoring well water level measurements, and specific capacity testing), VOCs will be monitored periodically. Periodic monitoring may include monitoring upon arrival at the sample location,

monitoring while opening a well cap, monitoring during well bailing and/or purging, monitoring at the perimeter of the work area, and/or monitoring prior to leaving a sample location. However, if a sampling location is near to potentially exposed individuals, VOCs will be monitored continuously during sampling activities at that location. All VOC readings will be recorded in the field logbook, as well as any instantaneous readings taken to facilitate activity decisions.

2.3 Particulate Matter Monitoring

As required by the NYSDOH guidance, real-time particulate matter will be monitored continuously during intrusive Site activities using instrumentation equipped with electronic data-logging capabilities. A MIE DataRAM (or equivalent) will be used to conduct the real-time PM_{10} monitoring. Attachment C-3 provides detailed information on the MIE DataRAM. All 15-minute readings will be recorded in the field logbook, as well as any instantaneous readings taken 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 (see Section 1.4).

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

As outlined in the NYSDOH guidance document for CAMPs, if the ambient air concentration for 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 for total VOCs persist at levels in excess of 5 ppm above background but less than 25 ppm above background, intrusive site work activities will be halted, the source of the elevated VOC concentrations identified, corrective actions to reduce or abate the emissions undertaken, and air monitoring will

be continued. Once these actions have been implemented, intrusive site work activities can resume provided the following two conditions are met.

- The 15-minute average VOC concentrations remain below 5 ppm above background
- The VOC level 200 feet downwind of the monitoring 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 over background for the 15-minute average.

If the ambient air concentrations for 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 (i.e., monitoring well development, collection of groundwater samples from monitoring wells, collection of monitoring well water level measurements, and specific capacity testing). If these activities are undertaken at the Site, 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 Level for Particulate Matter

As required by the NYSDOH guidance, if the ambient air concentration for PM_{10} at any one (or more) of the monitoring locations is noted at levels in excess of 100 micrograms per cubic meter (µg/m3) above the 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 is to be identified, corrective actions to reduce or abate the emissions will be undertaken, and air monitoring will continue. Work may continue following the implementation of dust suppression techniques provided the PM_{10} levels do not exceed 150 µg/m3 above background.

If, after implementation of dust suppression techniques, PM_{10} levels are greater than 150 µg/m3 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 less than 150 µg/m3 above background and in preventing visible dust from leaving the Site.

If the ambient air concentration of PM_{10} is above 150 µg/m3 above background, the intrusive Site activities must cease and emissions control measures must be implemented. The PM_{10} concentrations will be recorded in the field activity logbooks.

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. Wind direction will be recorded in the field activity logbooks.

2.6 Instrument Calibration

Calibration of the VOC and PM_{10} instrumentation will occur in accordance with each of the equipment manufacturer's calibration and quality assurance (QA) requirements. The VOC and PM_{10} monitors will be calibrated at least daily, and calibrations will be recorded in the field activity logbook.

3. Monitoring Schedule and Data Collection and Reporting

The following identifies 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 SC activities. VOC monitoring will also be performed periodically during non-intrusive SC 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 from VOC and PM_{10} monitors during intrusive SC activities by an electronic data-logging system. The data management software will be set up so that instantaneous observed readings would be recorded by the electronic data acquisition system and averaged over 15-minute time periods. All readings will be recorded and archived for review by NYSDOH and NYSDEC personnel.

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Attachments

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Attachment C-1

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

Fugitive Dust Suppression and Particulate Monitoring Programs 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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Attachment C-3

Monitoring Equipment Specifications

MiniRAE 2000
Handheld VOC Monitor

- Intrinsically safe
- Smallest handheld VOC monitor
- Datalogging workhorse

This VOC monitor with PID (photoionization detector) sensor weighs just over one pound, yet it's a heavyweight for leak detection, fugitive emissions monitoring to EPA Method 21 and inspecting leaking underground storage tanks. The MiniRAE 2000 is also a highly useful tool in industrial hygiene applications, including confined space entry, personnel and work place monitoring and for emergency response to hazardous spills. This rugged instrument comes with a belt clip.

With built-in correction factors for more than 100 chemicals, the MiniRAE 2000 provides excellent all-around sensitivity to most VOCs, down to 0.1 ppm. Selectable survey and hygiene modes permit the user to set appropriate alarm thresholds for STEL, TWA and low/high level peak values. Datalogging and custom software.

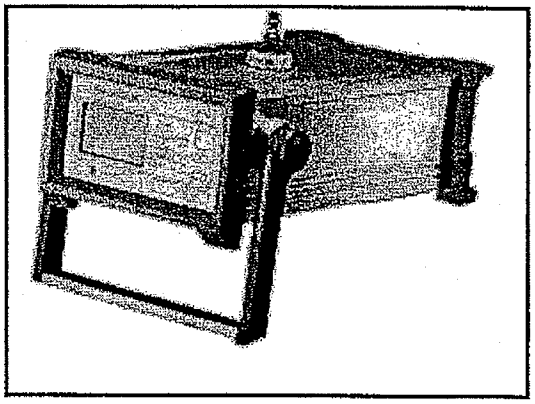
SPECIFICATIONS

Range	Resolution	Response Time	Accuracy
0 to 999 ppm	0.1 ppm	< 3 seconds	± 2 ppm or 10% of reading <2000 ppm
100 to 10,000 ppm	1 ppm	< 3 seconds	± 20% of reading >2000 ppm Calibrated to 100 ppm isobutylene

Sampling Pump	Internal integrated flow rate 400 cc/minute Sample from 100' horizontally or vertically
Datalogging	15,000 points with time/date, header information
Approvals	UL and cUL Class I, Division 1, Groups A, B, C and D, EEx ia IIC T4
Battery	Rechargeable, field changeable NiMH battery pack, 10 hours operation
Dimensions (HWD)	2" x 3" x 8.2"
Weight	19.5 oz

RAE SYSTEMS MiniRAE 2000 PID rents with download cable, zero filter, probe tip, hydrophobic filter, charger, alkaline battery adapter, case and operating manual.

MIE DataRAM Aerosol Monitor
Portable Real-Time Particulate Monitor



- Real-time measurement of particle concentrations
- Datalogging

The DataRAM aerosol monitor measures concentrations of airborne dust, smoke, mists, haze and fumes with real-time readout. The instrument can be used for exposure sampling of ambient air, continuous unattended monitoring of indoor, duct or process air, as well as environmental and perimeter monitoring. The DataRAM has the widest measurement range of any real-time aerosol monitor — from 0.0001 mg/m³ to 400 mg/m³, or a total span of almost seven decades.

OPTIONAL ACCESSORIES

Respirable Cyclone Precollector, for respirable particle monitoring.
Isokinetic Sampling Probe, for isokinetic sampling within ducts.
Temperature Conditioning Heater, for monitoring above 70 percent RH.
Omnidirectional Sampling Inlet, for ambient monitoring under a variety of wind speeds and directions.
PM-10 Inlet Head, for PM-10 or PM-2.5 ambient particulate monitoring.

SPECIFICATIONS

Concentration Measurement Ranges (autoranging)	0.1 to 999.99 µg/m³, with resolution of 0.1 µg/m³ 1.00 to 39.99 mg/m³, with resolution of 0.01 mg/m³ 40.0 to 399.9 mg/m³, with resolution of 0.1 mg/m³
Accuracy	± 5% of reading ± precision
Particle Size Range of Maximum Response	0.1 to 10 µm
Sample Flow Rate	1.7 to 2.3 lpm
Datalogging	10,000 data points, with average, minimum and maximum concentrations for each point
Output	RS-232 port
Power	Sealed lead-acid battery, 24 hours operation, or AC operation with adapter
Dimensions (HWD)	5.28" x 7.25" x 13.63"
Weight	11.7 lbs

The MIE DataRAM aerosol monitor rents with an AC adapter/charger, serial download cable, software, filter cassette, soft carrying case and operating manual.

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Appendix D

Health and Safety Plan

ARCADIS
Infrastructure, environment, facilities

Consolidated Edison Company of New York, Inc.

Health and Safety Plan (HASP)

Former Woodworth Avenue Works Site
(Site No. V00564)

Yonkers, New York

January 2009

ARCADIS

Health and Safety Plan (HASP)

Former Woodworth Avenue Works Site

Prepared for:
Consolidated Edison Company of New York, Inc.

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Our Ref.:
43017.001

Date:
January 2009

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1. Introduction

1.1 Objective

The objective of site activities is to conduct soil and groundwater sampling activities at the Consolidated Edison Company of New York, Inc. (Con Edison) Former Woodworth Avenue Manufactured Gas Plant (MGP) Site (the Site), located in Yonkers, NY. This Health and Safety Plan (HASP) has been written to address activities performed at the site. Activities at the site are expected to include the following tasks:

- Mobilization/Site Reconnaissance
- Subsurface utility location and clearance
- Installation of test pits and soil borings, soil sampling
- Installation and development of groundwater monitoring wells, groundwater sampling
- Management of investigation derived waste (IDW)
- Survey of the site limits
- Equipment decontamination
- Demobilization

The objective of this HASP is to provide a mechanism for establishing safe working conditions at the site. The safety organization, procedures, and protective equipment have been established based on an analysis of potential physical, chemical, and environmental hazards. No specific hazard control methodologies have been evaluated and selected to minimize the potential of injury, illness, or other incident.

1.2 Site and Facility Description

The former Woodworth Avenue MGP site is an approximately 4.3 acre property located on the west side of Woodworth Avenue between Babcock Place and Ashburton Avenue in the city of Yonkers, Westchester County, New York. The Site is separated into western and eastern sections by rail lines of the Metro-North Commuter Railroad.

The Site and surrounding area are zoned industrial by the City of Yonkers. Surrounding land use zoning includes Wholesale Business and Commercial Storage/Light Manufacturing. The Greyston Bakery (constructed on the western portion of the site during 2004) is a non-profit commercial bakery operated by the Greyston Foundation that employees economically disadvantaged people and has been identified as an important structure as part of the City of Yonkers Alexander Street Urban Renewal Plan and the Alexander Street Master Plan. Remedial activities have previously been implemented in the western portion of the site in connection with the construction of the bakery building under the New York State Brownfield Cleanup Program (BCP Site No. V00361). The layout of the Site is shown on Figure 2.

Historical MGP operations were conducted at the former Woodworth MGP site until 1928. Fuel oil used to support the gas manufacturing at the Site was stored in aboveground storage tanks located on the western portion of the Site. Manufactured gas produced at the Site was stored in three aboveground gas holders located in the eastern portion of the site. Based up on historic information provided by Retec, the former MGP plant was dismantled in 1930 and demolished in 1931. As mentioned above the future use of the Site is included as part of the City of Yonkers Alexander Street Urban Renewal Plan and the Alexander Street Master Plan. Based on available information, no previous investigation efforts have been conducted to evaluate the eastern portion of the Site. The western portion of the site has been previously characterized by several investigations conducted by Ecosystems Strategies, Inc. (Ecosystems) and others, in connection with the VCP for the Greyston Bakery.

1.3 Policy Statement

The policy of ARCADIS, Inc. is to provide a safe and healthful work environment. No aspect of operations is of greater importance than injury and illness prevention. A fundamental principle of safety management is that all injuries, illnesses, and incidents are preventable. ARCADIS will take every reasonable step to eliminate or control hazards to minimize the possibility of injury, illness, or incident.

This HASP prescribes the procedures that must be followed while performing site activities. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without prior approval of the Project Manager (PM) and the Health and Safety Officer (HSO). This document will be reviewed periodically to confirm that it is current and technically correct. Any changes in site conditions and/or the scope of work will require a review of and modification to this HASP. Such changes will be completed in the form of an addendum or a revision

to the HASP. In the event that the HASP is revised or an addendum is prepared, work pertaining to the activities contemplated in the revised portion of the HASP or addendum will not be commenced until modifications are review and considered acceptable by Con Edison.

The provisions of this HASP are mandatory for all ARCADIS personnel and subcontractors assigned to the project. The provisions of the ARCADIS HASP will be utilized by the subcontractors on the conditions that they follow and sign the provisions outlined in Schedule G of ARCADIS' subcontract agreement which states any reuse of the ARCADIS HASP by the subcontractor is conducted at their own risk and without liability or legal exposure to ARCADIS. Subcontractors may prepare their own site-specific HASPs that must meet the basic requirements of this HASP. All visitors to ARCADIS work areas at the site must abide by the requirements of this HASP.

Other contractors/consultants and their employees that are not subcontracted by ARCADIS may be conducting field activities at the site. Other contractors/consultants and their employees will operate under the requirements of HASPs prepared for their own use. Other contractors/consultants and their employees working at the site are not covered by this HASP. Use of this HASP by other organizations without the written approval of ARCADIS is prohibited and is at the sole discretion of the user.

This HASP complies with applicable Occupational Safety and Health Administration (OSHA) regulations, United States Environmental Protection Agency (USEPA) Standard Operating Safety Guidelines (USEPA, 1992), and ARCADIS' Health and Safety Manual (ARCADIS, 2003). This HASP follows the guidelines established in the references listed in Section 11.

1.4 Definitions

The following definitions (listed alphabetically) are applicable to this HASP:

- *Contamination-Reduction Zone* (CRZ) - Area between the exclusion zone and support zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.

- *Exclusion Zone* (EZ) - Any portions of the site where hazardous substances are present, or are reasonably suspected to be present, and pose an exposure hazard to onsite personnel.

- *Incident* - All losses, including first-aid cases, injuries, illnesses, near misses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires, and business interruptions.

- *Near Miss* - An incident in which no injury, illness, motor vehicle accident, equipment or property damage, etc., occurred, but under slightly different circumstances could have occurred.

- *Project* - All onsite work performed under the scope of work.

- *Site* - The area described in Section 1.2, Site and Facility Description, where the work is to be performed by ARCADIS personnel and subcontractors.

- *Subcontractor* - Includes contractor personnel hired by ARCADIS.

- *Support Zone* (SZ) - All areas of the site, except the EZ and CRZ. The SZ surrounds the CRZ and EZ. Support equipment and break areas are located in this zone.

- *Visitor* - All other personnel, except the onsite personnel.

- *Work Area* - The portion of the site where work activities are actively being performed. This area may change daily as work progresses and includes the SZ, CRZ, and EZ. If the work area is located in an area on site that is not contaminated, or suspected of being contaminated, the entire work area may be an SZ.

2. Roles and Responsibilities

2.1 All Personnel

All ARCADIS and subcontractor personnel must adhere to the procedures outlined in this HASP during the performance of their work. Each person is responsible for completing tasks safely and reporting any unsafe acts or conditions to their supervisor. No person may work in a manner that is in conflict with these procedures. After due warnings, the PM will dismiss from the site any person or subcontractor who violates safety procedures.

All ARCADIS and subcontractor personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all personnel will attend an initial hazard briefing prior to beginning work at the site.

The roles of ARCADIS personnel and subcontractors are outlined in the following subsections. Key project personnel and contacts are summarized in Table 2-1 at the end of this section.

2.2 ARCADIS Personnel

2.2.1 Project Officer

The Project Officer (PO) is responsible for providing resources so that project activities are completed in accordance with this HASP and for meeting all regulatory and contractual requirements.

2.2.2 Health and Safety Officer

The HSO or his/her designee (Health and Safety Manager) has overall responsibility for the technical health and safety aspects of the project, including review and approval of this HASP. Inquiries regarding ARCADIS health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSO or his/her designee must approve changes or addenda to this HASP.

2.2.3 Project Manager

The PM is responsible for verifying that project activities are completed in accordance with the requirements of this HASP. The PM is responsible for confirming that the Site Supervisor (SS) has the equipment, materials, and qualified personnel to fully implement the safety requirements of this HASP, and/or subcontractors assigned to this project meet the requirements established by ARCADIS. It is also the responsibility of the PM to perform the following duties:

- Consult with the HSO on site health and safety issues
- Verify that subcontractors meet health and safety requirements prior to commencing work
- Review Loss Prevention Observation (LPO) forms
- Verify that all incidents are thoroughly investigated
- Approve, in writing, addenda or modifications to this HASP
- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance

2.2.4 Health and Safety Supervisor

The Health and Safety Supervisor (HSS) is responsible for field health and safety issues, including the execution of this HASP. Questions in the field regarding health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSS will advise the PM on health and safety issues, and will establish and coordinate the project air monitoring program if one is deemed necessary (see Section 6.1, Air Monitoring). The HSS is the primary site contact on health and safety matters. It is the responsibility of the HSS to perform the following duties:

- Provide onsite technical assistance, if necessary
- Participate in all incident investigations (IIs), and confirm that they are reported to the Principal-in-Charge (PIC), PO, HSO, Client and PM within 24 hours; (or sooner to client based upon contractual agreement)

- Coordinate site and personal air monitoring, as required, including equipment maintenance and calibration
- Conduct site safety orientation training and safety meetings
- Verify that ARCADIS personnel and subcontractors have received the required physical examinations and medical certifications
- Review site activities with respect to compliance with this HASP
- Maintain required health and safety documents and records
- Assist the SS in instructing field personnel on project hazards and protective procedures
- Review LPO forms

2.2.5 Site Supervisor

The SS is responsible for implementing this HASP, including communicating requirements to onsite personnel and subcontractors. The SS will be responsible for informing the PM of changes in the work plan, procedures, or site conditions so that those changes may be addressed in this HASP. Other responsibilities are to perform the following duties:

- Consult with the HSS on site health and safety issues
- Conduct LPOs at the site and complete the LPO forms
- Stop work, as necessary, for personal safety, protection of property, and regulatory compliance
- Obtain a site map, determine and post routes to medical facilities, and post emergency telephone numbers
- Notify local public emergency representatives (as appropriate) of the nature of the site operations and post their telephone numbers (e.g., local fire department personnel who would respond for a confined-space rescue)

- Observe onsite project personnel for signs of ill-health effects
- Investigate and report any incidents to the PIC, PO, HSO, and PM
- Verify that all onsite personnel have completed applicable training
- Verify that onsite personnel are informed of the physical, chemical, and biological hazards associated with the site activities and the procedures and protective equipment necessary to control the hazards
- Issue/obtain any required work permits (hot work, confined space, etc.)
- Perform and/or oversee real-time breathing zone air monitoring and monitoring under the Community Air Monitoring Plan (CAMP)

2.3 Subcontractors

Subcontractors and their personnel must understand and comply with applicable regulations and site requirements established in this HASP. Subcontractors may prepare their own site-specific HASP that must be consistent with the requirements of this HASP. Subcontractors will, as a minimum, undergo LPS Orientation Training prior to starting work on site.

All subcontractor personnel will receive training in accordance with applicable regulations and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. All subcontractor personnel will attend an initial hazard briefing prior to beginning work at the site. Additionally, onsite subcontractor personnel must attend and participate in the documented daily safety meetings.

Subcontractors must designate individuals to function as the PM, HSO, HSS, and SS. In some firms, it is not uncommon for the duties of the HSO to be carried out by the PM. This is acceptable, provided that the PM has the required knowledge, training, and experience to properly address all hazards associated with the work, and to prepare, approve, and oversee the execution of the subcontractor's site-specific HASP. A subcontractor may designate the same person to perform the duties of both the HSS and the SS. However, depending on the level of complexity of a contractor's scope of work, it may be infeasible for one person to perform both functions satisfactorily.

2.4 All Onsite Personnel

All onsite personnel (including subcontractors) must read and acknowledge their understanding of this HASP before commencing work, and abide by the requirements of the HASP. All onsite personnel must sign the HASP Acknowledgement Form after reviewing this HASP.

All ARCADIS and subcontractor personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all onsite personnel will attend an initial hazard briefing (prior to beginning work at the site) and the daily safety meetings.

All onsite personnel must perform a safe performance self-assessment (SPSA) prior to beginning each work activity. The SPSA process is presented in Section 4.2.1. This process must be performed prior to beginning each activity and after any near-miss or other incident to determine if it is safe to proceed. Onsite personnel will immediately report the following to the SS or HSS:

- Personal injuries and illnesses, no matter how minor
- Unexpected or uncontrolled release of chemical substances
- Symptoms of chemical exposure
- Unsafe or hazardous situations
- Unsafe or malfunctioning equipment
- Changes in site conditions that may affect the health and safety of project personnel
- Damage to equipment or property
- Situations or activities for which they are not properly trained
- Near misses

2.5 Visitors

All visitors to ARCADIS work areas must check in with the SS. Visitors will be cautioned to avoid skin contact with surfaces, soils, groundwater, or other materials that may be, or are suspected to be, impacted by constituents of concern (COCs).

Visitors requesting to observe work at the site must don appropriate personal protective equipment (PPE) prior to entering the work area, and must have the appropriate training and medical clearances to do so. If respiratory protective devices are necessary, visitors who wish to enter the work area must have been respirator trained and fit-tested for a respirator within the past 12 months. Visitors will be escorted at all times while on site.

2.6 Stop Work Authority

Every ARCADIS employee and sub-contractor is empowered, expected and has the responsibility to stop the work of another co-worker if the working conditions or behaviors are considered unsafe.

2.7 Short Service Employee (SSE) Program

Recognizing that employees who are new to ARCADIS are at a greater risk for incidents, the following guidelines are established to identify those employees and ease their transition. Short Service Employees (SSEs) will have an assigned field mentor to assist them in adjusting to the project requirements and procedures. SSEs will be identified in the field by wearing an orange hardhat. The following procedures apply to SSEs:

- ARCADIS employees new to the industry and new to ARCADIS will be designated SSEs for 6 months.
- ARCADIS employees experienced in the industry but new to ARCADIS will be designated SSEs for 3-months.

Additionally, the following apply:

- A crew of 2-3 may have 1 SSE on site
- A crew of 5 may have 2 SSEs on site

- A crew of 10 or more may have no more than 3 SSEs on site

2.8 Near-Miss Reporting Hotline

In an effort to streamline near-miss reporting, especially for employees conducting field work who do not have real-time access to the web, ARCADIS has established a toll-free Near-Miss Reporting Hotline. The hotline will be checked daily and data will be entered into the ARCADIS LPS Database with the caller listed as the primary contact for the event. All entries will be saved as initial and can be accessed by the caller when they return to their computers. Entry into the database does not relieve the caller from the responsibility of following through with the near-miss investigation or of notifying other employees in the office or project team of the occurrence.

THE NEAR-MISS REPORTING NUMBER IS 1-866-242-4304

Callers will be prompted to provide the following information:

- Name and phone number
- Date of near-miss
- Location
- Project Number (if applicable)
- A brief description of what happened
- Name of division or office VP
- What you think could have happened if this situation had resulted in an injury or damage
- Any other information you think may be important

The intent of this service is to enable employees to phone in near-misses immediately and have the events entered into the ARCADIS LPS Database. Following all near-misses employees are expected to immediately conduct an SPSA in accordance with Section 4.2.1 to ensure that it is safe to continue with the task.

TABLE 2-1
KEY PERSONNEL

Title/Role	Name	Mailing Address	Phone
Con Edison	Charles P. Leary	31-01 20th Avenue Building 136, 2nd Floor Astoria, NY 11105	718.204.4347
ARCADIS			
Project Officer	Margaret Carrillo-Sheridan	6723 Towpath Road Syracuse, NY 13214	312.332.4937
Corporate Health and Safety Manager	Charles Webster	6723 Towpath Road Syracuse, NY 13214	315.671.9297
Health and Safety Officer	Jay Keough	8 South River Road Cranbury, NJ 08512	609.860.0590
Project Manager	Michael Jones	6723 Towpath Road Syracuse, NY 13214	315.671.9211
Health and Safety Manager	Tom Burgess	655 Third Avenue - 12th Floor New York City, NY 10017-9118	212.682.9271
Site Supervisor	TBD		
Health and Safety/Site Supervisor	TBD		
Subcontractors			
Aquifer Drilling & Testing	Bill Poupis	150 Nassau Terminal Road New Hyde Park, NY 11040	800.238.3745
NAEVA Geophysics, Inc.	Mark Weiss	50 N. Harrison Avenue Suite 11 Congers, NY 10920	845.268.1800
Triumvirate Environmental, Inc	Christina Peters	42-14 19th Avenue Astoria, NY 11105	718.274.3339
Regulatory Agency Personnel			
NYSDEC Division Environmental Remediation	Jamie Folsom	625 Broadway Albany, NY 12233	518.402.9564

2.9 Applicable Con Edison Environmental, Health and Safety (EH&S) Policy Guidelines

A completed Con Edison EH&S Hazard Analysis for Contractor Work and EH&S Hazard Analysis for Contractor Work are provided in Attachment A. The Con Edison Work Plan Guides that are applicable to the planned RI activities are also provided in Attachment A. These work plan guides will be reviewed by site personnel prior to the commencement of site activities covered by the guides.

3. Project Hazards and Control Measures

3.1 Scope of Work

Field activities will include the following tasks:

- Field mobilization/site reconnaissance
- Subsurface utility location and clearance
- Installation of soil borings, soil sampling
- Installation of test pits
- Installation, development, and sampling of monitoring wells
- Management of investigation derived waste (IDW)
- Equipment decontamination
- Surveying
- Demobilization

A job safety analysis (JSA) identifies potential safety, health, and environmental hazards associated with each type of field activity. Because of the complex and changing nature of field projects, supervisors must continually inspect the work site to identify hazards that may harm site personnel, the community, or the environment. The SS must be aware of these changing conditions and discuss them with the HSS, HSO, and the PM whenever these changes impact employee health, safety, the environment, or performance of the project. The SS will keep ARCADIS personnel and subcontractors informed of the changing conditions, and the HSO will write or approve addenda or revisions to this HASP as necessary. ARCADIS employees are not qualified to work with high voltage electrical sources. No work activities will be conducted in the vicinity of high voltage electrical sources without the direct supervision of a Con Edison qualified employee. If a situation occurs (i.e., an electrical emergency, control switching, etc.) which requires Con Edison personnel to enter the EZ of CRZ

designated areas, work activities will discontinue following reasonable efforts to restore unsafe site conditions (i.e., backfilling test pit excavations, relocating equipment, continuous air monitoring, etc.). Each field activity is described below, and potential hazards and control measures for each activity are discussed.

3.2 Field Mobilization/Site Reconnaissance

As part of the mobilization activities, project personnel will walk the site to confirm the existence of anticipated hazards, and identify safety and health issues that may have arisen since the writing of this plan. Site mobilization will also include establishing work areas and sampling locations. A break area will be established outside the regulated work area (i.e., in the support zone).

Hazards – The hazards of this phase of activity are associated with heavy equipment movement, manual materials handling, installation of temporary on-site facilities, and manual site preparation. Manual materials handling and manual site preparation may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion and laceration hazards. The work area presents slip, trip and fall hazards from scattered debris and irregular walking surfaces. Freezing-weather hazards include frozen, slick and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Installation of temporary field support facilities may expose personnel to electrical hazards, underground and overhead utilities, and physical injury due to manual lifting and moving of materials.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, rats, and snakes; weather, such as sunburn, lightning, rain, heat and cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Control – Control procedures for the above-mentioned hazards are discussed in Section 4, General Safety Practices.

3.3 Utility Clearance

All utility clearance activities will be performed in accordance to the *Con Edison Utility Clearance Process for Intrusive Activities Revision 1,* dated October 8, 2003 (Con Edison, October 2003). As part of the utility clearance activities, an initial geophysical survey followed by a removal of surface covers and excavation of a minimum of 5 feet of soil/fill at boring locations will be performed. The geophysical survey will include the

use of ground penetrating radar (GPR) and electromagnetic utility locating instruments. For any intrusive excavation activities within seven feet of a critical utility, identified as a 69/138/345KVelectric feeder, gas main over 125 psig, or fuel oil line, those utilities shall be exposed first by manual or vacuum excavation methods. The Con Edison Utility Clearance Process Checklist and Procedures as well as ARCADIS' Underground/Overhead Utility Checklist (Attachment B) shall be used to document that nearby utilities have been marked on the ground, and that the drill site has been cleared. Each checklist shall be in the possession of the SS prior to commencement of the intrusive investigation at that point of the site.

The surface cover removal will consist of using power tools to remove concrete and/or asphalt surface covers to expose underlying soil/fill material. Soil/fill material will be removed manually utilizing a decontaminated hand auger or post-hole digger in tandem with a non-conductive probe rod, which can be used to confirm the absence of underground utilities to a minimum depth of 5 feet below the bottom of the interior concrete slab, or vacuum excavation methods.

Hazards – Transport and operation of GPR and electromagnetic utility locating equipment and trips/slips/falls are the main hazards associated with the geophysical investigation. The primary physical hazards for this activity are associated with the use of concrete cutting equipment, lifting and awkward posture/repetitive motion, slips/trips/falls and potential exposure to COCs. Inhalation and absorption of COCs and/or dust, and proximity of operations to the breathing zone are the primary routes of entry associated with manual excavation of potentially impacted subsurface soils. The hazards directly associated with manual hand auguring include strains, sprains, pinching, and potential eye hazards.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, rats, and snakes; weather, such as sunburn, lightning, rain, heat and cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Control – Initially Level D protection will be worn during utility clearance activities. If COCs are encountered, personnel will upgrade to Modified Level D protection to control dermal exposure. If necessary, based on field observations and site conditions, air monitoring may be conducted during utility clearance activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Section 6.1, Air Monitoring, describes air monitoring

requirements and action levels. Each level of PPE is described in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Safety Practices.

Saw cutting or coring of concrete or asphalt surfacing will not be conducted directly above any dielectric feeder cables (a.k.a. "pipe-type" feeders), regardless of the dielectric feeder cable depth. Vacuum excavation, for utility clearance test pitting purposes, will be accomplished with vacuum excavation equipment that is equipped with a manual ("butterfly" valve) or remote (immediate) electronic vacuum cut-off control that is operational.

3.4 Field Sampling

Field sampling activities conducted at the site will include the following:

- Soil borings
- Soil sampling
- Monitoring well development
- Ground water sampling

Hazards and control measure and procedures for each sampling activity are discussed in the following sections.

3.4.1 Installation of Soil Borings

Hollow stem auger (HSA) or direct push drilling methods and equipment will be used to facilitate the collection of subsurface soil samples. This equipment poses a hazard to personnel if used incorrectly. Hazards and controls associated with the use of drill rigs is outlined below.

Drilling Hazards - Accidents can occur as a result of improperly placing the equipment on uneven or unstable terrain, or failing to adequately secure the equipment prior to the start of operations. Overhead utility lines can create hazardous conditions if contacted by the equipment. Underground installations such as electrical lines, conduit, and product lines pose a significant hazard if contacted.

The operator is responsible for the safe operation of the rig, as well as the crew's adherence to the requirements of this HASP. The operator must ensure that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions of the operator, wear all personal protective equipment, and be

aware of all hazards and control procedures. The operator and crew must participate in the Daily Safety Meetings and be aware of all emergency procedures.

Equipment Inspection - Each day, prior to the start of work, and as necessary during the workday, the rig and associated equipment must be inspected by the operator. The following items must be inspected:

- Vehicle condition
- Proper storage of equipment
- Condition of all drilling and lifting mechanisms
- Condition of all drill rods and internal threads
- Condition of all hydraulic lines
- Fire extinguisher
- First aid kit

Equipment Set Up - The rig must be properly leveled prior to beginning work.

All sampling locations will be inspected by the equipment operator prior to the location of the equipment to verify a stable surface exists. This is especially important in areas where soft, unstable terrain is common.

The primary physical hazards for this activity are associated with the use of the drilling rig. Rig accidents can occur as a result of improperly placing the rig on uneven or unstable terrain, or failing to adequately secure the rig prior to the start of operations. Underground and overhead utility lines can create hazardous conditions if contacted by drilling equipment. Tools such and equipment such as elevators, cat lines, and wire rope have the potential for striking, pinning, or cutting personnel.

Wire Rope – Worn or frayed wire rope presents a laceration hazard if loose wires protrude from the main bundle.

Cat Lines – Cat lines are used on drilling rigs to hoist material. Accidents that occur during cat line operations may injure the employee doing the rigging as well as injure the operator. Minimal hoisting control causes sudden and erratic load movements, which may result in hand and foot injuries.

Working Surfaces – Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls.

Materials Handling – The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or toe gets caught between two objects. Rolling stock can shift and/or fall from a pipe rack or truck bed.

3.4.1.1 Drilling Safety Procedures

Drill Crews – All drillers must possess required state or local licenses to perform such work. All members of the drill crew shall receive site specific training prior to beginning work.

The driller is responsible for the safe operation of the drill rig as well as the crew's adherence to the requirements of this HASP. The driller must ensure that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions of the driller, wear all personal protective equipment, and be aware of all hazards and control procedures. The drill crew must participate in the daily safety meeting and be aware of emergency procedures.

Rig Inspection – Each day, prior to the start of work, and as necessary during the workday, the drill rig and associated equipment must be inspected by the driller and/or drill crew. The following items must be inspected:

- Vehicle condition
- Proper storage of equipment
- Condition of all drilling and lifting mechanisms
- Condition of all drill rods and internal threads
- Condition of all wire rope
- Fire extinguisher
- First aid kit

Drill Rig Set Up – The drill rig must be properly blocked and leveled prior to raising the derrick. The wheels which remain on the ground must be chocked. The leveling jacks shall not be raised until the derrick is lowered. The rig shall be moved only after the derrick has been lowered.

All well sites will be inspected by the driller prior to the location of the rig to verify a stable surface exists. This is especially important in areas where soft, unstable terrain is common.

The drill rig must be properly blocked and leveled prior to raising the derrick. Blocking provides a more stable drilling structure by evenly distributing the weight of the rig. Proper blocking ensures that differential settling of the rig does not occur.

When the ground surface is soft or otherwise unstable, wooden blocks, at least 24" by 24" and 4" to 8" thick shall be placed between the jack swivels and the ground. The emergency brake shall be engaged, and the wheels that are on the ground shall be chocked.

Site Drilling Rules – The Con Edison Utility Clearance Process Checklist and Procedures as well as ARCADIS' Underground/Overhead Utility Checklist (see Attachment B) will be used to document that nearby utilities have been marked on the ground and that excavation and/or drilling areas have been cleared. The completed Con Edison Utility Clearance Process Checklist and Procedures/ARCADIS Underground and Overhead Utility Checklist will be in the possession of the SS prior to commencing any intrusive investigation.

Combustible gas readings of the general work area will be made regularly in areas where, and/or during operations when, the presence of flammable vapors or gases is suspected, such as during intrusive activities (see Section 6). Operations must be suspended and corrective action taken if the airborne flammable concentration reaches 10% of the LEL in the immediate area (a one-foot radius) of the point of drilling, or near any other ignition sources.

Under no circumstances will personnel be permitted to ride the traveling block or elevators, nor will the catline be used as a personnel carrier.

Overhead Electrical Clearances - If drilling is conducted in the vicinity of overhead power lines, the power to the lines must be shut off or the equipment must be positioned and blocked such that no part, including cables can come within the minimum clearances as follows:

Table 3-1
Minimum Overhead Electrical Clearances (All Equipment)

Nominal System Voltage	Minimum Required Clearance
0 - 50 kilovolts (kV)	10 feet
51 - 100kV	12 feet

Nominal System Voltage	Minimum Required Clearance
101 - 200kV	15 feet
201 - 300kV	20 feet
301 - 500kV	25 feet
501 - 750kV	35 feet
751 - 1,000kV	45 feet

When the drill rig is in transit, with the boom lowered and no load, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50 kV to 345 kV, and 16 feet for voltages above 345 kV.

Hoisting Operations - Drillers should never engage the rotary clutch without watching the rotary table, and ensuring it is clear of personnel and equipment. Hoisting mechanisms should be inspected by the driller at the start of work, and as necessary during the workday.

Unless the drawworks is equipped with an automatic feed control, the brake should not be left unattended without first being tied down.

Drill pipe, auger strings or casing should be picked up slowly. Drill pipe should not be hoisted until the driller is sure that the pipe is latched in the elevator, or the derrickman has signaled that he may safely hoist the pipe.

During instances of unusual loading of the derrick or mast, such as when making an unusually hard pull, only the driller should be on the rig floor; no one else should be on the rig or derrick.

The brakes on the drawworks of the drill rig should be tested by the driller each day. The brakes should be thoroughly inspected by a competent individual each week.

A hoisting line with a load imposed should not be permitted to be in direct contact with any derrick member or stationary equipment, unless it has been specifically designed for line contact.

Workers should never stand near the borehole whenever any wire line device is being run.

Hoisting control stations should be kept clean and controls labeled as to their functions.

Cat Line Operations - Only experienced workers will be allowed to operate the cathead controls. The kill switch must be clearly labeled and operational prior to operation of the cat line. The cathead area must be kept free of obstructions and entanglements. Devices associated with the use of the cat line should be inspected by the driller at the start of work, and as necessary during the workday.

The operator should not use more wraps than necessary to pick up the load. More than one layer of wrapping is not permitted.

Personnel should not stand near, step over, or go under a cable or cat line which is under tension.

Employees that rig loads on cat lines shall:

- Keep out from under the load
- Keep fingers and feet where they will not be crushed
- Be sure to signal clearly when the load is being picked
- Use standard visual signals only and not depend on shouting to coworkers
- Make sure the load is properly rigged, since a sudden jerk in the cat line will shift or drop the load

Wire Rope - When two wires are broken or rust or corrosion is found adjacent to a socket or end fitting, the wire rope shall be removed from service or re-socketed. Special attention shall be given to the inspection of end fittings on boom support, pendants, and guy ropes.

Wire rope removed from service due to defects shall be cut up or plainly marked as being unfit for further use as rigging.

Wire rope clips attached with U-bolts shall have the U-bolts on the dead or short end of the rope; the clip nuts shall be re-tightened immediately after initial load carrying use and at frequent intervals thereafter.

When a wedge socket fastening is used, the dead or short end of the wire rope shall have a clip attached to it or looped back and secured by a clip; the clip shall not be attached directly to the live end.

Protruding ends of strands in splices on slings and bridles shall be covered or blunted.

Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads, shall consist of one continuous piece without knot or splice.

An eye splice made in any wire rope shall have not less that five full tucks.

Wire rope shall not be secured by knots. Wire rope clips shall not be used to splice rope.

Eyes in wire rope bridles, slings, or bull wires shall not be formed by wire clips or knots.

Pipe/Auger Handling - Pipe and auger sections shall be transported by cart or carried by two persons. Individuals should not carry auger or pipe sections without assistance.

Workers should not be permitted on top of the load during loading, unloading, or transferring of pipe or rolling stock.

Employees should be instructed never to try to stop rolling pipe or casing; they should be instructed to stand clear of rolling pipe.

Slip handles should be used to lift and move slips. Employees are not permitted to kick slips into position.

When pipe is being hoisted, personnel should not stand where the bottom end of the pipe could whip and strike them.

Pipe and augers stored in racks, catwalks or on flatbed trucks should be secured to prevent rolling.

3.4.2 Soil Sampling

This task involves collecting soil samples for subsequent analysis and evaluation of potential impact by COCs. The physical hazards of these operations are primarily

associated with the sample collection methods and procedures used. In addition, personnel may be exposed to hazards associated with working in or near excavations and heavy equipment.

Hazards – Inhalation and absorption of COCs are the primary routes of entry associated with soil sampling due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. During this project, several different soil sampling methodologies may be used based on equipment accessibility and the types of materials to be sampled. These sampling methods may include the use of hand-auger/sampling probes, sampling spoons, Encore™ samplers or trowels. The primary hazards associated with these specific sampling procedures are not potentially serious; however, other operations in the area or the conditions under which samples must be collected may present chemical and physical hazards. The hazards directly associated with soil sampling procedures are generally limited to strains or sprains and potential eye hazards. Exposure to soil containing COCs is also possible. In addition to the safety hazards specific to sampling operations, hazards associated with the operation of vehicles (especially large vehicles with limited operator visibility), is a concern. Of particular concern will be the backing up of trucks, excavation equipment, and other support vehicles.

The flora and fauna of the site may present hazards of poison ivy, poison oak, ticks, ants, fleas, mosquitoes, wasps, spiders, rats and snakes. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, and/or slick walking surfaces and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Control – Modified Level D protection will be worn during soil sampling activities. Air monitoring will be conducted during soil sampling activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Each level of personal protection is described in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Safety Practices.

3.4.3 Groundwater Sampling/Monitoring Well Development

Groundwater sampling will involve uncapping, purging (pumping water out of the well), sampling, and monitoring new or existing monitoring wells. A mechanical pump may

be used to purge the wells; the pump may be hand-, gas-, or electric-operated. Water samples taken from the wells are then placed in containers and shipped to an analytical laboratory for analysis. The physical hazards of these operations are primarily associated with the sample collection methods and procedures used.

Hazards - Inhalation and absorption (contact) of COCs are the primary routes of entry associated with groundwater sampling, due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. During the course of this project, several different groundwater sampling methodologies may be utilized based on equipment accessibility and the types of materials to be sampled. These sampling methods may include hand or mechanical bailing. Equipment used for mechanical bailing may present noise and vibration hazards, and the potential for employee contact with hot surfaces. Manual materials handling may cause blisters, sore muscles, and joint and/or skeletal injuries.

The primary hazards associated with these specific sampling procedures are not potentially serious; however, other operations in the area, or the conditions under which samples must be collected may present chemical and physical hazards. The hazards directly associated with groundwater sampling procedures are generally limited to strains or sprains from hand bailing, and potential eye hazards. Exposure to soil and water containing COCs is also possible. In addition to the safety hazards specific to sampling operations, hazards associated with the operation of vehicles, especially large vehicles with limited operator visibility, is a concern.

The flora and fauna of the site may present hazards of poison ivy, poison oak, ticks, ants, fleas, mosquitoes, wasps, spiders, rats and snakes. The work area may present slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, and/or slick walking surfaces and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Control - Modified Level D protection will be worn during ground water sampling/monitoring well development activities. If necessary, based on field observations and site conditions, air monitoring may be conducted during groundwater sampling and monitoring activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will stop work and evacuate the area or upgrade to Level C protection. Section 6.1, Air Monitoring, describes air monitoring requirements and action levels. A description of each level of personal protection is included in Section 5, Personal Protective Equipment. Control procedures for

environmental and general hazards are discussed in Section 4, General Safety Practices. Control of vehicular traffic hazards is presented in Section 4.16, Traffic Safety.

3.4.4 Excavation of Test Pits

Test pits will be excavated as part of the site investigation. No ARCADIS or subcontractor personnel will enter the test pits. The subcontractor chosen to dig the test pits will have an Excavation Competent Person on site during the excavation activities. The Con Edison Utility Clearance Process Checklist and Procedures as well as ARCADIS' Underground/Overhead Utility Checklist (see Attachment B) will be used to document that nearby utilities have been marked on the ground and that excavation and/or drilling areas have been cleared. The completed Con Edison Utility Clearance Process Checklist and Procedures/ARCADIS Underground and Overhead Utility Checklist will be in the possession of the SS prior to commencing any intrusive investigation.

The physical hazards involved with excavating soil are related to the presence of overhead and underground installations, the excavation itself and the operation of heavy equipment. The presence of overhead utilities, such as power lines, requires careful positioning of the excavating equipment to maintain a safe distance between the lines and the closest part of the equipment.

Gas lines and other underground utilities are expected at the site. Dig Safely New York requires a call at least two full working days before you dig 1-800-962-7962. Be prepared to provide Dig Safely New York with information about the project including location, address, contact information, two nearest cross streets as well as any special instructions that are important to your specific location request.

Excavations pose significant hazards to employees if they are not carefully controlled. There exists a chance for the excavation to collapse if it is not dug properly, sloped, benched, or shored. Since no personnel will be entering the excavation, the protective systems specified in 29 Code of Federal Regulations (CFR) 1926 Subpart P are not required. The excavation must however be constructed so as to not present a hazard to personnel working in the area or to the public. This includes precautions to prevent a cave-in or collapse which could impact people standing or working near the top to the test pit, and barricading or making use of other precautions to protect from fall hazards.

The following control procedures are required during test pit installation activities:

- Each test pit will consist of a linear trench excavated to the limits of the backhoe reach (approximately depth of 8 to 10 feet) or to refusal. It is anticipated that each test pit will be approximately 2 to 3 feet wide (approximately 1.5 times the width of the backhoe bucket). Utility markout procedures will be conducted at each test pit location as described in Section 3.3 of this HASP. If the geophysical survey indicates that subsurface utility conduits are located within the proposed perimeter of the test pit or in its close proximity, a vacuum truck or similar non-mechanical means will be used to remove the top 5-feet of soil at the location of the identified subsurface conduit. If no subsurface utility conduits are identified in close proximity to a test pit location by the geophysical survey, the test pit will be excavated in 6-inch lifts and a dedicated spotter will be present to assess the presence or absence of potential subsurface utility conduits in the excavation.

- Noise also may present a hazard. Heavy equipment operation frequently results in noise levels exceeding 85 dBA, requiring the use of hearing protection.

- At the end of each workday, open test-pit excavations will be backfilled and equipment will be moved to a location away from high-voltage electrical equipment and away from routes necessary to access high-voltage electrical equipment.

- Airborne concentrations of COC in the site soil and the dust from the excavation procedure pose the potential for inhalation exposure. PPE for this phase is described in Section 5, Personal Protective Equipment. Airborne particulate generation will be controlled during site excavations. Dry, dusty soil will be wetted with a water spray from a potable water source to control the generation of dust. Soil will not be wetted to a degree that will cause runoff or erosion.

- Before excavation activities commence, the existence and location of underground pipe, electrical equipment, and gas lines must be determined. The Underground Facility Protection Organization (UFPO) must be contacted at least 1 week, but no more than 2 weeks, prior to subsurface activities. The SS will meet with electrical and natural gas locators onsite prior to marking out the underground utilities. During this meeting, the SS will provide the electric and natural gas locators with a site figure that shows the locations where excavation and drilling activities will be completed. The SS will conduct a site walkover with the electrical and natural gas locators to visually identify each location where excavation and drilling activities are to be completed during site operations. The Con Edison Utility Clearance Process Checklist and Procedures/ARCADIS Underground and Overhead Utility Checklist (see Attachment B) must be used to document that nearby utilities have

been marked on the ground, and that the excavation and drilling areas have been cleared. The completed Con Edison Utility Clearance Process Checklist and Procedures/ARCADIS Underground and Overhead Utility Checklist will be in the possession of the SS prior to commencing any intrusive investigation.

- If excavation operations are located near underground installations, the exact location of the installations must be determined by safe and acceptable means. Subsurface work conducted near expected utility locations will be conducted with a hand auger or shovel until utilities can be located. While the excavation is open, underground installations must be protected, supported, or removed as necessary to safeguard employees.

3.4.5 Overhead Electrical Clearances

If excavation activities are conducted in the vicinity of overhead power lines, the power to the lines must be de-energized, tested de-energized, marked up, and guaranteed, or the equipment must be positioned such that no part, including the excavation boom, can come within the minimum clearances outlined in Table 3-1.

When excavation equipment is in transit, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50kV to 345kV, and 16 feet for voltages above 345kV.

3.4.6 Excavation Entry Procedure

ARCADIS employees will not enter any excavations. All sampling will be done out of the bucket, and visual inspections from a safe location outside of the excavation.

3.4.7 Heavy Equipment Operation

Excavation activities involve using heavy equipment to remove, transport, and replace earthen materials. During field activities, ARCADIS and ARCADIS subcontractor personnel may be working in areas where heavy equipment is in operation. Heavy equipment operation will be conducted in accordance with this section and appropriate federal and state regulations.

Heavy equipment operation may take place in public areas of the Site. Additional precautions will be taken to protect the public during the operation of heavy equipment.

These precautions include additional flaggers, spotters, cones, or barricades whenever needed.

The physical hazards involved with working near heavy equipment relate to the equipment itself and the site environment. There exists a potential for incidents involving personnel being struck by or against heavy equipment or materials, resulting in fractures, cuts, punctures, or abrasions. Heavy equipment operation may present noise and vibration hazards, and a potential for contact with moving parts or hot surfaces to equipment operators. Walking and working surfaces may involve slip, trip, and fall hazards. Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls. Noise may also present a hazard. Heavy equipment operation frequently results in high noise levels.

Audible Alarms

Every vehicle used to haul dirt, rock, concrete, or other construction material must be equipped with a warning device that operates automatically while the vehicle is backing. The warning sound must be of such magnitude that it will normally be audible from a distance of 200 feet and will sound immediately on backing. In congested areas or areas with high ambient noise that obscures the audible alarm, a signaler, in clear view of the operator, must direct the backing operation. Other vehicles, if operating in areas where their backward movement would constitute a hazard to employees working in the area on foot and where the operator's vision is obstructed to the rear of the vehicle, must be equipped with an effective device or method to safeguard employees such as:

- an automatic backup audible alarm that would sound immediately on backing
- an automatic braking device at the rear of the vehicle that will apply the service brake immediately on contact with any obstruction to the rear
- in lieu of the above requirements, administrative controls must be established such as:

    - a spotter or flagger in clear view of the operator who must direct the backing operation
    - other procedures that will require the operator to dismount and circle the vehicle immediately prior to starting a backup operation
    - prohibiting all foot traffic in the work area
    - other means must be provided that will provide safety equivalent to the foregoing for personnel working in the area

The operator of all vehicles must not leave the controls of the vehicle while it is moving under its own engine power. Hauling or earth-moving operations must be controlled in

such a manner as to confirm that equipment or vehicle operators know of the presence of other personnel in the areas of their operations.

Equipment Inspection and Maintenance

All vehicles in use must be checked at the beginning of each shift to confirm that the following parts, equipment, and accessories are in safe operating condition and free of apparent damage that could cause failure while in use:

- service brakes, including trailer brake connections
- parking system (hand brake)
- emergency stopping system (brake)
- tires
- horn
- steering mechanism
- coupling devices
- seat belts
- operating controls
- safety devices

All defects affecting safe operation must be corrected before the vehicle is placed in service. These requirements also apply to equipment such as lights, reflectors, windshield wipers, defrosters, fire extinguishers, etc., where such equipment is necessary.

Vehicle engines must not be allowed to run in closed garages or other enclosed places unless vents are provided that effectively remove the exhaust gases from the building.

Except for emergency field repairs, a safety tire rack, cage, or equivalent protection must be used when inflating truck or equipment tires after mounting on a rim, if such tires depend on a locking ring or similar device to hold them on the rim.

No repairs must be attempted on power equipment until arrangements are made to eliminate the possibility of injury caused by sudden movements or operation of the equipment or its parts. When the equipment being repaired is a bulldozer, carryall, ripper, or other machine having sharp or heavy moving parts such as blades, beds, or gates, such parts must be lowered to the ground or securely and positively blocked in an inoperative position.

All controls must be in a neutral position, with the engine(s) stopped and brakes set, unless work being performed requires otherwise. Trucks with dump bodies must be

equipped with positive means of support, permanently attached, and capable of being locked in position to prevent accidental lowering of the body while maintenance or inspection work is being done. In all cases where the body is raised for any work, the locking device must be used.

Equipment Parking and Loading

Whenever equipment is parked, the parking brake must be set. Equipment parked on inclines must have the wheels chocked and parking brake set, or be otherwise prevented from moving by effective mechanical means.

Scissor points on all front-end loaders, which constitute a hazard to the operator, must be adequately guarded. A loader must not travel without adequate visibility for the driver and stability of the equipment. No loading device must be left unattended until the load or bucket is lowered to the ground, unless proper precautions such as blocking are taken to prevent accidental lowering.

Equipment Fueling

No internal combustion engine fuel tank must be refilled with a flammable liquid while the engine is running. Fueling must be done in such a manner that the likelihood of spillage is minimal. If a spill occurs, it must be contained and cleaned, or equivalent action taken to control vapors before restarting the engine. Fuel tank caps must be replaced before starting the engine.

Good metal to metal contact must be kept between fuel supply tank or nozzle of supply hose and the fuel tank. No open lights, welding, or sparking equipment must be used near internal combustion equipment being fueled or near storage tanks. Smoking is not permitted at or near the gasoline storage area or on equipment being fueled. A conspicuous sign must be posted in each fuel storage and fueling area stating: "**No Smoking within 50 Feet**" Class I liquids must not be dispensed by pressure from drums, barrels, and similar containers. Approved pumps taking suction through the top of the container or approved self-closing faucets must be used. No repairs must be made to equipment while it is being fueled.

Each fuel storage tank or drum must have the word "flammable" conspicuously marked thereon, and should also have a similarly sized word indicating the contents of the container. A fire extinguisher rated 20:BC or larger must be in a location accessible to

the fueling area. All fuel storage tanks, drums, or safety cans must be properly marked and of the proper type.

Additional Safety Requirements

To protect onsite personnel against hazards associated with materials handling, and to prevent injury due to unsafe heavy equipment operation, only properly trained and authorized personnel will be allowed to operate heavy equipment. All materials handling equipment will be maintained in a safe operating condition and inspected daily prior to use.

Additional heavy equipment safety requirements include, but are not limited to:

- Prior to operating any heavy equipment, the authorized operator must conduct a pre-operation inspection to determine if the heavy equipment is in safe operating condition prior to each work shift.
- All mobile equipment must be equipped with an audible back-up alarm.
- Personnel will not be allowed to stand or pass under the elevated portion of any heavy equipment, whether loaded or empty.
- Personnel will not place arms and legs between pinch or scissor points of the equipment, or outside the operator enclosure.
- A safe distance must be maintained from the edge of excavations, ditches, ramps, or platforms.
- Operators will maintain sufficient clearance under overhead utilities, installations, lights, pipes, etc.
- Heavy equipment must never be used for lifting or transporting personnel.
- The operator is required to look in the direction of, and maintain a clear view of the path of travel.
- Heavy equipment must not be operated without an overhead guard and roll-over protection to protect the operator against falling objects and equipment roll-over.
- Heavy equipment must not be driven up to anyone standing in front of any object.
- Stunt driving and horseplay are strictly prohibited.
- Operators will yield the right-of-way to other site vehicles.

- Other heavy equipment traveling in the same direction at intersections, blind spots, or other dangerous locations, must not be passed.
- A safe distance must be maintained from other heavy equipment, and the equipment must be kept under control at all times.
- The heavy equipment operator must slow down for wet and slippery conditions. Under all travel conditions, the equipment will be operated at a speed that will permit it to be brought to a stop safely.
- Operators will avoid running over loose objects on operating surfaces.
- Grades and ramps must be ascended and descended slowly.
- On all grades, the load will be tilted back and raised only as far as necessary to clear the operating surface.
- The operator will slow down and sound the horn at intersections, when entering buildings, and other locations where vision may be obstructed.
- If the load being carried obstructs forward view, the operator will travel with the load trailing.
- While negotiating turns, speed will be reduced to a safe rate, and turning will be in done a smooth, sweeping motion to avoid abrupt turns and potential equipment or load upset.
- Authorized operators will only handle stable or safely arranged loads that are within the rated capacity of the heavy equipment and will not affect the stability of the heavy equipment.
- When a piece of heavy equipment is left unattended, hydraulics will be fully lowered, controls will be neutralized, power will be shut off, and brakes set. Wheels will be blocked or chocked if the heavy equipment is parked on an incline. When internal combustion-engine-powered heavy equipment is used indoors, near confined spaces, or near excavations, carbon monoxide levels must be monitored to prevent personnel exposure.

Work may be performed on or near public parking areas and roadways of the Site. This may make a separate decontamination area impractical. To minimize the need for decontamination and to reduce the risk of spread of contaminants into public areas, contamination minimization and control practices should be implemented to minimize and control contamination during drilling and other work tasks. This includes covering areas and equipment with tarps, minimizing the spread of potentially contaminated soil and water, and minimizing the size of the EZ.

All equipment is decontaminated before leaving the site. In addition, all operations that have the potential to generate or release hazardous material will be conducted in a controlled area using the appropriate engineering controls. Specific decontamination techniques will be established based on site conditions. Decontamination procedures will be reviewed with all personnel onsite. A decontamination pad on a suitable surface (concrete or paved area) with polyethylene sheeting or other appropriate containment system will be established if needed. Pressure washing with manual scrub brushing as needed will be used to decontaminate equipment. COC-impacted equipment will be determined "clean" by visually inspecting all equipment.

The decontamination facility will be inspected daily for evidence of leaks or loss of integrity to the containment system. If any deficiencies are noted they will be corrected immediately. All wastewater and waste materials generated onsite will be contained in the decontamination system for characterization and proper disposal.

Personnel involved in decontamination activities may be exposed to skin contact with contaminated materials and chemicals brought to the site as part of the project work. All personnel will review the operating procedures and PPE prior to decontamination. Personnel involved in decontamination activities must wear PPE that is appropriate for the task, and no more than one level below the level worn by personnel working in the EZ.

3.5 Management of IDW

Most sampling activities will generate waste that will be managed in 55-gallon steel drums or roll-off dumpsters. Types of waste will include drill cuttings, decontamination fluids, groundwater development and liquids, sampling material, personal protective equipment (PPE) and general work-related refuse. The physical hazards of these operations are primarily associated with moving and storing the steel drums. In addition, personnel may be exposed to hazards associated with working near heavy equipment and exposure to COCs during disposal characterization sampling. Disposal of IDW by Con Edison-approved vendors will occur on an as-needed basis, based on available storage space and work location. Vendors transporting waste from the site will either transport the materials directly to the disposal facility or to a permitted temporary storage facility prior to final disposal. Contaminated soil and groundwater will be characterized using composite sampling at a frequency that is acceptable to the IDW disposal vendor prior to off-site disposal.

Hazards – Inhalation and absorption of COCs are the primary routes of entry associated with IDW management due to the transport of waste into drums. The primary hazards associated with IDW management are not potentially serious; however, other operations in the area may present chemical and physical hazards. The hazards directly associated with drum handling procedures include strains, sprains, crushing injuries, pinching, and potential eye hazards. Exposure to waste containing COCs is also possible. In addition to the safety hazards specific to sampling operations, hazards associated with the operation of vehicles (especially large vehicles with limited operator visibility), is a concern.

The flora and fauna of the site may present hazards of poison ivy, poison oak, ticks, ants, fleas, mosquitoes, wasps, spiders, rats and snakes. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, and/or slick walking surfaces and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Control –Initially Level D protection will be worn during IDW management activities. If drums contain COC impacted soil, personnel will upgrade to Modified Level D protection to control dermal exposure. Avoid laying tools and equipment on the ground to avoid contact with native poisonous or irritating flora and fauna.

Specific drum handling procedures include the following:

- Tightly secure all bung holes in the drum so that contents do not leak
- Inspect the drum handling area for laceration hazards
- Secure the drum on a surface that is accessible by the dollie or forklift
- Clear a path for moving the drums
- Clear slip, trip, and fall hazards from the path
- If the drum will be moved while on a pallet, secure the drum to the pallet prior to moving
- Use a drum dollie, forklift, or other acceptable method to move the drums and do not attempt to move them without an acceptable device
- Separate the drums by what the contents may be so that the drums do not have to be moved more than once to prevent accidents
- Make sure there are at least 3 people involved in the moving process
- Do not remove drums from pallets unless the pallet is in such a condition it is unsafe to move the drum while it is on it
- Use a pallet jack or fork lift to move pallet with drums on it to the designated area
- Avoid having to move the drum more than once to prevent accidents

Control procedures for environmental and general hazards are discussed in Section 4, General Safety Practices.

3.6 Equipment Decontamination

Equipment/materials decontamination will be performed to control the transfer of COCs from the site. Equipment will be decontaminated by either scrubbing with a mild detergent/citrus solvent or a high pressure steam/wash to remove visible dirt and dust.

Hazards – Sources of chemical hazards from decontaminating equipment are decontamination detergents or solvents, foreign matter and COCs on the equipment prior to decontamination, and rinsate from the decontamination process. Physical hazards associated with this activity are back strain, slippery surfaces, cuts and burns from the high pressure steam wash and hearing loss due high levels of noise generated by the equipment.

Control – All equipment shall be decontaminated before arriving at and leaving the site. In addition, all operations that have the potential to generate or release hazardous material will be conducted in a controlled area using the appropriate engineering controls. Specific decontamination techniques will be established based on site conditions. Decontamination procedures will be reviewed with all personnel on-site. A bermed (all four sides) decontamination pad on a suitable surface (concrete or paved area) with polyethylene sheeting or other appropriate containment system will be established. The decontamination pad will include a backsplash sheet. Pressure washing with manual scrub brushing as needed will be used to decontaminate equipment. COC impacted equipment will be determined “clean” by using visual inspection of all equipment.

The decontamination facility will be inspected on a daily basis for evidence of leaks or loss of integrity to the containment system. If any deficiencies are noted they will be corrected immediately. All wastewater and waste materials generated on-site will be contained in the decontamination system for characterization and proper disposal.

Personnel involved in decontamination activities may be exposed to skin contact with contaminated materials and chemicals brought to the site as part of the project work. All personnel will review the operating procedures and PPE prior to decontamination. Personnel involved in decontamination activities must wear PPE that is appropriate for the task, and no less than one level below the level worn by personnel working in the EZ. PPE for this activity is specified in Section 5, Personal Protective Equipment.

3.7 Field Demobilization

Demobilization involves removing all tools, equipment, supplies, and vehicles brought to the site. The hazards of this phase of activity are associated with heavy equipment operation and manual materials handling.

Hazards – Manual materials handling may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Environmental hazards include plants such as poison ivy and poison oak; aggressive fauna such as ticks, fleas, mosquitoes, wasps, spiders, rats and snakes; weather such as sunburn, lightning, rain, and heat- or cold-related illnesses; and pathogens such as rabies, Lyme disease, and blood-borne pathogens.

Control – Control procedures for these hazards are discussed in Section 4, General Safety Practices.

3.8 Land Surveying

Land surveying will include the location and measurement of the ground surface and other objects within the investigation area.

Hazards – Surveying near roadways represents risks associated with moving vehicles. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Environmental hazards include plants such as poison ivy and poison oak; aggressive fauna such as ticks, fleas, mosquitoes, wasps, spiders, rats and snakes; weather such as sunburn, lightning, rain, and heat- or cold-related illnesses; and pathogens such as rabies, Lyme disease, and blood-borne pathogens.

Control – Control procedures for these hazards are discussed in Section 4, General Safety Practices.

3.9 Chemical Hazards

The chemical hazards associated with site operations are related to inhalation, ingestion, and skin or eye contact with materials that are impacted by site COCs. Potential COCs at the site include: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and cyanide.

Ambient air monitoring will occur during all intrusive site activities or any surface activity which may generate airborne emissions. Air monitoring requirements for site activities are outlined in Section 6 Air Monitoring.

The potential for inhalation of COCs during mobilization and demobilization activities is low. The potential for inhalation of COCs during utility clearance, installation of soil borings and monitoring wells, monitoring well development, soil and groundwater sampling, IDW management, and decontamination activities is low to moderate. The potential for inhalation of COCs during surveying is low. The potential for dermal contact with environmental media containing COCs during mobilization and demobilization activities is low to moderate. The potential for dermal contact with COC-containing environmental media or equipment during utility clearance, installation of soil borings and monitoring wells, soil and groundwater sampling, IDW management, and decontamination activities is moderate to high. The potential for dermal contact with COC-containing environmental media or equipment during surveying is low.

Levels of PPE to be used for each work activity were selected based on the COCs at the site at the time this plan was written, and are discussed in Section 5, Personal Protective Equipment. As analytical data become available, this HASP will be amended to address additional COCs detected, and Material Safety Data Sheets (MSDS') for the specific chemicals will be attached to this HASP.

Any chemicals to be brought to the work site must be pre-approved for use by the Con Edison Corporate Environmental Health & Safety Department (a one week turnaround time will be allowed for review by Con Edison). A MSDS must accompany all materials brought to the site. No material shall be used or installed by any ARCADIS employee or subcontractor prior to review of the MSDS by the SS or HSS. Following review of MSDS' by the SS or HSS, copies shall be made and placed in this HASP. The location of MSDS for on-site chemicals shall be communicated to all on-site employees. All provisions of the ARCADIS Hazard Communication Standard Operating Procedure

and 29 CFR 1910.1200 are to be followed with regard to chemicals that are to be used during on-site activities.

The MSDSs for the COCs and the chemicals in use at the site are included in Attachment C. The Chemical Hazard Information Table (Table 3-2) lists the chemical, physical, and toxicological properties of several potential site COCs.

TABLE 3-2
CHEMICAL HAZARD INFORMATION

Substance [CAS Number]	IP[1] (eV)	Odor Threshold (ppm)	Route[2]	Symptoms of Exposure	Treatment	TWA[3]	STEL[4]	Source[5]	IDLH (NIOSH)[6]
Arsenic and soluble inorganic compounds (as As) [7740-38-2]	NA	NA	Inh Abs Ing Con	Ulceration of nasal septum; dermatitis; gastrointestinal disturbances; hyperpigmentation of skin (carcinogenic); peripheral neuropathy; respiratory irritation	Eye: Irrigate immediately (15 min) Skin: Soap wash immediately Swallow: Immediate medical attention	0.01 mg/m^3 0.01 mg/m^3 (Ca-29 CFR 1910.1018)	0.002 mg/m^3	PEL TLV REL	Ca (5 mg/m^3)
Benzene 71-43-2	9.24	1.5-5	Inh Abs Ing Con	Irritated eyes, skin, nose, respiratory system; giddiness; headache, nausea, staggered gait; fatigue, anorexia, lassitude; dermatitis; bone marrow depression; **carcinogenic**	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1 ppm 0.5 ppm (skin) 0.1 ppm	5 ppm 2.5 ppm 1 ppm	PEL TLV REL	**Ca** [500 ppm]
Benzo[a]pyrene (Coal tar pitch volatiles) 50-32-8			Inh Ing	Irritated eyes, skin, respiratory tract; skin irritation with burning sensation, rash, and redness, dermatitis - **carcinogenic**	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	0.2 mg/m^3* none mg/m^3* *Benzene soluble frac. **Cyclohexane extractable frac.	NE NE NE	PEL TLV REL	**Ca** [80 mg/m^3]

Substance [CAS Number]	IP[1] (eV)	Odor Threshold (ppm)	Route[2]	Symptoms of Exposure	Treatment	TWA[3]	STEL[4]	Source[5]	IDLH (NIOSH)[6]
Cadmium dust (as Cd) [7440-43-9]	NA	NA	Inh Ing	Pulmonary edema, dyspnea, cough, chest tightness, substernal pain; headache; chills, muscular aches; nausea, vomiting, diarrhea; anosmia, emphysema, proteinuria, mild anemia – carcinogenic	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	0.005 mg/m^3 0.01 mg/m^3 Ca, lowest feasible concentration		PEL TLV REL	Ca (9 mg/m^3)
Chromium metal (as Cr) [7440-47-3]	NA	NA	Inh Ing	Histologic fibrosis of lungs	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1 mg/m^3 0.5 mg/m^3 0.5 mg/m^3		PEL TLV REL	250 mg/m^3
Cyanides: calcium, potassium, and sodium [592-01-8; 151-50-8; 143-33-9]	NA	ND	Inh Abs Ing Con	Asphyxiation and death can occur; weakness, headache, and confusion; nausea and vomiting; increased respiratory rate; slow respiratory gasping; irritated eyes and skin	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	5 mg/m^3 5 mg/m^3 (skin) NE	C5 mg/m^3* NE C5 mg/m^3 *10 min	PEL TLV REL	50 mg/m^3
Fluorene [86-73-7]			Inh Con	It is irritating to the skin, eyes, and respiratory tract.	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	NE		PEL TLV REL	

Substance [CAS Number]	IP[1] (eV)	Odor Threshold (ppm)	Route[2]	Symptoms of Exposure	Treatment	TWA[3]	STEL[4]	Source[5]	IDLH (NIOSH)[6]
Ethylbenzene [100-41-4]	8.76	0.09-0.6	Inh Ing Con	Irritated eyes, mucous membranes; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush immediately Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 100 ppm 100 ppm	125 ppm 125 ppm 125 ppm	PEL TLV REL	800 ppm
Lead, inorganic dusts and fumes (as Pb) [7439-92-1]	NA	NA	Inh Ing Con	Weakness, lassitude, insomnia; facial pallor; eye pallor; anorexia, low weight, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremors; wrist and ankle paralysis; brain damage; kidney damage; irritated eyes; hypotension	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	0.05 mg/m^3 0.05 mg/m^3 <0.1 mg/m^3 See 29 CFR 1910.1025		PEL TLV REL	100 mg/m^3
Mercury vapor [7439-97-6]	ND	ND	Inh Abs Con	Coughing, chest pain, dyspnea, bronchial pneumonitis; tremors, insomnia; irritability, indecision; headache; fatigue, weakness, stomatitis, salivation; gastrointestinal disturbance, anorexia, low weight; proteinuria; irritated eyes and skin	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	0.05 mg/m^3 0.025 mg/m^3 0.05 mg/m^3 (skin)	C0.1 ppm C0.1 ppm	PEL TLV REL	2 mg/m^3

Substance [CAS Number]	IP[1] (eV)	Odor Threshold (ppm)	Route[2]	Symptoms of Exposure	Treatment	TWA[3]	STEL[4]	Source[5]	IDLH (NIOSH)[6]
Naphthalene [91-203]	8.12	ND	Inh Abs Ing Con	Irritated eyes; headache; confusion, excitement, malaise; nausea, vomiting, abdominal pain; irritated bladder, profuse sweating; jaundice, renal shutdown; dermatitis	Eye: Irrigate immediately Skin: Molten flush immediately/sol-liq soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention	10 ppm 10 ppm 10 ppm	15 ppm	PEL TLV REL	250 ppm
Polychlorinated biphenyls (PCB) Aroclor 1242 [53469-21-9] and Aroclor 1254 [11097-69-1]	ND	ND	Inh Abs Ing Con	Aroclor 1242: irritated eyes; chloracne; acne-form dermatitis; mildly toxic by ingestion; poison by subcutaneous route – carcinogenic Aroclor 1254: irritated eyes and skin; acne-form dermatitis; poison by intravenous route; moderately toxic by ingestion and intraperitoneal routes – carcinogenic	Eye: Irrigate immediately Skin: Soap wash immediately Breath: espiratory support Swallow: Immediate medical attention	Aroclor 1242: 1 mg/m^3 (skin) 1 mg/m^3 (skin) 0.001 mg/m^3 Aroclor 1254: 0.5 mg/m^3 (skin) 0.5 mg/m^3 (skin) 0.001 mg/m^3		PEL TLV REL PEL TLV REL	Ca (10 mg/m^3) Ca (5 mg/m^3)
Toluene [108-88-3]	8.82	0.16-37	Inh Abs Ing Con	Fatigue, weakness; confusion, euphoria, dizziness; headache; dilated pupils, lacrimation; nervousness, muscular fatigue, insomnia; paralysis; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 50 ppm (skin) 100 ppm	150 ppm NE 150 ppm	PEL TLV REL	500 ppm

Substance [CAS Number]	IP[1] (eV)	Odor Threshold (ppm)	Route[2]	Symptoms of Exposure	Treatment	TWA[3]	STEL[4]	Source[5]	IDLH (NIOSH)[6]
Xylene (o-, m-, and p-isomers) [1330-20-7; 95-47-6; 108-38-3; 106-42-3]	8.56 8.56 8.44	1.1-20	Inh Abs Ing Con	Dizziness, excitement, drowsiness, in coordination, staggering gait; irritated eyes, nose, throat; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 100 ppm 100 ppm	150 ppm 150 ppm 150 ppm	PEL TLV REL	900 ppm

Notes:

[1]IP = Ionization potential (electron volts).
[2]Route = Inh, Inhalation; Abs, Skin absorption; Ing, Ingestion; and Con, Skin and/or eye contact.
[3]TWA = Time-weighted average. The TWA concentration for a normal workday (usually 8 or 10 hours) and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day without adverse effect.
[4]STEL = Short-term exposure limit. A 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the TWA is not exceeded.
[5]PEL = Occupational Safety and Health Administration (OSHA) permissible exposure limit (29 CFR 1910.1000, Table Z).
[5]TLV = American Conference of Governmental Industrial Hygiene (ACGIH) threshold limit value – TWA.
[5]REL = National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit.
[6]IDLH (NIOSH) = Immediately dangerous to life or health (NIOSH). Represents the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.
NE = None established. No evidence could be found for the existence of an IDLH (NIOSH Pocket Guide to Chemical Hazards, Pub. No. 90-117, 1990, 1997).
C = Ceiling limit value which should not be exceeded at any time.
Ca = Carcinogen.
NA = Not applicable.
ND = Not Determined.
LEL = Lower explosive limits.
LC_{50} = Lethal concentration for 50 percent of population tested.
LD_{50} = Lethal dose for 50 percent of population tested.
NIC = Notice of intended change (ACGIH).

4. General Safety Practices

4.1 General Safety Rules

General safety rules for site activities include, but are not limited to, the following:

- At least one copy of this HASP must be in a location at the site that is readily available to personnel, and all project personnel must review the plan prior to starting work.
- The HASP review by ARCADIS and all workers on site will be documented, and a copy of this documentation will be provided to the Con Edison Construction Management representative on site.
- Consume or use food, beverages, chewing gum, and tobacco products only in the SZ or other designated area outside the EZ and CRZ. Cosmetics must not be applied in the EZ or CRZ.
- Wash hands before eating, drinking, smoking, or using toilet facilities.
- Wear all PPE as required, and stop work and replace damaged PPE immediately.
- Secure disposable coveralls, boots, and gloves at the wrists and legs, and confirm closure of the suit around the neck.
- Upon skin contact with materials that may be impacted by COCs, remove contaminated clothing and wash the affected area immediately. Contaminated clothing must be changed. Any skin contact with materials potentially impacted by COCs must be reported to the SS or HSS immediately. If needed, medical attention shall be sought.
- Practice contamination avoidance. Avoid contact with surfaces either suspected or known to be impacted by COCs, such as standing water, mud, or discolored soil. Equipment must be stored on elevated or protected surfaces to reduce the potential for incidental contamination.
- Remove PPE as required in the CRZ to limit the spread of COC-containing materials.

- At the end of each shift, or as required, dispose of all single-use coveralls, soiled gloves, and respirator cartridges in receptacles designated for this purpose.
- Do not remove soil containing site COCs from protective clothing or equipment with compressed air, by shaking, or by any other means that disperses contaminants into the air.
- Inspect all non-disposable PPE for contamination in the CRZ. Any PPE found to be contaminated must be decontaminated or disposed of appropriately.
- Recognize emergency signals used for evacuation, injury, fire, etc.
- Report all injuries, illnesses, near misses, and unsafe conditions or work practices to the SS or HSS.
- Use the "buddy system" during all operations requiring Level C PPE and, when appropriate, during Modified Level D operations.
- Obey all warning signs, tags, and barriers. Do not remove any warnings unless authorized to do so.
- Use, adjust, alter, and repair equipment only if trained and authorized to do so and in accordance with the manufacturer's directions.
- Personnel are to perform only tasks for which they have been properly trained, and will advise their supervisor if they have been assigned a task for which they are not trained.
- The presence or consumption of alcoholic beverages or illicit drugs during the workday, including breaks, is strictly prohibited. Notify your supervisor if you must take prescription or over-the-counter drugs that list drowsiness as a side-effect or indicate that heavy equipment should not be operated while taking the medication.
- Remain upwind during site activities whenever possible.

4.2 Loss Prevention System (LPS)

LPS is a behavior based safety system meant to prevent or reduce the occurrence of injury, illness, or other incident. This program seeks the prevention or reduction of

losses by:

- Emphasizing proactive activities
- Capitalizing on the on-the-job expertise of field employees
- Maximizing the use of positive reinforcement
- Integrating with daily field operations
- Solving problems from the bottom up while providing direction from the top down

Prior to assignment in the field, ARCADIS personnel that will be performing or overseeing work on this project must attend a LPS training session. This training session explains the objectives, elements, and requirements of LPS. Elements of the LPS program are briefly outlined below in sections 4.2.1-4.2.4.

4.2.1 Safe Performance Self-Assessment

All onsite personnel are required to perform an SPSA prior to beginning any activity. Each individual must perform the following three-step process:

- *Assess* the risk of the task to be performed. Ask the following questions:
  - What could go wrong?
  - What is the worst thing that could happen if something does go wrong?
- *Analyze* the ways the risk can be reduced. Ask the following questions:
  - Do I have all the necessary training and knowledge to do this task safely?
  - Do I have all the proper tools and PPE?
- *Act* to control the risk and perform the task safely:
  - Take the necessary action to perform the job safely.
  - Follow written procedures and ask for assistance if necessary.

This process must be performed prior to beginning any activity and after any near miss or other incident to determine if it is safe to proceed.

4.2.2 Incident Investigation

An incident includes any of the following events:

- First-aid cases
- Injuries
- Illnesses
- Near misses
- Spills or leaks
- Equipment and property damage
- Motor vehicle accidents
- Regulatory violations
- Fires
- Business interruptions

All incidents must be investigated within 24 hours, and reported to the PIC, PO, PM and the HSO.

IIs are conducted to prevent the recurrence of a similar hazardous event. IIs review all incidents in the same manner. Using the information gathered during an II, appropriate measures are to protect personnel from the hazard in question. The Incident/Near-Miss Investigation Report is included in Attachment D.

4.2.3 Near Miss Reporting

As a part of the philosophy that work-related accidents and losses are preventable, we believe that the practices and standards used to conduct work could sometimes lead to

an incident and that changing these practices and standards will reduce the potential for an incident. To achieve this end, we use the practice of "near-miss" reporting. Near-misses are situations where no injury or property damage occurred; however, under slightly different circumstances an injury or property damage could have occurred. The near miss report should identify the work that was conducted, what actually happened, discuss the "what could have happened" had the circumstances been slightly different, and recommend a change to procedures to prevent an incident from occurring from similar work in the future. Near miss reporting is encouraged for all workers at any level in the work force. The worker may feel comfortable completing the report themselves or may seek assistance from their HSS or supervisor. Near miss reporting and job safety assessments can be particularly useful after any changes to work practices are implemented, including changes to personnel, equipment, or means and methods.

4.2.4 Loss Prevention Observation

The SS or the HSS will coordinate LPOs (see Attachment E for the LPO Form). Peer-to-peer observations are recommended. LPOs are conducted to identify and correct potential hazards, and to positively reinforce behaviors and practices that are correct. The observer must identify positive practices as well as potential deviations from safe work practices that could possibly result in an incident. A feedback session is conducted to review positive and questionable practices, conduct root cause analysis and initiate corrective action. The LPO process includes the following steps:

- Identify tasks that have the greatest potential for hazardous incidents.
- Review the standard procedure for completing the task.
- Discuss with the observed employee the task and the SS/HSS role in observing the task.
- Observe the employee completing the task.
- Reference the LPO form for criteria. Complete the form, documenting positive actions, as well as areas in need of improvement.
- Discuss the results of the LPO with the employee. Discuss corrective action necessary.

- Implement corrective action.

- Communicate the results of the LPO and corrective action to the PM and the HSO.

4.2.5 Job Safety Analysis

JSA is a tool used to identify potential hazards, and to develop corrective or protective systems to eliminate the hazard. A JSA lists all potential hazards associated with an activity. Hazards may be physical (such as lifting hazards or eye hazards), environmental (such as weather), or biological (stinging insects, snakes, etc.). After identifying the hazards associated with an activity, control measures are evaluated and protective measures or procedures are then instituted. JSAs are reviewed periodically so that the procedures and protective equipment specified for each activity are current and technically correct. Any changes in site conditions and/or scope of work may require review of and modification to the JSA in question. During this review process, comments on the JSA and its procedures should be obtained from personnel associated with the activity being analyzed.

4.3 Buddy System

Onsite personnel must use the buddy system as required by operations. Use of the "buddy system" is required during all operations requiring Level C PPE, and when appropriate, during Level D operations. Personnel must observe each other for signs of chemical exposure and heat or cold stress. Indications of adverse effects include, but are not limited to:

- Changes in complexion and skin coloration
- Changes in coordination
- Changes in demeanor
- Excessive salivation and pupillary response
- Changes in speech pattern

Personnel must also be aware of the potential exposure to possible safety hazards, unsafe acts, or noncompliance with safety procedures.

Field personnel must inform their partners or fellow workers of nonvisible effects of exposure to toxic materials that they may be experiencing. The symptoms of such exposure may include, but are not limited to:

- Headaches

- Dizziness
- Nausea
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory tract

If protective equipment or noise levels impair communications, pre-arranged hand signals must be used for communication. Personnel must stay within line of sight of another team member.

4.4 Heat Stress

Heat stress is caused by several interacting factors, including environmental conditions, clothing, and workload, as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with heavy outdoor work conducted with direct solar load and, in particular, because wearing PPE can increase the risk of developing heat stress, workers must be able to recognize the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses, and be able to recognize the signs and symptoms of these illnesses in themselves and their co-workers.

The average mean, normal low, normal high, and record high, and record low temperatures for each month are provided for New York, NY in Table 4-1.

TABLE 4-1
NEW YORK, NEW YORK MONTHLY TEMPERATURE SUMMARY

Month	Mean (F)	Normal Low (F)	Normal High (F)	Record Low (F)	Record High (F)
January	32	25	38	-4	68
February	34	26	40	-2	73
March	42	34	49	10	83
April	52	43	60	19	89
May	62	53	70	36	98
June	71	63	79	46	99
July	77	68	84	54	105
August	76	67	83	50	101
September	69	60	76	41	98
October	58	49	65	30	86
November	48	41	54	17	80

Month	Mean (F)	Normal Low (F)	Normal High (F)	Record Low (F)	Record High (F)
December	37	30	42	-1	75

4.4.1 Heat Rashes

Heat rashes are one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

4.4.2 Heat Cramps

Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much or too little salt.

Cramps appear to be related to a lack of water replenishment. Because sweat is a hypotonic solution (plus or minus 0.3% NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

4.4.3 Heat Exhaustion

Heat exhaustion occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include:

- Pale, cool, moist skin

- Heavy sweating
- Dizziness
- Nausea
- Headache
- Vertigo
- Weakness
- Thirst
- Giddiness

This condition responds readily to prompt treatment.

Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment, given fluid replacement, and be encouraged to get adequate rest.

4.4.4 Heat Stroke

Heat stroke is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails, and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors and its occurrence is difficult to predict.

Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are:

- Confusion
- Irrational behavior
- Loss of consciousness
- Convulsions
- A lack of sweating (usually)
- Hot, dry skin
- An abnormally high body temperature (e.g., a rectal temperature of 41°C [105.8°F])

If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of workload and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first-aid treatment.

Regardless of the worker's protestations, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

4.4.5 Heat Stress Safety Precautions

Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. Screening criteria for heat stress exposure are described in Table 4-2 and examples of activities within metabolic rate categories are provided in Table 4-3.

TABLE 4-2
SCREENING CRITERIA FOR HEAT STRESS EXPOSURE
FOR 8 HOUR WORK DAY FIVE DAYS PER WEEK WITH CONVENTIONAL BREAKS

	Acclimatized				Unacclimatized			
Work Demands	**Light**	**Moderate**	**Heavy**	**Very Heavy**	**Light**	**Moderate**	**Heavy**	**Very Heavy**
100% Work	85.1ºF (29.5ºC)	81.5ºF (27.5ºC)	78.8ºF (26ºC)		81.5ºF (27.5ºC)	77ºF (25ºC)	72.5F (22.5ºC)	
75% Work; 25% Rest	86.9ºF (30.5ºC)	83.3ºF (28.5ºC)	81.5ºF (27.5ºC)		84.2ºF (29ºC)	79.7ºF (26.5ºC)	76.1ºF (24.5ºC)	
50% Work; 50% Rest	88.7ºF (31.5ºC)	85.1ºF (29.5ºC)	83.3ºF (28.5ºC)	81.5ºF (27.5ºC)	86ºF (30ºC)	82.4ºF (28ºC)	79.7ºF (26.5ºC)	77ºF (25ºC)
25% Work, 75% Rest	90.5ºF (32.5ºC)	87.8ºF (31ºC)	86ºF (30ºC)	85.1ºF (29.5ºC)	87.8ºF (31ºC)	84.2ºF (29ºC)	82.4ºF (28ºC)	79.7ºF (26.5ºC)

Source: 2004 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati: American Conference of Governmental Industrial Hygienists (ACGIH), 2004 - page 171.

TABLE 4-3
EXAMPLES OF ACTIVITIES WITHIN METABOLIC RATE CATEGORIES

Categories	Example Activities
Resting	Sitting quietly
	Sitting with moderate arm movements
Light	Sitting with moderate arm and leg movements
	Standing with light work at machine or bench while using mostly arms
	Using a table saw
	Standing with light or moderate work at machine or bench and some walking about
Moderate	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
	Walking on a level at 6 Km/hr while carrying 3 Kg weight load
Heavy	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a noncontinuous basis
	Intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work)
Very Heavy	Shoveling wet sand

Source: 2004 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati: American Conference of Governmental Industrial Hygienists (ACGIH), 2004 - page 172

Acclimatization is a set of physiological adaptations, which allows the body to react to heat stress conditions. Full-heat acclimatization requires up to 3 weeks of continued physical activity under heat-stress conditions similar to those anticipated for the work. Its loss begins when the activity under those heat-stress conditions is discontinued, and a noticeable loss occurs after 4 days. With a recent history of heat stress exposures (e.g., 5 of the last 7 days), a worker can be considered acclimatized for the purpose of using the table Screening Criteria for Heat Stress Exposure.

Additionally, one or more of the following control measures can be used to help control heat stress and are mandatory if any site worker has a heart rate (measure immediately prior to rest period) exceeding 115 beats per minute:

- Site workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day.
- Onsite drinking water will be kept cool (50 to 60°F).
- A work regimen that will provide adequate rest periods for cooling down will be established, as required.
- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps.
- Cooling devices, such as vortex tubes or cooling vests, should be used when personnel must wear impermeable clothing in conditions of extreme heat.
- Employees should be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary.
- A shaded rest area must be provided. All breaks should take place in the shaded rest area.
- Employees must not be assigned to other tasks during breaks.
- Employees must remove impermeable garments during rest periods. This includes white Tyvek™-type garments.

All employees must be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress disorders.

4.5 Cold Stress

Persons working outdoors in temperatures at or below freezing may be frostbitten. The monthly normal and record low temperatures for New York are provided in Table 4-1. Extreme cold for a short time may cause severe injury to exposed body surfaces or result in profound generalized cooling, causing death. Areas of the body which have high surface area-to-volume ratio such as fingers, toes, and ears are the most susceptible. Two factors influence the development of a cold weather injury: ambient temperature and the velocity of the wind. For instance, 10 degrees Fahrenheit (^{o}F) with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18^{o}F. An equivalent chill temperature chart relating the actual dry bulb temperature and wind velocity is presented in Table 4-4.

TABLE 4-4
WIND CHILL

Estimated Wind Speed (in mph)	Actual Temperature Reading (ºF)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (ºF)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute.			GREAT DANGER Flesh may freeze within 30 seconds.				
	Trench foot and immersion foot may occur at any point on this chart.											

(This chart was developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA {Source: ACGIH Threshold Limit Values for Chemical Substances and Physical Agents}).

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of tissue damage associated with frostbite. Frostbite of the extremities can be categorized into:

- Frost nip or incipient frostbite: characterized by suddenly blanching or whitening of skin.
- Superficial frostbite: skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- Deep Frostbite: tissues are cold, pale, and solid; extremely serious injury.

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature, and it can be fatal. Its symptoms are usually exhibited in five stages: 1) shivering, 2) apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95^{o}F, 3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate, 4) freezing of the extremities, and finally, 5) death. Trauma sustained in freezing or sub-zero conditions requires special attention, because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first aid treatment. To avoid cold stress, site personnel must wear protective clothing appropriate for the level of cold and physical activity. In addition to protective clothing, preventive safe work practices, additional training, and warming regimens may be utilized to prevent cold stress.

4.5.1 Safety Precautions for Cold Stress Prevention

- For air temperature of 0ºF or less, the hands should be protected by mittens. For exposed skin, continuous exposure should not be permitted when air speed and temperature results in a wind chill temperature of less than minus 25ºF.
- At air temperatures of 36ºF or less, field personnel who become immersed in water or whose clothing becomes wet must be immediately provided with a change of dry clothing and be treated for hypothermia.
- If work is done at normal temperature or in a hot environment before entering the cold, the field personnel must ensure that their clothing is not wet as a consequence of sweating. If wet, field personnel must change into dry clothes prior to entering the cold area.

- If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work must be modified or suspended until adequate clothing is made available or until weather conditions improve.

- Field personnel handling evaporative liquid (e.g., gasoline, alcohol, or cleaning fluids) at air temperatures below 40ºF must take special precaution to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

4.5.2 Safe Work Practices

- Direct contact between bare skin and cold surfaces (< 20ºF) should be avoided. Metal tool handles and/or equipment controls should be covered by thermal insulating material.

- For work performed in a wind chill temperature at or below 10ºF, workers should be under constant protective observation (buddy system). The work rate should be established to prevent heavy sweating that will result in wet clothing. For heavy work, rest periods must be taken in heated shelters and workers should be provided with an opportunity to change into dry clothing if needed.

- Field personnel should be provided the opportunity to become accustomed to cold-weather working conditions and required protective clothing.

- Work should be arranged in such a way that sitting or standing still for long periods is minimized.

During the warming regimen (rest period), field personnel should be encouraged to remove outer clothing to permit sweat evaporation or to change into dry work clothing. Dehydration, or loss of body fluids, occurs insidiously in the cold environment and may increase susceptibility to cold injury due to a significant change in blood flow to the extremities. Fluid replacement with warm, sweet drinks and soups is recommended. The intake of coffee should be limited because of diuretic and circulatory effects.

4.6 Carbon Monoxide

When working indoors or in an excavation with any type of gasoline, diesel or LP gas powered equipment; carbon monoxide (CO) is a significant hazard. Recognize that a single generator, propane heater or propane fork truck can quickly generate CO above

the permissible exposure level regardless of the size of the room. The following guidelines will mitigate any carbon monoxide issues.

- Utilize remotely powered equipment whenever possible. Validate that the exhaust from the generating unit is not being sucked or blown back into the building.
- Use an approved exhaust extension for stationary work. Run the extension to the outside of the building.
- Do not use unvented gas or kerosene space heaters in enclosed spaces.
- When operating any fossil-fueled equipment indoors ensure that all pre-operation equipment checks are completed and that the equipment is running to specifications. Smokey exhaust, sputtering, backfires, etc indicate an equipment problem requiring immediate service.
- Provide ventilation within the building regardless of the weather outdoors. Open vents and intakes as well as entry and overhead doors.
- Utilize large fans to move air into or out of the building. Sometimes you get better results blowing air out than bringing it in. For stationary work be sure to move fresh air through the breathing zone of employees.
- Operate a properly calibrated CO meter (such as the Multi-Rae) within the worker breathing zone before, during and after equipment operation. Recognize that a CO alarm requires immediate action. Stop work, shut down engines and move to the outdoors until the alarm subsides and it is safe to reenter. Exposure guidelines for CO are listed in Table 6-1.

4.6.1 Symptoms of Carbon Monoxide Exposure

CO is called the silent killer because it has no odor and it slowly overcomes those who are overexposed. Symptoms include: Headache, fatigue, shortness of breath, nausea and dizziness. Employees in the same room may or may not have all symptoms simultaneously. As with all field work, use the buddy system to keep each other safe.

4.6.2 Treatment of Carbon Monoxide Exposure

If you think you are experiencing any of the symptoms of CO poisoning, get fresh air immediately. Open windows and doors for more ventilation, turn off any combustion equipment, and leave the building. See medical treatment. You could lose consciousness and die if you do nothing. It is also important to contact a doctor immediately for a proper diagnosis. Tell your doctor that you suspect CO poisoning is causing your problems. Prompt medical attention is important if you are experiencing any symptoms of CO poisoning when you are operating fuel-burning devices.

If there are any changes or modifications to the work or site conditions that present additional hazards not covered by this addendum or the site-specific HASP, the PM and the HSO shall be notified.

4.7 Biological Hazards

Biological hazards may include poison ivy, snakes, thorny bushes and trees, ticks, mosquitoes, and other pests.

4.7.1 Ticks

Lyme disease **–** This disease commonly occurs in summer and is transmitted by the bite of infected ticks. "Hot spots" in the United States include New York, New Jersey, Pennsylvania, Massachusetts, Connecticut, Rhode Island, Minnesota, and Wisconsin.

Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull's eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, and swelling and pain in the joints, and eventually, arthritis.

Erlichiosis **–** This disease also commonly occurs in summer and is transmitted by the bite of infected ticks. "Hot spots" in the United States include New York, Massachusetts, Connecticut, Rhode Island, Minnesota, and Wisconsin. Symptoms of erlichiosis include muscle and joint aches and flu-like symptoms, but there is typically no skin rash.

Rocky Mountain Spotted Fever (RMSF) **–** This disease is transmitted via the bite of an infected tick. The tick must be attached for 4 to 6 hours before the disease-causing organism (Rickettsia rickettsii) becomes reactivated and can infect humans.

The primary symptom of RMSF is the sudden appearance of a moderate-to-high fever. The fever may persist for 2 to 3 weeks. The victim may also have a headache, deep muscle pain, and chills. A rash appears on the hands and feet on about the third day and eventually spreads to all parts of the body. For this reason, RMSF may be confused with measles or meningitis. The disease may cause death, if untreated, but if identified and treated promptly, death is uncommon.

Control – These diseases are transmitted primarily by the deer tick, which is smaller and redder than the common wood tick. The diseases may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page. Tick repellant containing diethyltoluamide (DEET) should be used when working in tick-infested areas, and pant legs should be tucked into boots. In addition, workers should search the entire body every 3 or 4 hours for attached ticks. Ticks should be removed promptly and carefully without crushing, since crushing can squeeze the disease-causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

4.7.2 Mosquitoes

Personnel may be exposed to mosquitoes during work activities.

West Nile Virus – Typical exposure to mosquitoes does not present a significant hazard. However, if West Nile virus is prevalent in the area exposure to this virus is increased. West Nile virus results in flu-like symptoms and can be serious if not treated or in immune compromised individuals.

Control – To minimize the threat of mosquito bites all personnel working outside must be aware of the potential for encountering mosquitoes and implement the basic precautions listed below:

- Avoid working at dawn or dusk when mosquitoes are most active
- Prevent accumulation of standing water at the work-site
- Apply an insect repellent that contains DEET to exposed skin
- Wear light colored clothes, preferably with long-sleeves and full-length pants
- Do not touch any dead birds or animals that you encounter

If dead birds are detected near the site, report to the local County Health Department. If flu-like symptoms are present, contact your doctor or the HSO for more information.

4.7.3 Poisonous Plants

Poisonous plants may be present in the work area. Personnel should be alerted to their presence and instructed on methods to prevent exposure. Poison sumac grows as a shrub or small tree with large alternate, compound leaves having 7-13 leaflets without teeth. All plant parts are poisonous. The lack of 1) leaflet glands, 2) "wings" between the leaflets, and 3) teeth on the leaves, in addition to this species' red stems supporting the leaflets and leaves, help to distinguish this plant from similar-looking nonpoisonous species such as other sumacs and tree-of-heaven. Flowers are shades of green, white and yellow and appear in late spring. Fruits are small white berries that mature in late summer and may last through winter. Occasionally found in moist or wet soils.

Poison ivy is a woody shrub or vine with hairy looking aerial roots. It grows to 10 feet or more, climbing high on trees, walls and fences or trails along the ground. All parts of poison ivy, including the roots, are poisonous at all times of the year.

Poison Sumac

Poison Ivy

The main control for both poison ivy and poison sumac is to avoid contact with the plant, cover arms and hands, and frequently wash potentially exposed skin. Particular attention must be given to avoiding skin contact with objects or protective clothing that have touched the plants. Treat every surface that may have touched the plant as contaminated, and practice contamination avoidance.

Poison ivy and sumac are very easy to treat if you identified your contact with the irritating plant within a few hours of the incident. The urushiol oil present in both plants

chemically bonds with the proteins in your skin about 30 minutes after contact. 75% of the population is affected by contact with urushiol, although immunity to urushiol today does not assure immunity tomorrow, and vice versa. Rash symptoms can appear within a few hours but can take two to five days to appear. The rash starts as a red, annoyingly itchy area that starts to swell. The area then gets inflamed and will get covered in clusters of tiny pimples, the pimple eventually merge and turn into blisters. The fluid in the blisters turns yellow, dries up, and becomes crusty. Left completely untreated, this cycle can last as short as five days and in severe cases as long as five to six weeks.

If you come in contact with poison ivy, oak or sumac, or a animal exposed to any of these, or tools, gear, or clothing exposed to any of these, you should wash off with hot water (not so hot that it burns) and strong soap as soon as possible. If you can get washed up in the first six hours, before the first symptoms appear, you have a good chance of avoiding an outbreak, and an even better chance of minimizing the effects if you do have one.

4.7.4 Snakes

Hazards – The possibility of encountering snakes exists, specifically for personnel working in wooded or vegetated areas. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include:

- Neurotoxic effects with sensory, motor, cardiac, and respiratory difficulties
- Cytotoxic effects on red blood cells, blood vessels, heart muscle, kidneys, and lungs
- Defects in coagulation
- Effects from local release of substances by enzymatic actions

Other noticeable effects of venomous snakebites include swelling, edema, and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

Control – To minimize the threat of snakebites, all personnel walking through vegetated areas must be aware of the potential for encountering snakes and the need to avoid actions that will provoke encounters, such as turning over logs. If a snake bite

occurs, an attempt should be made to identify the snake via size and markings. The victim must be transported to the nearest hospital within 30 minutes. First aid consists of applying a constriction band and washing the area around the wound to remove any unabsorbed venom.

4.7.5 Spiders

Hazards – Personnel may encounter spiders during work activities. Two spiders of concern are the black widow and the brown recluse. Both prefer dark sheltered areas such as basements, equipment sheds and enclosures, and around woodpiles or other scattered debris. The black widow is shiny black, approximately 1-inch long, and found throughout the United States. There is a distinctive red hourglass marking on the underside of the black widow's body. The bite of a black widow is seldom fatal to healthy adults, but effects include respiratory distress, nausea, vomiting, and muscle spasms. The brown recluse is smaller than the black widow and gets its name from its brown coloring and behavior. The brown recluse is more prevalent in the Southern United States. The brown recluse has a distinctive violin shape on the top of its body. The bite of the brown recluse is painful, and the bite site ulcerates and takes many weeks to heal completely.

Control – To minimize the threat of spider bites, all personnel walking through vegetated areas must be aware of the potential for encountering these arachnids. Personnel should avoid actions that may result in encounters, such as turning over logs and placing hands in dark places such as behind equipment or in corners of equipment sheds or enclosures. If a spider bite occurs, the victim must be transported to the nearest hospital as soon as possible. First aid consists of applying ice packs and washing the area around the wound to remove any unabsorbed venom.

4.7.6 Rats

Hazards – Rats are known to spread 35 diseases to humans and animals. Some human diseases rats spread are salmonellosis, rabies, tularemia, leptospirosis, amoebic dysentery, typhus, jaundice, trichinosis, rickettsial pox, lymphocytic choriomeningitis, ray fungus, and ringworm.

Control – New York City rats are typically Norway Rats that burrow underground and can be disturbed by soil intrusive activities such as drilling and excavation. Piles of lumber, trash or other materials can also be shelter for rats. Keep clear of debris piles or other potential rat habitats. If the pile must be cleared, use long handle tools. Keep

clear of rats and do not attempt to corner or kill them, they are wild animals and will fight to protect themselves.

Do not leave trash, especially food, in the area as this will attract rats to the site.

If you are bitten by a rat, wash the wound with soap and water and see a doctor immediately. Rats may carry diseases and at the least, rat bites can cause infection. If the rat is captured or killed, health authorities may wish to check it for rabies or other diseases. When picking up a carcass, use the inside of a plastic bag to avoid touching it. Double-seal it in plastic and freeze until further notice.

4.8 Noise

Hazards – Exposure to noise louder than the appropriate action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increase with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on site.

Control – All personnel must wear hearing protection, with a noise reduction rating (NRR) of at least 20, when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA and hearing protection is necessary. All site personnel who may be exposed to noise must also receive baseline and annual audiograms, and training as to the causes and prevention of hearing loss. Noise monitoring is discussed in Section 6.2, Noise Monitoring.

Whenever possible, equipment that does not generate excessive noise levels will be selected. If using noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

4.9 Spill Control

All personnel must take every precaution to minimize the potential for spills during site operations. All onsite personnel must immediately report any discharge, no matter how small, to the SS.

Spill control equipment and materials will be located on site at locations that present the potential for discharge. All sorbent materials used to cleanup spills will be

containerized and labeled appropriately. In the event of a spill, the SS will follow the provisions in Section 9, Emergency Procedures, to contain and control released materials and to prevent their spread to offsite areas.

Fluid-containing vehicles and equipment on the project site and spotted on a pervious surface (e.g., soil, blue stone, etc.) will be parked over polyethylene sheeting that extends the full length and width of the vehicle. Following usage, sheeting will be disposed of properly.

4.10 Sanitation

Site sanitation will be maintained according to appropriate federal, state, and local requirements.

4.10.1 Break Area

Breaks must be taken in the SZ, away from the active work area, after site personnel go through decontamination procedures. There will be no smoking, eating, drinking, or chewing gum or tobacco in any area other than the SZ.

4.10.2 Potable Water

The following rules regarding potable water apply to all field operations:

- An adequate supply of potable water will be provided at each project site. Potable water must be kept away from hazardous materials or media and contaminated clothing or equipment.
- Portable containers used to dispense drinking water must be capable of being tightly closed and must be equipped with a tap dispenser. Water must not be consumed directly from the container (drinking from the tap is prohibited) nor may it be removed from the container by dipping.
- Containers used for drinking water must be clearly marked and must not be used for any other purpose.
- Disposable drinking cups must be provided. A sanitary container for dispensing cups and a receptacle for disposing of used cups is required.

4.10.3 Sanitary Facilities

Access to facilities for washing before eating, drinking, or smoking, or alternate methods such as waterless hand cleaner and paper towels, will be provided.

4.10.4 Lavatory

If permanent toilet facilities are not available, an appropriate number of portable chemical toilets will be provided.

This requirement does not apply to mobile crews or to normally unattended site locations so long as employees at these locations have transportation immediately available to nearby toilet facilities.

4.11 Emergency Equipment

Adequate emergency equipment for the activities being conducted on site and as required by applicable sections of 29 CFR 1910 and 29 CFR 1926 will be on site prior to commencing project activities. Personnel will be provided with access to emergency equipment including, but not limited to, the following:

- Fire extinguishers of adequate size, class, number, and location as required by applicable sections of 29 CFR 1910 and 1926
- Industrial first-aid kits of adequate size for the number of personnel on site
- Emergency eyewash and/or shower if required by operations being conducted on site. The eyewash will be kept in the field support vehicle to prevent from freezing

4.12 Lockout/Tagout Procedures

Only fully qualified and trained personnel will perform maintenance procedures. Before maintenance begins on energized equipment, lockout/tagout procedures per OSHA 29 CFR 1910.147 and the ARCADIS Lockout/Tagout Policy will be followed.

Lockout is the placement of a device that uses a positive means, such as lock, to hold an energy- or material-isolating device such that the equipment cannot be operated until the lockout device is removed. If a device cannot be locked out, a tagout system must be used. Tagout is the placement of a warning tag on an energy- or material-

isolating device to indicate that the equipment controls may not be operated until the tag is removed by the person who attached the tag.

4.13 Electrical Safety

Electricity may pose a particular hazard to site workers due to the use of portable electrical equipment. If wiring or other electrical work is needed, a qualified electrician must perform it.

General electrical safety requirements include:

- Contact with any Con Edison electric manhole or vault cover cannot be made until the cover has been tested for stray-voltage concerns. If an entry into a confined space is anticipated the procedures to be used for entering the space will be provided to Con Edison.

- All electrical wiring and equipment must be a type listed by Underwriters Laboratories (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency.

- All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or USCG regulations.

- Portable and semi-portable tools and equipment must be grounded by a multi-conductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle.

- Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double-insulated tools must be distinctly marked and listed by UL or FM.

- Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them.

- Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching.

- All circuits must be protected from overload.

- Temporary power lines, switchboxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage.

- Plugs and receptacles must be kept out of water unless they are approved for submersible construction.

- All extension cord outlets must be equipped with ground-fault-circuit interrupters (GFCIs).

- Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment.

- Extension cords or cables must be inspected prior to each use and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire.

- Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician.

4.14 Lifting Safety

Using proper lifting techniques may prevent back strain or injury. The fundamentals of proper lifting include:

- Consider the size, shape, and weight of the object to be lifted. A mechanical lifting device or additional persons must be used to lift an object if it cannot be lifted safely alone.

- The hands and the object should be free of dirt or grease that could prevent a firm grip.

- Gloves must be used and the object inspected for metal slivers, jagged edges, burrs, or rough or slippery surfaces.

- Fingers must be kept away from points that could crush or pinch them, especially when putting an object down.

- Feet must be placed far enough apart for balance. The footing should be solid and the intended pathway should be clear.
- The load should be kept as low as possible, close to the body, with the knees bent.
- To lift the load, grip firmly and lift with the legs, keeping the back as straight as possible.
- A worker should not carry a load that he or she cannot see around or over.
- When putting an object down, the stance and position are identical to that for lifting; the legs are bent at the knees and the back is straight as the object is lowered.

4.15 Ladder Safety

When portable ladders are used to access an upper landing surface, the ladder side rails must extend at least 3 feet (1 m) above the upper landing surface to which the ladder is used to gain access. Or, when such an extension is not possible because of the ladder's length, then the ladder must be secured at its top to a rigid support that will not deflect, and a grasping device (such as a grabrail) must be provided to assist employees in mounting and dismounting the ladder. In no case, shall the extension be such that ladder deflection under a load would, by itself, cause the ladder to slip off its support.

Additional ladder precautions include:

- Ladders must be maintained free of oil, grease, and other slipping hazards.
- Ladders must not be loaded beyond the maximum intended load for which they were built or beyond their manufacturer's rated capacity.
- Ladders must be used only for the purpose for which they were designed.
- Non-self-supporting ladders must be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).

- Wood-job-made ladders with spliced side rails must be used at an angle such that the horizontal distance is one-eighth the working length of the ladder.
- Fixed ladders must be used at a pitch no greater than 90° from the horizontal, as measured to the back side of the ladder.
- Ladders must be used only on stable and level surfaces unless secured to prevent accidental displacement.
- Ladders must not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. Slip-resistant feet must not be used as a substitute for care in placing, lashing, or holding a ladder that is used on slippery surfaces, including, but not limited to, flat metal or concrete surfaces that are constructed so they cannot be prevented from becoming slippery.
- Ladders placed in any location where they can be displaced by workplace activities or traffic, such as in passageways, doorways, or driveways must be secured to prevent accidental displacement or a barricade must be used to keep the activities or traffic away from the ladder.
- The area around the top and bottom of ladders must be kept clear.
- The top of a non-self-supporting ladder must be placed with the two rails supported equally unless it is equipped with a single support attachment.
- Ladders must not be moved, shifted, or extended while occupied.
- Ladders must have nonconductive side rails.
- The top, top step should not be used as a step (or the step labeled that it or any step above it should not be used as a step).
- Cross-bracing on the rear section of stepladders must not be used for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.
- Ladders must be inspected by the HSO for visible defects daily and after any occurrence that could affect their safe use.

- Portable ladders with structural defects such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; corroded components; or other faulty or defective components must either be immediately marked in a manner that readily identifies them as defective or tagged with "**Do Not Use**" or similar language, and withdrawn from service.

- Fixed ladders with structural defects such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; or corroded components must be withdrawn from service.

- Ladder repairs must restore the ladder to a condition meeting its original design criteria before the ladder is returned to use.

- Single-rail ladders must not be used.

- When ascending or descending a ladder, the user must face the ladder.

- Each employee must use at least one hand to grasp the ladder when progressing up and/or down the ladder.

- An employee must not carry any object or load that could cause the employee to lose balance and fall.

4.16 Traffic Safety

If investigation work will take place within a street, diagrams will be provided to Con Edison for mid-street and intersection traffic protection mechanisms. Work-area protection plans shall, minimally, conform to the *Con Edison Work Area Protection and Traffic Control Field Manual*, February 2005.

The work area may be located within or adjacent to a public or private roadway or sidewalk where exposure to vehicular traffic is possible. For work within roadways and sidewalks, a permit will be required, as issued by the New York City Department of Transportation or New York State Department of Transportation, or both organizations, as applicable. Signage and other control measures stipulated by the permitting authority or authorities will be applied during field activities. This may include the closure of a travel lane or lanes or sidewalks, and erection of signs, cones, barricades, or flashing lights, as applicable.

In addition, during activities along or within a roadway, equipment will be aligned parallel to the roadway to the extent feasible, facing into the oncoming traffic so as to place a barrier between the work crew and the oncoming traffic. All crewmembers must remain behind the equipment and the traffic barrier. Crewmembers working in or near streets will wear orange reflective traffic safety vests.

The flow of traffic into and out of the adjacent business and other organizations must be assessed, and precautions taken to warn motorists of the presence of workers and equipment. Where possible, vehicles should be aligned to provide physical protection to people and equipment.

4.17 Bloodborne Pathogens

Standard operating procedures for exposure controls for bloodborne pathogens and other infectious materials are described in Attachment F.

4.18 Material Handling

In general, the following guidelines will be used for material handling activities. This may include the movement of drums, investigation equipment, debris, or objects blocking drilling locations.

If investigation work will take place within a street, diagrams will be provided to Con Edison for mid-street and intersection traffic protection mechanisms. Work-area protection plans shall, minimally, conform to the *Con Edison Work Area Protection and Traffic Control Field Manual*, February 2005.

- Whenever possible heavy objects will be lifted and moved by mechanical devices rather than by manual effort

- The mechanical devices will be appropriate for the lifting or moving task and will be operated only by trained and authorized personnel

- Objects that require special handling or rigging will only be moved under the guidance of a person who has been specifically trained to move such objects

- Lifting devices (including equipment, slings, ropes, chains and straps) will be inspected, certified, and labeled to confirm their weight capacities. Defective equipment will be taken out of service immediately and repaired or destroyed

- The wheels of any trucks being loaded or unloaded will be chocked to prevent movement
- Outriggers will be extended on a flat, firm surface during operation
- The lift and swing path of a crane/equipment will be watched and maintained clear of obstructions
- Personnel will not pass under a raised load, nor will a suspended load be left unattended
- Personnel will not be carried on lifting equipment, unless it is specifically designed to carry passengers
- All reciprocating, rotating, or other moving parts will be guarded at all times
- Accessible fire extinguishers will be available in all mechanical lifting devices
- All material must be stored in tiers, racked, blocked, or otherwise secured to prevent sliding, falling, or collapse
- Verify all loads/material are secure before transportation

Materials Handling tasks that are unusual or require specific guidance will need a written addendum to this HASP. The addendum must identify the lifting protocols and must be submitted to Con Edison for acceptance before the tasks are performed. Upon acceptance, the plan must be reviewed with all affected employees and documented. Any deviation from a written plan will require approval by Con Edison.

4.19 Compressors

A New York City Fire Department Certificate of Fitness is required for the individual operating a compressor (e.g., compressor used for an air knife employed as part of vacuum excavation activities). The Certificate of Fitness will be provided to the Con Edison Construction Inspection representative.

4.20 Loose Paint

Prior to cutting painted surfaces, the proposed cutting location will be wrapped with a heavy-duty tape (i.e., duct tape or similar). The cut will be performed, and the tape, paint chips, and cuttings will be appropriately disposed of at a Con Edison-approved off-site facility. This procedure provides controls to reduce airborne dust generation and dispersal of paint chips in the work area, to the extent feasible.

Potential health risks associated with loose paint include exposure to lead, polychlorinated biphenyls (PCBs), cadmium and chromium. Unless otherwise determined through characterization sampling, paint chips resulting from cutting work will be handled as hazardous waste. Personnel involved with loose paint handling will use Modified Level D personal protective equipment.

The Con Edison Work Plan Guides for lead and PCB management and welding and burning are included as part of this attachment.

5. Personal Protective Equipment

5.1 Levels of Protection

PPE is required to safeguard site personnel from various hazards. Varying levels of protection may be required depending on COC levels and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level. Table 5-1 summarizes the levels of personal protection required for the anticipated work activities.

Table 5-1
PPE Selection Matrix

Task	Anticipated Level of Protection
Field Mobilization / Site Reconnaissance	Level D
Utility Clearance	Level D/Modified Level D/Level C
Excavation of Test Pits	Level D/Modified Level B/Level C
Installation of Soil Borings	Modified Level D/Level C
Soil Sampling	Modified Level D/Level C
Groundwater Sampling / Monitoring Well Development	Modified Level D/Level C
Equipment Decontamination	Level D/Modified Level D
IDW Management	Level D/Modified Level D
Demobilization	Level D
Land Surveying	Level D
Chemical Hazards	Modified Level D/Level C

5.1.1 Level D Protection

The minimum level of protection that is required of ARCADIS personnel and subcontractors at the site is Level D, which is worn when activities do not involve potential dermal contact with contaminants and air monitoring indicates that no inhalation hazard exists. Level D protection includes the following equipment:

Work clothing as prescribed by weather

- Steel-toe work boots, meeting ANSI Z41
- Safety glasses with side shields or goggles, meeting ANSI Z87
- Hard hat, meeting ANSI Z89, at all times when working on site. Hard hats cannot be white or “Con Edison blue” in color and tape/paint applied from other than the manufacturer is not permitted on hard hats

- Orange reflective safety vest, meeting ANSI 107 (vests shall always be worn in and around streets)

- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used)

Metatarsal protectors will be worn by those performing saw cutting and jack hammering activities. If possible, cut-resistant gloves will be used in combination with nitrile gloves for cutting activities.

5.1.2 Modified Level D Protection

Modified Level D will be used when airborne contaminants are not present at levels of concern, but site activities present the potential for skin contact with contaminated materials. Modified Level D consists of the following equipment:

- Nitrile outer gloves worn over nitrile surgical gloves

- Latex or PVC overboots when contact with COC-impacted media is anticipated

- Steel-toe work boots, meeting ANSI Z41

- Safety glasses with side shields or goggles, meeting ANSI Z87

- Face shield in addition to safety glasses or goggles when projectiles or splash hazards exist

- Orange reflective safety vest, meeting ANSI 107 (vests shall always be worn in and around streets)

- Tyvek®, Poly-coated Tyvek® (for wet conditions) or KleenGuard®coveralls when skin contact with COC-impacted media is anticipated. Coveralls shall extend from the neck to ankles and wrists

- Hard hat, meeting ANSI Z89, at all times when working on site. Hard hats cannot be white or “Con Edison blue” in color and tape/paint applied from other than the manufacturer is not permitted on hard hats

- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used)

Metatarsal protectors will be worn by those performing saw cutting and jack hammering activities. If possible, cut-resistant gloves will be used in combination with nitrile gloves for cutting activities.

5.1.3 Level C Protection

Level C protection will be required when the airborne concentration of COCs reaches a level of concern, typically one-half of the OSHA Permissible Exposure Limit (PEL) or ACGIH TLV. The following equipment will be used for Level C protection:

- Full-face, National Institute for Occupational Safety and Health- (NIOSH-) approved, air-purifying respirator with combination organic vapor cartridges
- Polyethylene-coated Tyvek® suit with ankles and cuffs taped to boots and gloves
- Nitrile outer gloves worn over nitrile surgical gloves
- Steel-toe work boots, meeting ANSI Z41
- Orange reflective safety vest, meeting ANSI 107 (vests shall always be worn in and around streets)
- Chemical-resistant boots with steel toes, or latex or PVC overboots over steel-toe boots
- Hard hat, meeting ANSI Z89 at all times when working on site. Hard hats cannot be white or “Con Edison blue” in color and tape/paint applied from other than the manufacturer is not permitted on hard hats
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used)

Metatarsal protectors will be worn by those performing saw cutting and jack hammering activities. If possible, cut-resistant gloves will be used in combination with nitrile gloves for cutting activities. Workers requiring a respirator will have medical clearance and fit-test documentation available on site.

5.2 Site Respiratory Protection Program

Respiratory protection is an integral part of employee health and safety at the site due to potentially hazardous concentrations of airborne COCs. The site respiratory protection program will consist of the following elements (as a minimum):

- All onsite personnel who may use respiratory protection will have an assigned respirator.
- All onsite personnel who may use respiratory protection will have been fit-tested and trained in the use of a full-face, air-purifying respirator within the past 12 months.
- All onsite personnel who may use respiratory protection must, within the past year, have been medically certified as being capable of wearing a respirator. Documentation of the medical certification must be provided to the HSS prior to commencing site work.
- Only cleaned, maintained NIOSH-approved respirators will be used.
- If respirators are used, the respirator cartridge is to be properly disposed of at the end of each work shift, or when load-up or breakthrough occurs, whichever occurs first.
- Contact lenses are not to be worn when a respirator is worn.
- All onsite personnel who may use respiratory protection must be clean-shaven. Mustaches and sideburns are permitted, but they must not touch the sealing surface of the respirator.
- Respirators will be inspected and a negative-pressure test performed prior to each use.
- After each use, the respirator will be wiped with a disinfectant, cleansing wipe. When used, the respirator will be thoroughly cleaned at the end of the work shift. The respirator will be stored in a clean plastic bag, away from direct sunlight in a clean, dry location, in a manner that will not distort the face piece.

5.3 Using PPE

Depending on the level of protection selected, specific donning and doffing procedures may be required. The procedures presented in this section are mandatory if Modified Level D or Level C PPE is used. All personnel entering the EZ must put on the required PPE in accordance with the requirements of this HASP. When leaving the EZ, PPE will be removed in accordance with the procedures listed to minimize the spread of COCs.

5.3.1 Donning Procedures

These procedures are mandatory only if Modified Level D or Level C PPE is used on site:

- Remove bulky outerwear. Remove street clothes and store in clean location.
- Put on work clothes or coveralls.
- Put on the required chemical-protective coveralls.
- Put on the required chemical-protective boots or boot covers.
- Put on the required chemical-protective gloves.
- Don the required respirator and perform appropriate fit check (Level C).
- Put hood or head covering over head and respirator straps, and tape hood to face piece (Level C).
- Don remaining PPE, such as safety glasses or goggles, safety vest and hard hat.

When these procedures are instituted, one person must remain outside the work area to confirm that each person entering has the proper protective equipment.

5.3.2 Doffing Procedures

The following procedures are only mandatory if Modified Level D or Level C PPE is required for the site. Whenever a person leaves the work area, the following decontamination sequence will be followed:

- Upon entering the CRZ, rinse contaminated materials from the boots or remove contaminated boot covers.
- Clean reusable protective equipment.
- Remove protective garments, equipment, and respirator (Level C). All disposable clothing should be placed in plastic bags with contaminated-waste labels.
- Wash hands, face, and neck (or shower if necessary).
- Proceed to clean area and dress in clean clothing.
- Clean and disinfect respirator for next use.

All disposable equipment, garments, and PPE must be bagged in plastic bags labeled for disposal. See Section 7, Work Zones and Decontamination, for detailed information on decontamination stations.

5.4 PPE Selection

PPE will be selected based on the potential for contact, site conditions, ambient air quality, and the judgment of supervising site personnel and health and safety professionals. The PPE used will be chosen to be effective against the COCs present on site.

Specifically, the level of PPE selected will be based on air monitoring of the work environment, and an assessment by the SS and HSS of the potential for skin contact with COCs. The Airborne Contaminant Action Levels in Table 6-1 (provided in Section 6) should be used to verify that the PPE prescribed in Table 5-1 is appropriate.

6. Air Monitoring

6.1 Air Monitoring

Air monitoring will be conducted to verify that flammable/explosive atmospheres do not exist during drilling, sampling and excavation activities, and to evaluate employee exposure to airborne constituents. The monitoring results will dictate work procedures and the selection of PPE. The monitoring device to be used is a Rae Systems MultiRAE detector (PID with an 11.7 eV lamp/oxygen/LEL/Hydrogen Sulfide Sensors) (or equivalent) and a MIE PDR1000 particulate monitor. The ARCADIS HSS will be responsible for utilizing the air monitoring results to determine appropriate health and safety precautions for ARCADIS personnel and subcontractors. Air monitoring results will be recorded in the field notebook or on an air monitoring log (see Appendix G).

6.1.1 VOCs, CO, and Flammable Vapors

Air monitoring will be conducted continuously during ground intrusive activities. All work activity must stop where tests indicate the concentration of flammable vapors exceeds 10% of the LEL at a location with a potential ignition source. Such an area must be ventilated to reduce the concentration to an acceptable level.

6.1.2 Benzene

In areas where petroleum hydrocarbons are suspected, benzene detector tube readings must be taken if PID readings exceed 1ppm, and are sustained for 15 minutes in the breathing zone. The benzene detector tubes will be used to verify that the level of benzene in the breathing zone is less than 1 ppm.

6.1.3 Airborne Particulates

Air monitoring must be conducted using a portable dust monitor (e.g. PDR1000, TSI DustTRAK or equivalent) during all activities that have the potential to generate airborne particulates. Readings should be taken in the breathing zone of site workers as well as downwind of site activities in order to identify potential off-site impacts.

6.2 Noise Monitoring

Noise monitoring may be conducted as required. Hearing protection is mandatory for all employees in noise hazardous areas, such as around heavy equipment. As a general rule, sound levels that cause speech interference at normal conversation distance should require the use of hearing protection. Where ambient sound levels cause speech interference, hearing protection will be mandatory within 15 feet of the noise source.

6.3 Monitoring Equipment Maintenance and Calibration

All direct-reading instrumentation calibrations should be conducted under the approximate environmental conditions that the instrument will be used. Instruments must be calibrated before and after use, noting the reading(s) and any adjustments that are necessary. All air monitoring equipment calibrations, including the standard used for calibration, must be documented on a calibration log or in the field notebook. All completed health and safety forms must be reviewed by the HSS and maintained by the SS.

All air-monitoring equipment will be maintained and calibrated in accordance with the specific manufacturer's procedures. Preventive maintenance and repairs will be conducted in accordance with the respective manufacturer's procedures. When applicable, only manufacturer-trained and/or authorized personnel will be allowed to perform instrument repairs or preventive maintenance.

If an instrument is found to be inoperative or suspected of giving erroneous readings, the HSS must be responsible for immediately removing the instrument from service and obtaining a replacement unit. If the instrument is essential for safe operation during a specific activity, that activity must cease until an appropriate replacement unit is obtained. The HSS will be responsible for confirming that a replacement unit is obtained and/or repairs are initiated on the defective equipment.

6.4 Action Levels

Table 6-1 presents airborne contaminant action levels that will be used to determine the procedures and protective equipment necessary based on conditions as measured at the site.

Table 6-1
Airborne Contaminant Action Levels

Parameter	Reading	Action
Total Organic Vapors	0 ppm to ≤ 1 ppm	Normal operations; hourly breathing zone monitoring; continuous monitoring during soil intrusive activities.
	> 1 ppm to 5 ppm	Normal operations; continuous monitoring; screen for benzene with colorimetric tubes at these concentrations if readings are sustained for more than 15 minutes; investigate cause of reading and initiate controls if feasible
	≥ 5 ppm to ≤ 10 ppm	Normal operations; continuous monitoring; screen for benzene with colorimetric tubes; investigate cause of reading and initiate controls if feasible
	≥ 10 ppm to ≤ 50 ppm	Upgrade to Level C PPE; screen for benzene with colorimetric tubes; investigate cause of reading and initiate controls if feasible
	> 50 ppm	Stop work; investigate cause of reading; initiate controls before resuming work
Benzene (colorometric tube)	< 1 ppm	Normal operations
	≥ 1 ppm to 5 ppm	Upgrade to Level C PPE
	> 5 ppm	Stop work; investigate cause of reading
Total Particulates[2]	≤0 to 0.100 milligrams per cubic meter (mg/m^3)	Normal operations
	>0.100 mg/m^3 above background, or visible airborne dust.	Initiate wetting of work area to control dust; upgrade to level C if dust control measures do not control dust within 15 minutes, monitor downwind impacts.
	>0.15 mg/m^3 in worker breathing zone or at downwind perimeter of work area.	Stop work; investigate cause of reading; contact PM and HSO.
Carbon Monoxide	0 ppm to <10 ppm	Normal operations.
	10 ppm to <20 ppm	Normal operations; evaluate sources of carbon monoxide and implement additional ventilation of work area.
	20 ppm	Stop work.
Flammable Vapors LEL	< 10% LEL	Normal operations; investigate any positive readings above and initiate controls if feasible
	> 10% LEL	Stop work; ventilate area; investigate source of vapors.
Oxygen	< 19.5 %	Stop work; evacuate work area, investigate cause of reading; ventilate area; contact J. Keough or C. Webster.

Parameter	Reading	Action
	> 19.5% to < 23.5 %	Normal operations.
	> 23.5 %	Stop work; evacuate work area; investigate cause of reading; ventilate area; contact J. Keough or C. Webster.
Hydrogen Sulfide	0 ppm to < 5 ppm	Normal operations.
	> 5 ppm	Stop work; evacuate work area, investigate cause of reading; ventilate area; contact J. Keough or C. Webster.

Notes:
1) PID readings are sustained for a period of two minutes at breathing zone height, measured with a calibrated photoionization detector with an 11.7 eV lamp.
2) Readings for particulate are sustained for two minutes at breathing zone height, measured with a calibrated Real Time Aerosol Monitor (mini RAM/PDR1000). Dust sampling instruments provide "total dust" levels, and do not differentiate between contaminated and non-contaminated dust particulate. Dust action levels are based upon total dust and not respirable dust levels. Action levels are in excess of background levels, as measured either prior to activities in work areas or off-site.

6.5 Community Air Monitoring Plan

ARCADIS has prepared a Community Air Monitoring Plan [Appendix C to the Site Characterization Work Plan: former Woodworth Avenue Works Site, (ARCADIS, 2008)] which fulfills the requirements set forth by the New York State Department of Health (NYSDOH) *Generic Community Air Monitoring Plan*, dated June 2000 (Attachment C-1, Appendix A). 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 RI activities. As such, this CAMP specifies the potential air emissions, as well as the air monitoring methods, action levels, and abatement measures that will be implemented during RI activities at the site.

As required by the NYSDOH CAMP, ambient air monitoring will be implemented at the site for total volatile organic compounds (VOCs) and particulate matter less than 10 microns in diameter (PM_{10}). Air monitoring will occur during any site activity that may generate dust emissions. Total VOCs and PM_{10} levels in ambient air will be continuously measured in real-time using portable instruments. The sample location rationale, sample methods, action levels, and abatement procedures are discussed below.

6.5.1 Sampling Location Selection

One upwind and one downwind air monitoring sample location will be selected based on the established work zone area, proximity to potential community receptors, and the prevailing wind direction. In general the initial air monitoring stations will be located along the perimeter of the work zone as defined in the site health and safety plan (HASP). If VOC or PM_{10} action levels (discussed below) are exceeded at the downwind work zone perimeter, then the downwind air monitoring location will be moved to the nearest downwind community receptor.

Note that the upwind and downwind air monitoring locations may change throughout the day based on changes in wind direction and work zone areas.

6.5.2 Sampling Methods

Total VOCs in ambient air will be monitored and recorded using a portable organic vapor analyzer (OVA) equipped with a photoionization detector (PID) with data-logging capabilities (MiniRae2000 or equivalent). The OVA-PID will be housed in a watertight shelter attached to a tripod and set at a height of approximately five feet above the ground. Total VOC levels will be measured continuously and recorded at 15-minute average intervals.

PM_{10} levels in ambient air will be monitored and recorded using a portable dust monitor capable of particle size fractionization of less than 10 microns in diameter (TSI Dust TRAK or equivalent). The dust monitor will be housed with the OVA-PID in a watertight shelter attached to a tripod and set at a height of approximately five feet above the ground. PM_{10} levels will be measured continuously and recorded at 15-minute average intervals.

On-site personnel will monitor the total VOC and PM_{10} levels within the work zone as part of health and safety plan. If VOC or PM_{10} levels within the work zone increase then the upwind and downwind perimeter air monitoring stations will be checked at 15-minute intervals to determine if the VOC levels or PM_{10} are increasing at the work zone perimeter. If the downwind levels are greater than the upwind levels then it will be assumed that the emissions are the result of work zone activities. If the difference between the downwind and upwind VOC or PM_{10} level is greater than their respective action level (discussed below), monitoring will commence at the nearest downwind community receptor.

6.5.3 Action Levels

The action levels provided below are based on the values provided in the NYSDOH generic CAMP and will be used to initiate response actions, if necessary, based on real-time monitoring.

6.5.3.1 Total VOC Action Levels

The following total VOC action levels and responses, based on the NYSDOH generic CAMP, will be implemented during any RI activity that may generate emissions.

- If the ambient air concentration of total VOCs exceeds 5 parts per million (ppm) above the 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 will resume with continuous monitoring.

- If the ambient air concentrations of total VOCs persist at levels in excess of 5 ppm above background but less than 25 ppm above background, intrusive site work activities will be halted, the source of the elevated VOC concentrations identified, corrective actions to reduce or abate the emissions undertaken, and air monitoring will continue. Once these actions have been implemented, intrusive site work activities will resume provided the following two conditions are met.

    - The 15-minute average VOC concentrations remain below 5 ppm above background

    - The VOC level 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 over background for the 15-minute average

- If the ambient air concentrations of total VOCs are above 25 ppm above background, intrusive site activities will stop and emission control measures will be implemented.

6.5.3.2 PM_{10} Action Levels

The following PM_{10} action levels and responses, based on the NYSDOH generic CAMP, will be implemented during any RI activity that may generate emissions.

- If the average ambient air concentration of PM_{10} at any one (or more) of the sampling locations is noted at levels in excess of 100 micrograms per cubic meter ($\mu g/m^3$) above the background (upwind location) for the 15 minute interval, 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 is to be identified, corrective actions to reduce or abate the emissions will be undertaken, and air monitoring will continue. 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, provided no visible dust is migrating from the work are.

- If, after implementation of dust suppression techniques, PM_{10} levels are greater than 150 $\mu g/m^3$ above background, work will stop and site activities will be re-evaluated. Work will only resume after dust suppression measures and other controls are implemented and PM_{10} levels are less than 150 $\mu g/m^3$ above background and no visible dust is migrating from the work area.

6.5.4 Emission Control Measures

The following emission control measures may be used if action levels are exceeded during RI activities:

- Apply water to exposed soil/material piles.
- Cover excavated soil/material piles with polypropylene sheeting or other appropriate material.
- Reduce surface area of exposed material/soil area.
- Containerize excavated material/drill cuttings.
- Stop drilling and cover borehole.
- Implement whatever methods are necessary to eliminate continuing emissions that could occur after site work ceases.

6.5.5 Meteorological Monitoring

Wind direction and wind speed be monitored and recorded at least once per hour during intrusive sampling activities. Wind direction will be determined using a windsock, wind vane, multi-purpose wind meter, or other appropriate equipment. Wind speed will be determined using a handheld wind speed meter.

6.5.6 Instrument Calibration

Calibration of the VOC and PM_{10} instrumentation will occur in accordance with each of the equipment manufacturer's calibration and quality assurance requirements. The VOC and PM_{10} monitors will be calibrated at least daily, and calibrations will be recorded in the field activity logbook.

7. Work Zones and Decontamination

7.1 Work Zones

7.1.1 Authorization to Enter

Only personnel with the appropriate training and medical certifications (if respirators are required) will be allowed to work at the project site. The SS will maintain a list of authorized persons; only personnel on the authorized-persons list will be allowed to enter the site work areas.

7.1.2 Site Orientation and Hazard Briefing

No person will be allowed in the work area during site operations without first being given a site orientation and hazard briefing. This documented orientation will be presented by the SS or HSS and will consist of a review of this HASP. This review must cover the chemical, physical, and biological hazards; protective equipment; safe work procedures; and emergency procedures for the project. Following this initial meeting, daily safety meetings will be held each day before work begins.

All people entering the site work areas, including visitors, must document their attendance at this briefing, as well as the daily safety meetings, on the forms included with this plan.

7.1.3 Certification Documents

A training and medical file may be established for the project and kept on site during all site operations. Specialty training, such as first aid and cardiopulmonary resuscitation (CPR), as well as current medical clearances for all project field personnel required to wear respirators, will be maintained within that file. All ARCADIS and subcontractor personnel must provide their training and medical documentation to the HSS prior to starting work.

7.1.4 Entry Log

A log-in/log-out sheet will be maintained on site by the SS. Personnel must sign in and out on a log sheet as they enter and leave the work area, and the SS may document entry and exit in the field notebook.

7.1.5 Entry Requirements

In addition to the authorization, hazard briefing, and certification requirements listed above, no person will be allowed in any ARCADIS work area unless they are wearing the minimum PPE as described in Section 5, Personal Protective Equipment.

7.1.6 Emergency Entry and Exit

People who must enter the work area on an emergency basis will be briefed of the hazards by the SS. All activities will cease in the event of an emergency. People exiting the work area because of an emergency will gather in a safe area for a head count. The SS is responsible for confirming that all people who entered the work area have exited in the event of an emergency.

7.1.7 Contamination-Control Zones

Contamination-control zones are maintained to prevent the spread of contamination, and to prevent unauthorized people from entering hazardous areas.

7.1.7.1 Exclusion Zone

An EZ may consist of a specific work area or may be the entire area of potential contamination. All employees entering an EZ must use the required PPE, and must have the appropriate training and medical clearance for hazardous waste work. The EZ is the defined area where there is a possible respiratory and/or contact health hazard. Cones, caution tape and a site diagram will identify the location of each EZ.

7.1.7.2 Contamination-Reduction Zone

The CRZ or transition area will be established, if necessary, to perform decontamination of personnel and equipment. All personnel entering or leaving the EZ will pass through this area to prevent any cross-contamination. Tools, equipment, and machinery will be decontaminated in a specific location. All personnel will be decontaminated on site adjacent to the EZ. Personal protective outer garments and respiratory protection will be removed in the CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the EZ and the SZ.

7.1.7.3 Support Zone

The SZ is a clean area outside the CRZ located to prevent employee exposure to hazardous substances. Eating and drinking will be permitted in the SZ only after proper decontamination. Smoking may be permitted in the SZ, subject to site requirements.

7.1.8 Posting

Work areas will be prominently marked and delineated using cones, caution tape and a site diagram.

7.1.9 Site Inspections

The SS will conduct a daily inspection of site activities, equipment, and procedures to verify that the required elements are in place. The Health and Safety Inspection Form in Attachment H may be used as a guide for daily inspections. An LPO schedule will be determined prior to project start. All LPOs will be entered into the LPS Database.

7.2 Decontamination

7.2.1 Personnel Decontamination

All personnel wearing Modified Level D or Level C protective equipment in the EZ must undergo personal decontamination prior to entering the SZ. The personnel decontamination area will consist of the following stations, at a minimum:

- *Station 1*: Personnel leaving the contaminated zone will remove the gross contamination from their outer clothing and boots.

- *Station 2*: Personnel will remove their outer garment and gloves and dispose of them in properly labeled containers. Personnel will then decontaminate their hard hats and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items are then hand carried to the next station.

- *Station 3*: Personnel will thoroughly wash their hands and face before leaving the CRZ. Respirators will be sanitized and then placed in a clean plastic bag.

7.2.2 Equipment Decontamination

All equipment such as bailers, oil/water probes, transfer containers must be decontaminated prior to leaving the work area. A solution of Alconox (or equivalent) will be used to remove all visible contamination. The decontamination solution and rinsate must be poured into a drum for disposal.

7.2.3 PPE Decontamination

Where and whenever possible, single-use, external protective clothing must be used for work within the EZ or CRZ. This protective clothing must be disposed of in properly labeled containers. Reusable protective clothing will be rinsed on site with detergent and water. The rinsate will be collected for disposal.

When removed from the CRZ, the respirator will be thoroughly cleaned with soap and water. The respirator face piece, straps, valves, and covers must be thoroughly cleaned at the end of each work shift and ready for use prior to the next shift. Respirator parts may be disinfected with a solution of bleach and water, or by using a spray disinfectant.

8. Training and Medical Surveillance

8.1 Training

8.1.1 General

All onsite project personnel who work in areas where they may be exposed to site contaminants must be trained as required by OSHA Regulation 29 CFR 1910.120 (HAZWOPER). Field employees also must receive a minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed their initial training more than 12 months prior to the start of the project must have completed an 8-hour refresher course within the past 12 months. The SS must have completed an additional 8 hours of supervisory training, and must have current first-aid and CPR certificates.

8.1.2 Basic 40-Hour Course

The following is a list of the topics typically covered in a 40-hour HAZWOPER training course:

- General safety procedures
- Physical hazards (fall protection, noise, heat stress, cold stress)
- Names and job descriptions of key personnel responsible for site health and safety
- Safety, health, and other hazards typically present at hazardous waste sites
- Use, application, and limitations of PPE
- Work practices by which employees can minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements
- Recognition of symptoms and signs that might indicate overexposure to hazards
- Worker right-to-know (Hazard Communication OSHA 1910.1200)
- Routes of exposure to contaminants
- Engineering controls and safe work practices

- Components of a health and safety program and a site-specific HASP
- Decontamination practices for personnel and equipment
- Confined-space entry procedures
- General emergency response procedures

8.1.3 Supervisor Course

Managers and supervisors must receive an additional 8 hours of training, which typically includes:

- General site safety and health procedures
- PPE programs
- Air monitoring techniques

8.1.4 Site-Specific Training

Site-specific training will be accomplished through a thorough site briefing by the PM, SS, or HSS on the contents of this HASP before work begins. The review must include a discussion of the chemical, physical, and biological hazards; protective equipment and safety procedures; and emergency procedures.

8.1.5 Daily Safety Meetings

Twice daily safety meetings will be held to cover the work to be accomplished, hazards anticipated, PPE and procedures required to minimize site hazards, and emergency procedures. The SS or HSS should present these meetings prior to beginning the day's fieldwork and again in the afternoon. No work will be performed in an EZ before the morning safety meeting has been held. The safety meeting must also be held prior to new tasks and repeated if new hazards are encountered. The Daily Safety Meeting Log is included in Attachment I.

8.1.6 First Aid and CPR

At least one employee current in first aid and CPR will be assigned to the work crew, and will be on site during operations. Refresher training in first aid (triennially) and CPR (annually) is required to keep the certificate current. These individuals must also receive training regarding the precautions and protective equipment necessary to protect against exposure to blood-borne pathogens.

8.2 Medical Surveillance

8.2.1 Medical Examination

All personnel who are potentially exposed to site contaminants must participate in a medical surveillance program as defined by OSHA at 29 CFR 1910.120(f).

8.2.2 Pre-Placement Medical Examination

All potentially exposed personnel must have completed a comprehensive medical examination prior to assignment and periodically thereafter, as defined by applicable regulations. The pre-placement and periodic medical examinations typically include the following elements:

- Medical and occupational history questionnaire
- Physical examination
- Complete blood count, with differential
- Liver enzyme profile
- Chest x-ray, at a frequency determined by the physician
- Pulmonary function test
- Audiogram
- Electrocardiogram for persons older than 45 years of age, or if indicated during the physical examination
- Drug and alcohol screening, as required by job assignment
- Visual acuity
- Follow-up examinations, at the discretion of the examining physician or the corporate medical director

The examining physician must provide the employee with a letter summarizing his or her findings and recommendations, confirming the worker's fitness for work and ability to wear a respirator. Documentation of medical clearance will be available for each employee during all project site work.

Subcontractors will certify that all their employees have successfully completed a physical examination by a qualified physician. The physical examinations must meet the requirements of 29 CFR 1910.120 and 29 CFR 1910.134. Subcontractors will supply copies of the medical examination certificate for each onsite employee.

8.2.3 Other Medical Examinations

In addition to pre-employment, annual, and exit physicals, personnel may be examined:

- At employee request after known or suspected exposure to toxic or hazardous materials.
- At the discretion of the HSS, HSO, or occupational physician in anticipation of, or after known or suspected exposure to toxic or hazardous materials.

8.2.4 Periodic Exam

Following the placement examination, all employees must undergo a periodic examination similar in scope to the placement examination. For employees potentially exposed more than 30 days per year, the frequency of periodic examinations will be annual. For employees potentially exposed less than 30 days per year, the frequency for periodic examinations will be 24 months.

8.2.5 Medical Restriction

When the examining physician identifies a need to restrict work activity, the employee's supervisor must communicate the restriction to the employee and the HSS. The terms of the restriction will be discussed with the employee and the supervisor.

9. Emergency Procedures

9.1 General

Prior to the start of operations, the work area will be evaluated for the potential for fire, contaminant release, or other catastrophic event. Unusual conditions or events, activities, chemicals, and conditions will be reported to the SS/HSS immediately.

The SS/HSS will establish evacuation routes and assembly areas for the site. All personnel entering the site will be informed of this route and the assembly area.

9.2 Emergency Response

If an incident occurs, the SS or HS should take the following steps:

- Evaluate the incident and assess the need for assistance and/or evacuation
- Contact the Con Edison Construction Management representative, unless a personal injury is involved, in which as call 911. The Con Edison Construction Management representative will contact the Bronx/Westchester Control Center
- Confirm that the PIC, PO, HSM/HSO, and PM are notified promptly of the incident
- Take appropriate measures to stabilize the incident scene

9.2.1 Fire

In the case of a fire on site, the SS/HSS will assess the situation and direct firefighting activities. The SS/HSS will confirm that the PM is immediately notified of any fires. Site personnel will attempt to extinguish the fire with available extinguishers, if safe to do so. In the event of a fire that site personnel are unable to safely extinguish with one fire extinguisher, the local fire department will be summoned.

9.2.2 Contaminant Release

In the event of a contaminant release, the following steps will be taken:

- Notify SS/HSS and Con Edison Construction Management representative immediately

- Evacuate immediate area of release
- Conduct air monitoring to determine needed level of PPE
- Take mitigative measures to prevent the entrance of contaminants to sewers, catch basins, manholes, and vaults
- Don required level of PPE and prepare to implement control procedures

The SS/HSS has the authority to commit resources as needed to contain and control released material, and to prevent its spread to offsite areas.

9.3 Medical Emergency

All employee injuries must be promptly reported to the HSS/SS, who will:

- Confirm that the injured employee receives prompt first aid and medical attention.
- In emergency situations, the worker is to be transported by appropriate means to the nearest urgent care facility (normally a hospital emergency room).
- If the injured person is an ARCADIS employee, notify ARCADIS Workers Comp coordinator Pat Bullock at 720.344.3844, as soon as possible after the injured employee has been safely evacuated from the site.

9.3.1 Emergency Care Steps

After identifying the emergency and contacting the Con Edison Construction Inspection representative, and upon entering an accident area, site personnel must follow these emergency care steps:

- Survey the scene. Determine if it is safe to proceed. Try to determine if the conditions that caused the incident are still a threat. Protect yourself from exposure before attempting to rescue the victim.
- Do a primary survey of the victim. Check for airway obstruction, breathing, and pulse. Assess likely routes of chemical exposure by examining the eyes, mouth, nose, and skin of the victim for symptoms.

- Phone emergency medical services (EMS). Give the location, telephone number used, caller's name, what happened, number of victims, victim's condition, and help being given.

- Maintain airway and perform rescue breathing as necessary.

- Perform CPR as necessary.

- Do a secondary survey of the victim. Check vital signs and do a head-to-toe exam.

- Treat other conditions as necessary. If the victim can be moved, take him or her to a location away from the work area where EMS can gain access.

9.4 First Aid—General

All persons must report any injury or illness to their immediate supervisor or the SS and the Con Edison Construction Inspection representative. Trained personnel will provide first aid. Injuries and illnesses requiring medical treatment must be documented. The SS and HSS must conduct an II as soon as emergency conditions no longer exist, and first aid and/or medical treatment has been confirmed. IIs must be completed and submitted to the PM within 24 hours after the incident.

In addition to the II discussed above, in the event of injury or illness, a Con Edison Contractor Injury Report form will be completed and provided to the Con Edison representative on site within 24 hours of the incident. A Con Edison Contractor Injury Report Form is included in Attachment J. An investigation report that includes a description of the incident, root cause determination, and actions to be taken to prevent recurrence will be submitted with the Con Edison Contractor Injury Report Form. Work will not be allowed to re-commence on the task where the injury occurred until Con Edison considers ARCADIS' preventative action plan to be acceptable.

If first-aid treatment is required, first-aid kits are kept at the CRZ. If treatment beyond first aid is required, the injured person(s) should be transported to the medical facility. If the injured person is not ambulatory or shows any sign of not being in a comfortable and stable condition for transport, then an ambulance and/or paramedics should be summoned. If there is any doubt as to the injured worker's condition, it is best to let the local paramedic or ambulance service examine and transport the worker.

9.4.1 First Aid - Inhalation

Any employee complaining of symptoms of chemical overexposure as described in Section 4, General Safety Practices, will be removed from the work area and transported to the designated medical facility for examination and treatment.

9.4.2 First Aid - Ingestion

Call EMS and consult a poison control center for advice. If available, refer to the MSDS for treatment information. If the victim is unconscious, keep them on their side and clear the airway if vomiting occurs.

9.4.3 First Aid - Skin Contact

Project personnel, who have had skin contact with contaminants will, unless the contact is severe, proceed through the CRZ to the wash area. Personnel will remove any contaminated clothing and then flush the affected area with water for at least 15 minutes. The worker should be transported to the medical facility if he or she shows any sign of skin reddening, irritation, or if he or she requests a medical examination.

9.4.4 First Aid - Eye Contact

Project personnel who have had contaminants splashed in their eyes, or who have experienced eye irritation while in the E, must immediately proceed to the eyewash station in the CRZ. Do not decontaminate prior to using the eyewash. Remove whatever protective clothing is necessary to use the eyewash. Flush the eye with clean running water for at least 15 minutes. Arrange prompt transport to the designated medical facility.

9.4.5 Reporting Injuries, Illnesses, and Near-Miss Incidents

Injuries and illnesses, however minor, will be reported to the SS immediately. The SS will notify the PIC, PO, HSM/HSO, and PM of the incident The SS will complete an injury report and submit it to the HSO and PM within 24 hours.

Near-miss incidents are situations in which no injury or property damage occurred, but under slightly different circumstances an injury or property damage could have occurred. Near misses are caused by the same factors as injuries; therefore, they must be reported and investigated in the same manner. An SPSA must be done

immediately after an injury, illness, near miss, or other incident to determine if it is safe to proceed with the work.

9.5 Non-Emergency, Non-Life Threatening Work Related Injury or Illness

For minor illnesses or injuries that may be work-related and are **not** life threatening or emergencies (e.g., you're in your hotel room and your lower back tightens up, earlier in the day you hand-augured 50 borings; you cut your hand in the office, put a band-aid on the cut, and go back to work, but when you get home you realize the cut is deep and is still bleeding; you hit your head on a cabinet while loading paper, and later on that day you suddenly feel dizzy.) employees will take the following steps **before** seeking medical treatment at a medical treatment facility:

As soon as possible, contact WorkCare at 1-800-455-6155 (Once you've spoken with WorkCare, you can let your supervisor know).

WorkCare will discuss the medical issues with you and provide appropriate medical guidance.

- If WorkCare feels that you should see a physician:
- They will help you locate a physician/clinic and will contact the clinic to discuss the treatment plan. If they have a concern about the treatment plan, one of the WorkCare physicians will attempt to contact the treating physician to discuss the plan and will keep you advised.
- If WorkCare feels that first-aid/self-treatment is medically appropriate:
- They will provide the treatment information to you and will follow up with you to determine effectiveness.
- If the medical issue persists, WorkCare will advise alternative treatment or will refer you to a physician.
- Keep your supervisor informed on what action you will be taking. If you are seen by a physician, keep them advised as to your work status and upcoming medical appointments.

If an injury or illness is life-threatening or an emergency, please seek medical attention immediately. As soon as possible, notify your supervisor. Notify ConEdison no later than the start of the next shift.

9.6 Emergency Information

The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the daily safety meeting. These agencies are identified in Table 9-1 below.

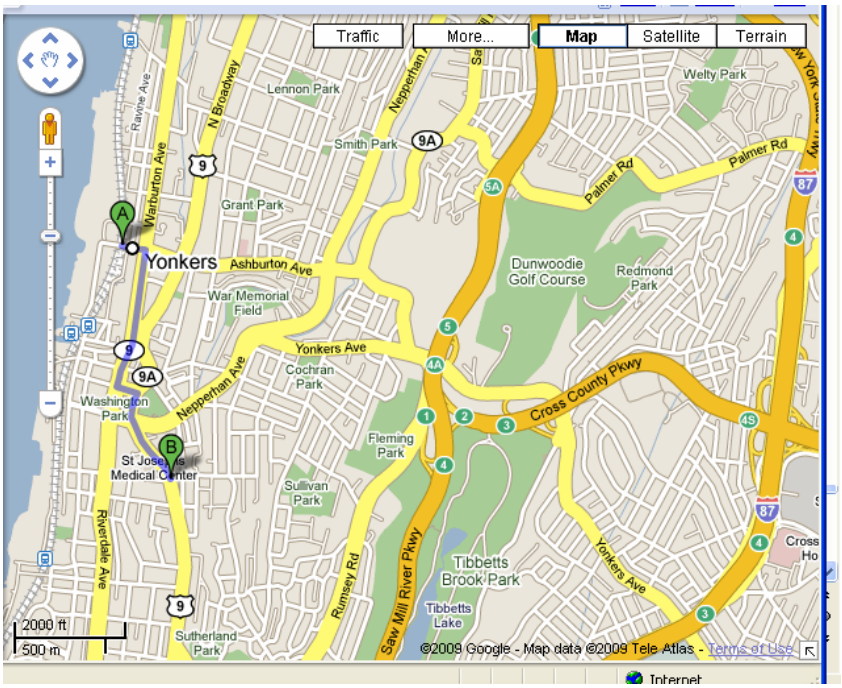
Table 9-1
Emergency Contacts

Emergency Contacts	**Telephone No.**
Charles P. Leary - Con Edison	718.204.4145 (office)
Jeff Rutwoski - Con Edison Construction Management Chief Construction Inspector (CCI)	(718) 204 4019
Contingency Contacts	**Telephone No.**
Police: Yonkers Police Department	911 914.377.7252
Dig Safely NY (3 day notice required for utility markouts)	800.962.7962
Poison Control Center:	800.222.1222
National Pollution Toxic Chemical Oil Spills	800.424.8802
New York Spills Hotline	800.457.7362
Medical Emergency	**Telephone No.**
Ambulance Service:	911
Hospital Name	**St. Joseph's Medical Center: General Hospital**
Hospital Phone Number	914.378.7000
Hospital Address	127 South Broadway Yonkers, New York 10701
Route to Hospital:	See Figure 9-1
Travel Time From Site:	4 minutes
Travel Distance From Site	0.8 mile
Project Contractor Contacts	**Telephone No**
Project Manager: Michael Jones	315.671.9211 315.247.3244(cell)
Project Contractor Health & Safety Officer: TBD	
Consolidated Edison Contacts	**Telephone No**
Project Manager: Charles P. Leary	718.204.4347 (office)
Construction Manager: TBD	TBD

9.6.1 Directions to Hospital

It is the responsibility of the HSS to verify the directions to the hospital prior to the start of work.

Driving Directions
Head south on Alexander Street toward Ashburton Avenue 0.3 miles.
Turn right on to River Street 394 feet.
Continue on Buena Vista Avenue 0.2 miles.
Turn left at Prospect Street 0.2 miles.
Turn right onto South Broadway/RT-9A/US-9 0.2 miles.
Travel time: 4 minutes; distance 1.0 miles



10. Acronyms and Abbreviations

The following acronyms and abbreviations (listed alphabetically) are applicable to this HASP:

ACGIH - American Conference of Governmental Industrial Hygienists
ARCADIS – ARCADIS of New York, Inc. (formerly known as Blasland, Bouck & Lee, Inc.)
CFR - Code of Federal Regulations
CO - Carbon Monoxide
COC - Constituent of Concern
Con Edison -Consolidated Edison Company of New York, Inc.
CPR - Cardiopulmonary Resuscitation
CRZ - Contamination-Reduction Zone
DEET - diethyltoluamide
DOT - Department of Transportation
EMS - Emergency Medical Services
EZ - Exclusion Zone
FM - Factory Mutual Engineering Corporation
GFCI - Ground-Fault-Circuit Interrupter
HASP - Health and Safety Plan
HSO - Health and Safety Officer
HSS - Health and Safety Supervisor
II - Incident Investigation
JSA - Job Safety Analysis
kV - Kilovolts
LEL - Lower Explosive Limit
LFL - Lower Flammable Limit
LPO - Loss Prevention Observation
mph - Miles Per Hour
MSDS - Material Safety Data Sheet
NEC - National Electrical Code
NESC - National Electrical Safety Code
NIOSH - National Institute for Occupational Safety and Health
NRR - Noise Reduction Rating
OSHA - Occupational Safety and Health Administration
PEL - Permissible Exposure Limit

PFD - Personal Flotation Device
PIC - Principal-in-Charge
PID - Photoionization Detector
PM - Project Manager
PO - Project Officer
PPE - Personal Protective Equipment
RMSF - Rocky Mountain Spotted Fever
SPSA - Safe Performance Self-Assessment
SS - Site Supervisor
SZ - Support Zone
TLV - Threshold Limit Value
UFPO - Underground Facility Protection Organization
UL - Underwriters Laboratory
USEPA - United States Environmental Protection Agency

11. References

This HASP follows the guidelines established in the references listed below.

- Standard Operating Safety Guides, USEPA (Publication 9285.1-03, June 1992).
- Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH, OSHA, USCG, USEPA (86116, October 1985).
- Title 29 of the Code of Federal Regulations (CFR), Part 1910.
- Title 29 of the Code of Federal Regulations (CFR), Part 1926.
- Con Edison Utility Clearance Process for Intrusive Activities Revision 1, Con Edison, (October 2003)
- Pocket Guide to Chemical Hazards, DHHS, PHS, CDC, NIOSH (2005).
- Threshold Limit Values, ACGIH (2006).
- Guide to Occupational Exposure Values, ACGIH (2006).
- Quick Selection Guide to Chemical Protective Clothing, Forsberg, K. and S.Z. Mansdorf, 2nd Ed. (1993).
- Health and Safety Manual, ARCADIS (2003).

Attachment A

Con Edison EH&S Hazard Analysis for Contractor Work, Hazard Analysis for Contractor Work, and Work Plan Guides

ATTACHMENT 3
EH&S HAZARD ANALYSIS FOR CONTRACTOR WORK
CONSTRUCTION MANAGEMENT: REMEDIATION
PROJECT: **MGP Site Investigation, Land and Over Water (ARCADIS BBL)**
LOCATION: _____

Section	Applicable Yes	Applicable No	Comments	Indicate Section in EHASP item(s) discussed
1.0 Introduction	X			1.0
2.0 Air Resources		X		N/A
3.0 Asbestos Awareness		X		N/A
4.0 Bloodborne Pathogens Exposure Control Plan (including first aid)	X			Attachment H
5.0 Chemical Safety & Handling	X		MSDSs are required for all chemicals brought on site. Please send in advance so Con Edison has an opportunity to review before those chemicals arrive on site. Unapproved chemicals will not be allowed on site, or additional time will be needed for a review/approval, if use may even be permitted.	Attachment E?
6.0 Confined Space Program		X		N/A
7.0 Electrical Safety	X			4.14
8.0 Electrical Enclosed Spaces		X		N/A
9.0 Excavation & Trenching	X		Drilling, site COC hazards	3.0
10. Fish, Wildlife and Wetlands		X	DEC/USACOE permits not required for VCA activities.	N/A
11. Fire Protection & Prevention	X		Reminder - FDNY C of F for Fire Watch	4.21
12. Gas Enclosed Spaces		X		N/A
14. Hearing Conservation	X			4.9
15. Insulation Materials		X		N/A
16. Lead Management Program		X	Con Edison assumes that all paint contains lead unless tested otherwise. Employees must have awareness level training.	N/A
17. Management of Change	X			1.3
18. Material Handling	X			4.19
19. Mechanical Equipment	X		Address all safety and environmental issues related to equipment being used.	3.0
20. Mercury Management		X		N/A
21. Noise	X			4.9
22. Oil & Dielectric Fluid	X			4.10
23. PCB Management		X	Con Edison assumes that all paint contains PCBs unless tested otherwise. Employees must have awareness level training.	N/A
24. Personal Protective Equipment	X		Please review/revise the appropriate PPE for the various tasks involved.	5.0
25. Pesticide/Herbicide		X		N/A
26. Respiratory Protection Program	X			5.2

Section	Applicable Yes	No	Comments	Indicate Section in EHASP item(s) discussed
27. Sampling	X		Worker (OSHA) and Environmental sampling procedures	3.5, Table 6-1
28. Vehicle Management	X		Concerned particularly with vehicle/equipment spills. Full length/width polysheeting under…	4.10
29. Waste Management	X		How/by whom IDW will be managed (i.e., stored, characterized, transported, and disposed).	3.9
30. Water Resources		X		N/A
31. Welding & Burning			Hot Work, as appropriate	4.21
32. Work Area Protection	X		Work zone delineations, traffic safety plans.	4.17, 7.0
33. Working at Elevations		X		N/A
34. Drug and Alcohol Program		X		N/A
35. FR Clothing		X	Required in Electrical Enclosed Space and anytime torch cutting, burning, welding, and grinding to occur.	4.21
36. Close Call Program	X			4.2.3
37. Job Briefings	X		Daily job briefings required with documentation.	2.4, 2.5
38. Time Out Program	X		All workers on site authorized to call a Time Out	2.7
39. Other – Water Safety	X		Please refer to items requiring action on the Con Edison Comments to this HASP.	3.7

Provided by: Con Edison Maintenance & Construction Services: Remediation (*date*): [11/14/06]

(a) Environmental & Safety – *Thomas O'Connell, Project Specialist*
O'Connellt@coned.com

Received by:
Contractor Representative: _____
(Name & Date)

ATTACHMENT 4
EH&S PLAN CHECKLIST

Contractor: ARCADIS BBL (f.k.a. Blasland, Bouck, and Lee, Inc.)

Name/Description of Project/Job and PO Number: _____

Con Edison Facility/Location: _____

If you answer "Yes" to any of the items below, describe in the site environmental, health and safety (EH&S) plan how you will protect your employees, Con Edison employees, the public and the environment, if applicable, from the indicated hazard as required by OSHA, EPA, DEC. and any other federal, state, or local laws and regulations. Indicate how and where you will dispose of all wastes. After you complete your EH&S plan, enter the page number(s) to identify where in the EH&S plan each hazard is addressed. This checklist does not preclude the submission of a work plan nor is it meant to be an all-inclusive guide to EH&S plans.

1) Do you expect that the job may involve any of the following (please circle the response for each item, either to confirm or indicate that the project does not involve the item)?

	Yes	No	Page #
Asbestos		X	____
PCBs		X	____
Lead or lead paint or chips*		X	____
Silica		X	____
Mercury	X		3-19
Other hazardous wastes (corrosive, reactive, toxic, ignitable, or listed hazardous wastes)	X		3-18
Non-hazardous wastes	X		____
Other hazardous materials/chemicals (MSDS)	X		Att E
Work at high elevations (scaffolds, ladders, etc.)	X		4-11
Work in excavations		X	____
Heavy equipment: cranes, aerial lifts, forklifts	X		3-4
Hand and/or power tools		X	____
Work in confined or enclosed spaces		X	____
Welding/burning		X	____
Electrical, Gas or Steam work		X	____
Explosives		X	____
Discharges to water, land or sewers	X		3-1
Confined Space entry		X	____
Lockout/Tagout of facilities	X		4-13
Air Emissions	X		6-1
Excessive Noise	X		4-9

Traffic and/or Roadway	X		4-17
Petroleum or Used Oil		X	____
Pesticides		X	____

*Note: All paint removed at Con Edison is considered to contain lead

2) If you expect to encounter any other EH&S hazards, please list them below and address them in your EH&S Plan.

Hazard	Page
Boating/Water Hazards	3-8
_____	____
_____	____
_____	____

3) In your EH&S plan, detail the training and personal protective equipment your employees will be required to have to perform the job. Modified Level D or Level C

4) Provide and maintain all applicable Material Safety Data Sheets for hazardous substances used on the jobsite. Attachment E

5) List in your EH&S plan all emergency contacts and phone numbers, including contractor and Con Edison representatives.

6) Company NAICS/SIC Code: **NAICS:** 541620, 541330, 541690 / **SIC:** 8711

7) Last 3 Years OSHA Incident Rate: **2005:** 1.269 / **2004:** 0.97 / **2003:** 1.66

8) Last 3 Years Experience Modification Rate: **2005:** 0.99 / **2004:** 0.93 / **2003:** 0.96

Signature[1] _____ Date _____

Type/Print Name _____ Title _____

[1] In lieu of a hardcopy of the form with an actual signature, an electronic record is an acceptable substitute.

Con Edison Acceptance
To be completed by authorized Con Edison Representative

	Yes	No
Accepted	X	X

Signature _____ Date _____

Type/Print Name _____ Title _____

Con Edison

Health and Safety Plan

Guide 1: Introduction

Program outline

Contractors EHS Programs and Procedures (eHASP)

Contractor Responsibility

Purpose of this Guide

eHASP – Hazard Analysis and Control

Contractor eHASP Implementation & Oversight

Con Edison Contractor Evaluation and Procurement Process

Table 1	Matrix of Common Con Edison Contracts and Typical Associated Project Hazards
Attachment 1	EH&S Hazard Analysis For Contractor Work
Attachment 2	EH&S Plan Checklist
Attachment 3	Project Specific eHASP (Template)

Guide 1: Introduction

Con Edison commitment to EH&S excellence

Con Edison's policy is to demonstrate leadership and excellence in worker and public safety and health and environmental protection. This commitment shall be evident and continually reinforced in all Company operations and shall be adopted by each contractor performing work for Con Edison.

Each contractor shall be required to meet fundamental workplace requirements established by law and by regulation and be expected to reach beyond these basic requirements to realize a higher level of achievement for Environmental Health and Safety (EH&S) matters.

Contractors EHS programs and procedures (ehasp)

Contractors interested in working for ConEdison are required to submit 2 types of EHS Plans. The first plan required of contractor's is the Corporate EHS Program and Procedures (generic eHASP) and the second may be a project specific EHS Plan and or a task specific EHS Plan.

The first plan, the Contractor's corporate environmental, health, and safety programs and procedures (generic eHASP) is required in order to be placed on the approved bidder list. This information shall consist of documents uniquely authored by each contractor for the purpose of detailing practical implementation of all environmental, health, and safety standards that would be applicable to their work, such as a respiratory protection, scaffold or hazard communication program. If a primary activity of the contractor is scaffold erection, a corporate scaffold procedure (in addition to other programs) is required in order for contractor approval. Health and safety-related documents shall, as a minimum, address all applicable Occupational Safety and Health Act (OSHA) regulations. These documents shall be prepared at a level of detail necessary to illustrate how the contractor complies with each applicable OSHA requirement applicable to the business they are involved in. Documents that simply restate the regulatory standards verbatim will not be considered acceptable.

Once on the approved bidder list, a contractor may be chosen to bid on specific project within the Con Ed system which then requires the second EHS plan. A requirement of this bid is the development of a project specific environmental, health and safety plan (eHASP). This document is a written plan outlining the work to be performed which addresses the hazards expected and presents control measures for environmental and personnel protection. The hazards and control measures identified here are briefly stated but clearly identify the requirements of the contactors workers in performing the job activities. The hazards and control

measures identified are supported by the contractors corporate EHS programs and procedures. As an example, control measure specified in a project specific eHASP requiring the use of respiratory protection would also require a Corporate Respiratory Protection Program in compliance with OSHA. See attachment 3 for a project specific eHASP template that can be used to develop you project specific eHASP.

For those situations where a repetitive and routine task is performed by a contractor at several locations within our territory, we have approved the use of a "Task Specific eHASP". A Task

Specific eHASP is an alternate form of a project specific eHASP. A Task Specific eHASP is a general EHS plan developed by Con Ed or the contractor and accepted by Con Ed for use. This plan identifies the common hazards expected and control measures which the contractor is expected to be expert in and responsible for addressing. The contractor may utilize a Task Specific eHASP if they have agreed to the terms of the plan and have provided Con Edison with a signed copy. See section C of the manual for an example task specific ehasp.

The following sections provide guidance in the process of developing project specific environmental, health and safety plans (eHASP). At this point, we would expect the contractor has already been placed on the approved bidders list and has satisfied their obligation to provide an acceptable Corporate EHS Program.

Contractor responsibility

It is the responsibility of every contractor to be aware of and comply with all federal, state, and local regulations governing the environment and worker health and safety (EH&S). The contractor work plan required by Con Edison prior to the start of work must include processes for anticipating, identifying, assessing, and controlling any potential effects to the environment and potential hazards to workers, Con Edison employees, and the public. Con Edison personnel will review this work plan against the project scope of work, specifications and EH&S considerations and verify it is implemented in the field.

Con Edison will review the EH&S component of each contractor's work and any violations of EH&S law by a contractor can result in suspension or termination of that contractor.

Purpose of this guide

This guide is a general reference for all contractors for the preparation of acceptable EH&S programs and work plans when performing work for Con Edison. This document provides EH&S guidance for the development of a eHASP for all contractors performing the following three work catagories:

- Work requiring a project/site specific work plan (see # 1 on page 6);
- Work that complies with Con Edison's EH&S task specific guidance (see # 2 on page 8);
- All other work to be performed for Con Edison (see # 3 on page 8).

  Note: The user organization's EH&S representative will determine the type of eHASP required of the contractor.

The requirement for a site eHASP depends on the environmental, health and safety issues expected on the job. Jobs that involve the handling of hazardous materials, working around unsafe situations or working with power equipment, requires a written eHASP. When this type of work is performed in new locations with changing environmental conditions and with variable hazards, a site specific or job specific eHASP is required. When the job is routine and performed on a regular basis, a task specific eHASP may be used for all similar jobs. The contractor may

use a Con Edison generated task specific eHASP or may prepare their own task specific eHASP for our review. The eHASP shall address

- Important contractor information for project management and emergency use
- Job description
- Hazard identification and control methods
- Personal protective equipment requirements
- Employee training
- Site control and housekeeping
- Waste management

This guide is **not** intended to be, nor should it be interpreted as, an all-inclusive and comprehensive digest of all applicable federal, state, and local EH&S laws and regulations. The guide will help focus contractors on potential EH&S issues that may be encountered during work at Con Edison facilities and project sites and allow contractors to take appropriate steps in assessing and proactively preparing for site conditions.

This guide presents summaries of the main points found in EH&S laws and regulations that are commonly applicable to contractor activities at Con Edison facilities. References for locating additional sources of information for each topic are provided. This guide is meant to encourage every contractor to better preplan Con Edison projects and to assure EH&S regulatory compliance, accident prevention and efficient job completion.

eHASP - Hazard analysis and control

The following three sections identify what actions will be taken by Con Edison and the Contractor for the development of an eHASP for a specific project/job. The intent of this process is to assure that all EH&S issues are identified and properly addressed by the contractor in the eHASP. In the event any new or unusual situations or hazards arise which were not initially addressed, it is the responsibility of both Con Edison and the contractor to resolve these issues onsite.

1. **For contractors who are required to submit a project /site specific eHASP , the following steps are required:**

Con Edison will:

- Provide a "Request for Bid" or Proposal to qualified contractors.
- Include in the Request for Bid or Proposal details about the job to be performed and a listing of the hazards present or that may be expected on-site, by attaching a completed and signed "EH&S Hazard Analysis for Contractor Work", Attachment 1. Also provide a copy of attachment 2 "EH&S Plan Checklist" for the contractor to complete and sign.

Contractor will:

- Review Table 1 to determine some of the hazards expected based on the job activity.
- Review Attachment 1 to verify the information is accurate and co-sign the page. Comment and include additional hazards as necessary.
- Complete and sign Attachment 2, the "EH&S Plan Checklist.
- Identify any additional hazards in Attachments 1 and 2. Address all these hazards in the eHASP to be submitted for review by Con Edison.
- Ensure that the specific requirements of regulations and standards are met during all phases of the project.
- Bids for the proposed work are sent directly to the Corporate Purchasing Department.
- The proposed project/site specific eHASP for work to be performed shall be forwarded directly to the Contract Administrator by the contractor and will include completed and signed Attachments 1 and 2.

The contractor will correspond directly with the user organization requesting the work to assure a complete and clear project/site specific work plan is approved prior to the start of work. The Purchasing Department will issue a purchase order when commercial procurement matters are satisfied notwithstanding any work plan issues. Work will commence only when a 'Notice to Proceed' is issued by the user organization upon receipt of an acceptable project/site specific work plan.

2. For contractors who will comply with a Con Edison EH&S Task Specific EH&S guidance, the following steps are required:

Con Edison will:

- Provide a Request for Bid or Proposal to qualified contractors.
- Include in the Request for Bid or Proposal an EH&S task-specific eHASP guidance developed by Con Edison for the task to be performed for the length of the contract.

Contractor will:

Review and sign the task-specific eHASP guidance for implementation. Contractor may prepare there own task specific guidance for Con Edison review.

- Prepare a written explanation when a signed task specific guidance package is not provided.
- Provide the signed task specific eHASP guidance or explanation, and bid to Con Edison's Corporate Purchasing Department.

3. All other contractors working for Con Edison will:

Use the information in this guide for the continued improvement of their work practices, EH&S programs and compliance with all federal, state and local laws and regulations

Contractor eHASP implementation & oversight

Contractor:

Will have in possession, the project or task specific eHASP at the start of work. Each contractor supervisor, worker and employee onsite will be familiar with contents of the eHASP. Contractor supervision will be accountable and will be responsible to assure all work is performed in compliance with the eHASP as written. Contractor will conduct a prejob review of the work to be performed to review the eHASP and technical aspects of the job and to verify current EH&S issues in the field have not changed.

Con Edison:

Will review with the contractor the work to be performed and the eHASP prior to the start of work. Contractor employees will be evaluated as to their knowledge of the eHASP by the designated Con Ed Representatives. Con Ed will verify the eHASP is on site and being implemented in all phases of work. Appropriate equipment, supplies and ppe will be inspected. Inspection frequency of the contractors will be determined by the local organizations and will be conducted as necessary to assure compliance to the contract and the eHASP.

Failure of the contractor to comply with the requirements of their eHASP and EH&S law may lead to suspension or termination in accordance with our Corporate Procedures.

Con Edison contractor evaluation and procurement process

The Con Edison Purchasing Department, the EH&S Department, and the designated operating department representatives (as appropriate) are responsible for contractor evaluation and award as follow:

- Purchasing - will identify the successful bidder and notify the requesting organization.
- EH&S – will resolve Corporate eHASP Plan issues directly with the contractor(s).
- Operating Department - will review the contractor work plan and eHASP specific to the job specifications and the EH&S requirements of the job in compliance with this document.

It is Con Edison's policy that each prime contractor and its subcontractor(s) must meet all requirements of this program. The contractors must assure that environmental, health and safety matters are managed during all phases of the project to ensure the safety and health of contractor personnel, Con Edison personnel and the public, and to ensure the protection of the environment.

Contractors are responsible for ensuring that their work activities are completed as required by this guide and applicable EH&S laws and regulations, whichever will better protect the environment and ensure the safety of the public and personnel.

Table 1

Matrix of common Con Edison contracts And typical associated project hazards

Contractor	Typical Hazards	Applicable Guide Sections
Asbestos Abatement Operations	**Respiratory:** asbestos, silica, dust	3, 17, 26
	Dermal: chemicals, cuts, abrasions	3,5
	Eye: asbestos, dusts, particles, chemicals	3,5
	Electrical: shock from frayed wires, improper grounds, cut wires	7
	Hand Tools: cuts, pinching, smashing, exposed moving parts	19
	Lifting: musculoskeletal problems	18
	Falls: heights, scaffolds, ladders	33
	Fires: open flame, storage, housekeeping	11
Excavation	**Heavy Equipment:** crushing, pinching	17, 18, 19
	Trenching: cave in, unstable soils, falls, falling objects, drowning	9
	Utilities: electrocution, explosion, steam heat, water	7
	Tools: cuts, pinching, smashing, exposed moving parts	19
	Confined Spaces: lack of oxygen, toxic gases, H2S, methane	6, 26
	Respiratory: asbestos, silica, dust	26
	Eye: asbestos, dust, particles, chemical	24
	Lifting: musculoskeletal problems	18
	Traffic: accidents, pedestrian safety	32
Construction – General	**Heavy Equipment:** crushing, pinching	16,17
	Trenching: cave in, unstable soils, falls, falling objects, drowning	8
	Utilities: electrocution, explosion, steam heat, water	7
	Tools: cuts, pinching, smashing, exposed moving parts	19
	Confined Spaces: lack of oxygen, toxic gases, hydrogen sulfide, methane	6, 8

Contractor	Typical Hazards	Applicable Guide Sections
Construction – General (continued)	**Respiratory:** asbestos, silica, dust	26
	Eye: asbestos, dusts, particles, chemicals	24
	Lifting: musculoskeletal problems	18
	Welding / Torching: fire, sparks, heat, toxic gases, metal fumes	11, 31
	Grinding: abrasions, cuts, heat, fire, particles, metal fumes	11, 24, 26
	Traffic: accidents, pedestrian safety	32
Construction – Electrical	**Heavy Equipment:** crushing, pinching	17, 18
	Trenching: cave in, unstable soils, falls, falling objects, drowning	9
	Utilities: electrocution, explosion, steam heat, water	7
	Tools: cuts, pinching, smashing, exposed moving parts	19
	Confined Spaces: lack of oxygen, toxic gases, hydrogen sulfide, methane	6, 8
	Respiratory: asbestos, silica, dust	26
	Eye: asbestos, dusts, particles, chemicals	24
	Lifting: musculoskeletal problems	18
	Falls: heights, scaffolds, ladders	33
	Traffic: accidents, pedestrian safety	32
Construction – Gas	**Heavy Equipment:** crushing, pinching	17, 18
	Trenching: cave in, unstable soils, falls, falling objects, drowning	9
	Utilities: electrocution, explosion, steam heat, water	7
	Tools: cuts, pinching, smashing, exposed moving parts	19
	Confined Spaces: lack of oxygen, toxic gases, hydrogen sulfide, methane	6, 8
	Respiratory: asbestos, silica, dust	26
	Eye: asbestos, dusts, particles, chemicals	24
	Lifting: musculoskeletal problems	18
	Traffic: accidents, pedestrian safety	32
Construction – Asphalt	**Heavy Equipment:** crushing, pinching	17, 18
	Utilities: electrocution, explosion, steam heat, water	7
	Tools: cuts, pinching, smashing, exposed moving parts	19
	Respiratory: asbestos, silica, dust, volatile organic vapors, H2S	26

Contractor	Typical Hazards	Applicable Guide Sections
Construction – Asphalt cont.	**Eye:** asbestos, dusts, particles, chemicals	24
	Lifting: musculoskeletal problems	18
	Traffic: accidents, pedestrian safety	32
Painting	**Tools**: cuts, pinching, smashing, exposed moving parts	17, 19
	Respiratory: asbestos, silica, dust, volatile organic vapors	26
	Eye: asbestos, dusts, particles, chemicals	24
	Lifting: musculoskeletal problems	18
	Falls: heights, scaffolds, ladders	33
	Grinding: abrasions, cuts, heat, fire, airborne particles, metal dust	24
Lead Abatement	**Lead:** toxic materials	16, 17
	Tools: cuts, pinching, smashing, exposed moving parts	19
	Respiratory: asbestos, silica, dust, volatile organic vapors	26
	Eye: asbestos, dusts, particles, chemicals	24
	Lifting: musculoskeletal problems	18
	Falls: heights, scaffolds, ladders	33
	Grinding: abrasions, cuts, heat, fire, airborne particles, metal dust	24
	Fires: smoke, toxic vapors, burns	11
Welding/Torch Cutting	**Respiratory:** metal fumes, VOC	17, 26
	Eye: airborne metal particles, intense light	24
	Dermal: burns, cuts, abrasions	24
	Fires: intense heat, open flame	11
Grinding	**Tools**: cuts, pinching, smashing, exposed moving parts	17, 19
	Eye: airborne metal particles, sparks	24
Grinding (continued)	**Dermal:** burns, cuts, abrasions	24
	Fires: intense heat, sparks	11
	Chemicals: organic vapors, fire, dermal contact	11, 26
	Work Positions: musculoskeletal problems	18
HVAC Maintenance	**Tools**: cuts, pinching, smashing,	17, 19
	Eye: dusts, particles, chemicals	24
	Respiratory: dust, volatile organic chemicals, biological agents	26
	Lifting: musculoskeletal problems	18
	Falls: heights, scaffolds, ladders	33

Contractor	Typical Hazards	Applicable Guide Sections
	Grinding: abrasions, cuts, heat, fire, airborne particles, metal dust	24
	Lead: inhalation and ingestion	16, 26
	Gas: fire, explosion, asphyxiant	11, 12
	Electrical: shock	7
	Asbestos: incidental contact with walls, insulation, respiratory and dermal hazard	3, 15
Housekeeping	**Asbestos:** incidental contact, dermal hazard, respiratory protection	3, 15, 17
	Lead: paint, inhalation and ingestion	16
	Tools: cuts, pinching, smashing, exposed moving parts	19
	Respiratory: dust, volatile organic chemicals, biological agents	26
	Eye: dusts, particles, chemicals	24
	Lifting: musculoskeletal problems	18
	Falls: heights, scaffolds, ladders	33
	Grinding: abrasions, cuts, heat, fire, airborne particles, metal dust	24
	Gas: fire, explosion, asphyxiant	11, 12
	Electrical: shock	7
Vehicle Maintenance	**Asbestos:** respiratory/ dermal hazard	3
	Lead: paint, inhalation and ingestion	16
	Tools: cuts, pinching, smashing, exposed moving parts	19
	Respiratory: dust, volatile organic chemicals, biological agents	26
	Eye: dusts, particles, chemicals	24
	Lifting: musculoskeletal problems	18
Vehicle Maintenance (continued)	**Gas:** fire, explosion, asphyxiant	11,12, 17
	Electrical: shock	7
	Grinding: abrasions, cuts, heat, fire, airborne particles, metal dust	24
	Welding/Torching: fire, sparks, heat, metal fumes	11, 31
	Lifting: musculoskeletal problems	18
	Falls: heights, scaffolds, ladders	33
Roofing Repair/Replacement	**Grinding:** abrasions, cuts, heat, fire, airborne particles, metal dust	17, 24
	Welding/Torching: fire, sparks, heat, metal fumes	11, 31
	Lifting: musculoskeletal problems	18
	Falls: heights, scaffolds, ladders	33
	Asbestos: insulation, respiratory and dermal hazard	3,
	Lead: paint, inhalation and ingestion	16
	Tools: cuts, pinching, smashing, exposed moving parts	19

Contractor	Typical Hazards	Applicable Guide Sections
	Respiratory: dust, volatile organic chemicals, biological agents	26
	Eye: dusts, particles, chemicals	24
	Fire: Burns	11
	Volatile organic chemicals: tar/pitch	5
	Sheet metal: cuts	24
Boiler Maintenance / Repair	**Grinding:** abrasions, cuts, heat, fire, airborne particles, metal dust	17, 24
	Welding/Torching: fire, sparks, heat, metal fumes	11, 31
	Lifting: musculoskeletal problems	18
	Falls: heights, scaffolds, ladders	33
	Asbestos: insulation, respiratory and dermal hazard	3
	Lead: paint, inhalation and ingestion	16
	Tools: cuts, pinching, smashing, exposed moving parts	19
	Respiratory: dust, volatile organic chemicals	26
	Eye: dusts, particles, chemicals	24
	Fire: Burns	11
	Volatile organic chemicals: tar/pitch	5
	Utilities: explosion, steam heat, water	7

Attachment 1 Eh&s hazard analysis for Contractor work

Applicable to		Project	
Section		**Yes**	**No**
1.0	Introduction	____	____
2.0	Air Resources	____	____
3.0	Asbestos Awareness	____	____
4.0	Bloodborne Pathogens Exposure Control Plan	____	____
5.0	Chemical Safety and Handling	____	____
6.0	Confined Space Program (Permit-Required)	____	____
7.0	Electrical Safety	____	____
8.0	Electrical Enclosed Spaces	____	____
9.0	Excavation and Trenching	____	____
10.0	Fish, Wildlife and Wetlands	____	____
11.0	Fire Protection and Prevention	____	____
12.0	Gas Enclosed Spaces	____	____
13.0	Hazard Communication Program	____	____
14.0	Hearing Conservation	____	____
15.0	Insulation Materials (Non-Asbestos)	____	____
16.0	Lead Management Program	____	____
17.0	Management of Change	____	____
18.0	Materials Handling	____	____
19.0	Mechanical Equipment	____	____
20.0	Mercury Management Program	____	____
21.0	Noise	____	____
22.0	Oil and Dielectric Fluid	____	____
23.0	PCB Management	____	____
24.0	Personal Protective Equipment	____	____
25.0	Pesticide Use, Storage, and Disposal	____	____
26.0	Respiratory Protection Program	____	____
27.0	Sampling	____	____
28.0	Vehicle Management	____	____
29.0	Waste Management	____	____
30.0	Water Resources	____	____
31.0	Welding and Burning	____	____
32.0	Work Area Protection	____	____
33.0	Working at Elevations	____	____

Explanation of Additional Hazards Present:

_____
_____
_____
_____
_____

Provided by: Con Edison Representative

_____ _____
Name Date

Received by: Contractor Representative

_____ _____
Name

Attachment 2

EH&S plan checklist

Contractor: _____

Description of Project/Job: _____

_____

Con Edison Facility/Location: _____

_____

If you answer "yes" to any of the items below, describe in the project – specific environmental, health and safety) plan (eHASP) how you will protect your employees, Con Edison employees, the public and the environment, if applicable, from the indicated hazard as required by OSHA, EPA, DEC, and any other federal, state, or local laws and regulations. The hazards identified by Con Edison in attachment 1 shall also be used to answer this questionnaire and develop your eHASP. Indicate how and where you will dispose of all waste. After you complete your EH&S plan, enter the page number(s) to identify where in your eHASP each hazard is addressed. This checklist does not preclude the submission of a eHASP nor is it meant to be an all-inclusive guide to EH&S issues.

1) Do you expect that the job may involve any of the following? (Please circle the response for each item, either to confirm or indicate that the project does not involve the item.)

	Yes	No	Section(s)
Asbestos	X	X	_____
PCBs	X	X	_____
Lead or lead paint or chips*	X	X	_____
Mercury	X	X	_____
Other hazardous wastes (corrosive, reactive, toxic, ignitable, or listed hazardous wastes)	X	X	_____
Non-hazardous wastes	X	X	_____
Other hazardous materials/chemicals (MSDS)	X	X	_____
Work at high elevations (scaffolds, ladders, etc.)	X	X	_____
Work in excavations	X	X	_____
Heavy equipment	X	X	_____
Hand and/or power tools	X	X	_____
Work in confined or enclosed spaces	X	X	_____
Welding/burning	X	X	_____
Electrical, Gas or Steam work	X	X	_____
Explosives	X	X	_____

- *Note: All paint removed at Con Edison is considered to contain lead*

	Yes	No	Page(s)
Discharges to water, land or sewers	X	X	_____
Air emissions	X	X	_____
Excessive Noise	X	X	_____
Traffic and/or Roadway	X	X	_____
Petroleum or Used Oil	X	X	_____
Pesticides	X	X	_____
Permits and/or Certifications-Licenses	X	X	_____

2) If you expect to encounter any other EH&S hazards, please list them below and address them in your EH&S plan.

Hazard	Page(s)
_____	_____
_____	_____
_____	_____
_____	_____

3) In your EH&S plan, detail the training and personal protective equipment your employees will be required to have to perform this job.

4) List in your EH&S plan all emergency contacts and phone numbers, including contractor and Con Edison representatives.

5) Company SIC Code: _____

6) Last 2 Years OSHA Incident Rate: _____ _____

7) Present Experience Modification Rate: _____

Signature _____ Date _____

Type/Print Name _____ Title _____

Con Edison Acceptance
To be completed by authorized Con Edison Representative

	Yes	No
Accepted.....	..X	X

Signature _____ Date _____

_____

Type/Print Name _____ Title _____

Guide 4: Bloodborne Pathogens Exposure Control Plan

Overview

Bloodborne pathogens (BBP) are pathogenic microorganisms that may be present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV). A source of occupational exposure may occur when an employee gives First Aid and CPR to an individual who has infectious blood. The occupational exposure occurs when there is the possibility for an employee's eyes, mucous membranes, non-intact skin (i.e., cut and abraded skin) to come into contact with potentially infectious materials from another employee. Additional sources of exposure are contact with infectious waste found at project sites, glassware, needles and other sharp objects which have been involved in injuries to personnel and are contaminated with blood or related bodily fluids.

Minimum BBP Requirements

In order to perform work on any Con Edison facility or project, all contractors must, at least, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison and include a process to meet these requirements.

- If there is a reasonably anticipated contact with any potentially infectious materials, the contractor's written BBP Exposure Control Plan must be available to all contractor and Con Edison personnel for review upon request.

- The Exposure Control Plan must include procedures for:
    - Exposure determinations;
    - Methods of compliance;
    - HBV vaccinations and post-exposure evaluation and follow-up;
    - Communications of hazards to workers;
    - Worker training.

- Universal precautions (i.e., treat all potentially infectious material as if it were infected) must be used at all times.

- Proper PPE must be used at all times when there is a chance for exposure to infectious materials.

- Hand-washing facilities or products (antiseptic hand cleaner, etc.) must be readily available to all employees.

- All infectious material must be placed in appropriate, labeled containers (sharps containers, biohazard bags, etc.) and disposed of properly.

- All infected equipment and surfaces must be decontaminated with an appropriate disinfecting solution prior to re-use.

- Following a report of exposure, the exposed employee is entitled to a confidential medical evaluation.

- All employees with a reasonable risk for exposure must attend appropriate training, which includes:
    - An explanation of the OSHA BBP standard;
    - A general explanation of bloodborne diseases;
    - An explanation of the modes of transmission of BBP;
    - An explanation of the Exposure Control Plan;
    - Appropriate methods for recognizing tasks that involve potential exposure;
    - An explanation of the use and limitations of methods to prevent exposure;
    - Proper types, use, handling, decontamination, and disposal of PPE;
    - The availability of HBV vaccines and the procedures for obtaining a vaccination;
    - Appropriate actions to take during an emergency involving BBP;
    - Post-exposure procedures;
    - An explanation of required signs and labels.

- All required records for exposed employees must be kept confidential.

Regulatory Citations

A complete text of the requirements for BBP can be found in Title 29 Code of Federal Regulations, Part 1910, Section 1030.

Contacts

For additional information regarding BBP requirements or clarification of these requirements, contact the New York regional OSHA office located at 201 Varick Street, Room 670, New York, New York 10014 (212-337-2378), or visit the OSHA web site at: www.OSHA.gov

Guide 5: Chemical Safety and Handling

Overview

Federal and State laws as well as Con Edison require that specific procedures are followed to properly handle chemicals to protect workers and prevent spills. These procedures include those for storing, handling, transferring, and processing chemicals.

Minimum Chemical Safety and Handling Requirements

Prior to working in any Con Edison facility or on any Con Edison project, all contractors must, at a minimum, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific work plan submitted to Con Edison and include a process to meet these requirements.

- The contractor must assure that the equipment brought into a Con Edison site to deliver or store hazardous chemicals is in good condition and that all equipment required is operating. This includes, but is not limited to all deadman switches, valves, hoses, pumps, lights, etc.

- Contractor personnel must be licensed and/or have the necessary handling permits or certifications. Documentation must be present with the driver or on the vehicle at all times for inspection by Con Edison representative. Incomplete documentation will prevent chemicals/shipment from being permitted in a Con Edison facility or site.

- Contractor personnel must be thoroughly familiar with operation of equipment and the use of materials or chemicals used in the Con Edison facility.

- Contractor personnel should have knowledge of the physical properties, hazards, and personnel protective equipment (PPE) required. All contractor personnel shall be provided with appropriate PPE for the chemicals or hazards present.

- Spill response equipment shall be available on location to contain or control a reasonably anticipated release or spill. All chemical spills in a Con Edison facility or location must be reported to a Con Edison authorized representative immediately upon discovery.

- Contractor will provide to Con Ed a complete inventory of chemicals brought onto a Con Ed facility or location. Contractor must have all material safety data sheets (MSDS) for the material carried or at Con Ed facilities or locations and available on request.

- The reportable quantity of each hazardous substance and the amount that exceeds the reportable quantity shall be known regardless of the units used (pounds vs. gallons).

- At the end of the project the contractor shall remove any chemicals that were not used.

- If quantities of chemicals brought on-site exceed the threshold planning quantities (TPQs) or threshold reporting quantities (TRQs), the contractor shall identify how the Community Right-To-Know reporting requirements will be met, including the procedures for:

    - Retaining of Material Safety Data Sheets (MSDS).
    - Filing an annual chemical inventory form with the NYSDEC.
    - Coordinating with the local emergency planning committee (LEPC) and the fire department with jurisdiction over the job area.
    - Preparing Risk Management Plans, as required.

Regulatory Citations

A complete text of the requirements for chemical safety and handling can be found in:

- Title 29 Code of Federal Regulations (CFR) Part 1910; Title 33 CFR Part 153.

- Title 40 CFR Parts 68, 117, 280, 302, 355 and 370.

- Title 6 New York Code of Rule and Regulations (NYCRR), Parts 595 through 599.

- The New York City Administrative Code Chapter 4, Subchapter 9.

- Title 3 Rules of New York City (RCNY) Chapter 1; Title 15 RCNY Chapters 11 and 41.

- Article 22 Westchester County Sanitary Code, Articles 1&3 Rockland Sanitary Code.

Contacts

For additional information or clarification of these requirements, contact the following agencies:

- Projects in the five boroughs, contact Region 2 NYSDEC office located at Hunters Point Plaza, 47-40 21st St, Long Island City, NY 11101 (718-482-4900). www.dec.state.ny.us.

- For projects in Westchester, Rockland and Dutchess Counties, contact the NYSDEC Region 3 office at 21 South Putt Corners Road, New Paltz, NY 12561 (914-256-3000).

- Projects in the five boroughs, contact the NYCDEP at 59-17 Junction Boulevard, 10th Floor, Corona, NY 11368 (718-337-4375). NYCEP's web is www.ci.nyc.ny.us.

- Westchester County projects, contact Westchester Department of Environmental Facilities at 207 North Avenue, New Rochelle, NY 10810 (914-637-3000). www.co.westchester.ny.us.

- For projects located in Rockland County, contact the Rockland County Department of Health on Sanatorium Road, Pamona, NY 10970 (914-634-2500). www.co.rockland.ny.us.

Region II office of the Environmental Protection Agency (EPA) is located at 290 Broadway, New York, New York 10007 (212-637-3000). The EPA's website is www.EPA.gov.

Guide 7: Electrical Safety

Overview

Electrical safety is an important component to any safety program. To minimize personal injury from contact with energized sources, workers must be trained in the fundamentals of electrical safety and all electrical hazards on a project must be identified and corrected. Only properly licensed electricians may perform any electrical work on Con Edison projects.

Minimum Electrical Safety Requirements

In order to perform work on any Con Edison facility or project, all contractors must, at least, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison and include a process to meet these requirements.

- Before work begins, all electric circuits, exposed or concealed, that may be contacted by workers must be posted with warning signs.
- All workers must be notified of the location and hazard involved with nearby electrical circuits and protective measures taken.
- Workers must not work near any part of an electrical circuit unless they are protected against shock by guarding or by de-energizing and grounding the circuit.
- Workspaces, walkways, and similar locations must be kept free of electric cords and tools.
- Equipment must not be stored around electrical cabinets to prevent access.
- Workers must inspect all electrical equipment, including extension cords, for the following hazards:
    - Missing ground pins on plugs (except double-insulated);
    - Insulation pulled free from plugs or support connections;
    - Damaged insulation;
    - Exposed wires; and
    - Evidence of arcing, sparking, or smoking
- When any conditions are identified on equipment that make it unsafe to operate, the equipment must be removed from the site until repaired by a qualified person.
- Portable lamps must be covered by a fixed, grounded (if metal) guard and equipped with an insulated handle.

Guide 7: Electrical Safety

- All underground utilities must be marked prior to any groundbreaking activities.
- Flexible cords must be suitable for the condition and location of use and must be used as appropriate.
- Three-wire extension cords must be used and must be rated for hard or extra-hard use.
- Splices and/or taps are prohibited in extension cords.
- Extension cords must not be fastened with staples, hung on nails, or suspended on wires.
- Workers must be trained in the safety-related work practices that pertain to their job and cannot work near electrical hazards without training to recognize and avoid the hazard.
- Electrical workers must test all equipment to verify if energy is present.
- Only qualified, trained workers may test electrical equipment.
- Workers must properly lockout and tagout any circuit or equipment being worked on and verify the equipment is de-energized.
- Personal protective equipment used by electrical workers must be appropriate and in good condition.
- Portable metal ladders and ladders with metal reinforcement are prohibited near energized electrical equipment.
- ALL electrical equipment used on a project (hand tools, etc.) must be protected with a ground-fault circuit interrupter (GFCI).
- Materials must not be stored in transformer vaults.
- AC and DC wiring systems must be properly grounded.
- Proper clearance from overhead power lines must be maintained at all times.

Regulatory Citations

A complete text of the requirements for Electrical Safety can be found in Title 29 Code of Federal Regulations, Part 1910, Section 147 and Subpart S, and Part 1926, Subpart K.

Contacts

For additional information regarding Electrical Safety requirements or clarification of these requirements, contact the New York regional OSHA office located at 201 Varick Street, Room 670, New York, New York 10014 (212-337-2378). The OSHA website can be found at www.OSHA.gov.

Guide 11: Fire Protection and Prevention

Overview

Fire safety and prevention is critical to the effective operations of Con Edison facilities. Con Edison focuses on responsibly safeguarding human and business assets to avoid a fire or explosion that may cause injury or disrupt operations. All contractors performing construction and maintenance operations must implement measures to prevent and control fires, if one occurs.

Fire Prevention and Fire Control Requirements

Prior to working in a Con Edison facility or on a Con Edison project, all contractors must, at a minimum, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety (EH&S) Plan submitted to Con Edison and a process to meet these requirements.

- The contractor program must identify the fire protection requirements and procedures.
- The contractor must identify personnel who are trained in the use of fire extinguishers and fire fighting techniques personnel and can fight a fire during the early or incipient stage.
- A Con Edison Rep will be informed of all fire or explosion occurrences.
- Ensure all field offices, shanties, and storage facilities are constructed in accordance with applicable codes, and fabricated noncombustible material for protection against fire.
- The contractor must identify operations that present a potential fire hazard, for example hotwork (welding, grinding and cutting) and the use of flammable liquids and gases.
- Contractor must identify procedures to eliminate and control fire hazards including housekeeping, electrical safety, safety procedures for hot work, storage and handling of flammable and combustible liquids and compressed gases.
- Good housekeeping standards must be enforced in the work area, including the requirements that waste, rubbish and flammable materials and rags be removed from the area daily.
- All waste, rubbish, and flammable materials must be stored in approved containers.
- Handling procedures will address safe transport, use, and storage of flammable materials.
- Noncombustible tables or shelves, or protected work area will be used for hot work.

- Storing flammable liquids in approved safety cans that are painted red with a yellow band around the can and labeled to identify the contents.
- Storing combustible liquids in green safety cans that are labeled to identify the contents.
- Storing all FCL in closed approved metal cabinets and only storing quantities of these liquids on-site that do not exceed the minimum amount required for efficient operation.
- Storing bulk drum quantities of FCL liquids in storage rooms specially designed for fire and spill protection.
- Prohibit the use of gasoline and other highly flammable liquids for cleaning.
- Using approved pumps, or approved self-closing faucets and drip pans when dispensing FCL from drums or portable tanks.
- Class B/C rated fire extinguishers will be located in close proximity to FCL areas and monthly and annual inspections will be performed to ensure that the units are ready for use.
- In the event of a fire involving compressed gases, the gases will be permitted to burn and not extinguished, under any circumstances, unless it is possible to control the gas flow.
- Oil, grease, and highly volatile liquids must not be stored near oxygen cylinders.
- Smoking is prohibited in the vicinity of flammable or combustible liquids and gases.
- Using liquefied petroleum gas (LPG) indoors for cutting and/or welding operations shall be limited to small quantities and no more than a 1-pound bottle shall be stored in the building.
- Open flames or spark-producing tools must not be used in any enclosure where an explosion concern may exist until testing indicates that an explosion hazard does not exist.

Regulatory Citations

A complete text of the requirements for Hot Work can be found in Title 29 Code of Federal Regulations, Part 1910, Subpart Q and Part 1926, Subpart J.

Contacts:

For additional information or clarification of these requirements, contact:

- The New York regional OSHA office located at 201 Varick Street, Room 670, New York, New York (212-337-2378), or visit the OSHA web site at: www.OSHA.gov.

- The NYC Fire Department located at 250 Livingston Blvd, Brooklyn, NY (718-694-2000).

Guide 13: Hazard Communication

Overview

OSHA requires that the hazards associated with all chemicals used or stored at a job site be evaluated. This information must be communicated to employees who may be exposed to these chemicals or use them in their daily jobs. The process for informing employees about the chemicals, their locations, and potential hazards is called a Hazard Communication (HAZCOM) program. In general, this program includes requirements and procedures for container labeling and other forms of warning, procedures for obtaining and retaining material safety data sheets (MSDSs) and employee training.

Minimum HAZCOM Requirements

In order to work in any Con Edison facility or on any project, all contractors must, at least, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison and include a process to meet these requirements.

- If any hazardous material is used or stored at the job site, the contractor's written HAZCOM program must be available to all contractor and Con Edison personnel for review upon request.

- The HAZCOM program must include procedures for:

    - Labeling containers and the use of warning forms;
    - Obtaining and retaining MSDSs;
    - Specific worker training requirements;
    - Documentation that these training requirements have been completed by each worker;
    - A list or inventory of hazardous material at the job site.

- The supervisor must inform all workers about the hazardous materials at the job site when they first are first assigned to a project and whenever a new hazardous material is brought to the site.

- Workers must be informed of the location of:

    - The HAZCOM program;
    - The list/inventory of hazardous substances;
    - The locations of MSDSs and the procedures for obtaining a copy of an MSDS;
    - These must all be available for each worker to review during their work period.

- The Con Edison representative must be informed of all chemicals brought to the site.

- Each contractor must obtain information from the Con Edison representative regarding chemicals that Con Edison uses or stores at the site.

- When more than one contractor is working at a job site, each contractor must inform the other(s) concerning the location of their MSDSs and procedures for labeling and worker protection.

- THE PRIME CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE HAZCOM PROGRAM ON THE JOB SITE.

- ALL containers will be labeled.

    - Labels on hazardous material containers will not be defaced or removed.
    - The labels will identify the substance in the container and appropriate warnings about the substance.
    - The material identity will match the material currently in the container, its MSDS, and the overall list/inventory.

- An MSDS must be available at the job site for every chemical that is present at that site.

- A documented training program will be provided to every worker at the job site. This training will include:
    - Information regarding the HAZCOM program;
    - Health and environmental hazards of every chemical used at the job site;
    - Ways to detect the presence of hazardous materials at a job site (including monitoring methods and devices used);
    - How to read and understand the information contained on an MSDS; and
    - How workers can protect themselves from harmful exposure (e.g., safe work practices, personal hygiene, and protective equipment).

Regulatory Citations

A complete text of the requirements for HAZCOM can be found in Title 29 Code of Federal Regulations, Part 1910, Section 1200, and Title 29 Code of Federal Regulations, Part 1926, Section 59.

Contacts

For additional information regarding HAZCOM requirements or clarification of these requirements, contact the New York regional OSHA office located at 201 Varick Street, Room 670, New York, New York 10014 (212-337-2378). The OSHA web site can be found at www.OSHA.gov.

Overview

Noise is defined as unwanted sound. Noise can cause sudden traumatic temporary hearing loss, long-term slowly occurring hearing loss that is irreversible, disruption of communication, and masking of warning devices and alarms. These long-term effects may occur at noise levels lower that are constant and daily.

Minimum Hearing Conservation Requirements

In order to perform work on any Con Edison facility or project, all contractors must, at least, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison and include a process to meet these requirements.

- Workers must not be exposed to noise levels above those stated in the regulations.
- All noise levels must be measured on the A-weighted scale by a trained person.
- When noise exposure includes two or more periods at different noise levels, the combined noise exposure must be calculated.
- When noise levels exceed the permissible limits, worker exposure must be controlled through engineering controls, administrative controls, personal protective equipment (PPE), or a combination of these.
- Engineering controls consist of isolating, enclosing, or insulating equipment or operations or substituting quieter equipment or operations.
- Engineering controls are always preferred over other controls.
- Administrative controls involve rotating workers to jobs having lower noise exposures and reducing the time that each worker is exposed.
- PPE, for example earplugs and earmuffs, must be rated to reduce the noise exposure to within acceptable limits.
- A noise exposure at or above 85 decibels on the A-weighted scale (dBA) averaged over an 8-hour time period (with or without PPE) requires a formal written hearing conservation program.
- A hearing conservation program must include:
    - Noise monitoring;

- Procedures for employee notification;
- Provisions to permit employees to observe monitoring;
- Initial and annual audiometric testing, and an evaluation of the audiogram by a qualified professional;
- A noise training program for all affected workers; and
- Formal record keeping

- The following table is a guide to common noise levels:

Permissible Duration	dBA	Examples of Noise Sources
No protection or time exposure calculation required.	15	Wooded Forest
	25	Quiet Bedroom
	35	Library
	65	Normal Speaking
	75	General Office Area
Action Level for Hearing Conservation Program	85	Average Machine Shop
8 Hours	90	
6 Hours	92	
4 Hours	95	
3 Hours	97	
2 Hours	100	Air Spray Operation
1.5 Hours	102	
30 Minutes	110	Power Table Saw
15 Minutes	115	
7.5 Minutes	120	
4 Minutes	125	Rock-n-Roll Concert
2 Minutes	130	Aircraft Jet Engine/Ear Pain Threshold
NOT TO EXCEED	140	

- A standard rule-of-thumb for noise states that when standing face-to-face at a distance of 1 to 2 feet, if it is necessary to raise your voice to be heard, the background noise exceeds 85 dBA.

Regulatory Citations

A complete text of the requirements for Hearing Conservation can be found in Title 29 Code of Federal Regulations, Part 1910, Section 95 and Part 1926, Section 52.

Contacts

For additional information regarding Hearing Conservation requirements or clarification of these requirements, contact the New York regional OSHA office located at 201 Varick Street, Room 670, New York, New York 10014 (212-337-2378). The OSHA website can be found at www.OSHA.gov.

Guide 17: Management of Change

Overview

Con Edison requires that all contractors comply with all environmental, health and safety (EH&S) regulations. This includes EH&S regulations that are identified prior to beginning each project and those that become apparent after the job has begun. To ensure that all EH&S requirements are met during the project, the Contractor must develop a process to manage change. This management of change process will allow the Contractor to meet all EH&S obligations required by the regulations and to keep Con Edison informed of changing conditions that may trigger modifications to the Contractor's anticipated work plan.

Minimum Management of Change Requirements

When working in any Con Edison facility or on any Con Edison project, all contractors must, at least, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison and include a process to meet these requirements.

- The Contractor must notify the Con Edison Authorized Representative of any change in working conditions that could affect compliance with environmental or health and safety requirements as soon as the changed conditions are identified.

- An example of change in conditions can include, but is not limited to the following:

    - Unforeseen hazards not anticipated the bidding process.
    - Weather conditions that could affect worker safety.
    - Unexpected changes in the scope of the project.
    - The potential to generate wastes not expected during project planning.
    - The potential for unexpected sample collection.

- The Contractor shall identify the contingencies they have prepared for managing change.

- The Contractor shall take all appropriate precautions prior to implementing any contingencies prepared to manage change. Precautions can include the following:

    - Increasing or decreasing the levels of personal protective equipment.
    - Taking special safety precautions to deal with unsuspected conditions (for example, unanticipated confined space conditions).
    - Planning for inclement weather.
    - Identifying the potential for environmental permits due to changing field conditions.

- All personnel shall be appropriately trained to perform their job function under the changed conditions prior to being allowed to work under the changed conditions.

- Subcontractors will be held to the management of change procedures outlined by the Prime Contractor.

- THE PRIME CONTRACTOR SHALL HAVE THE ULTIMATE RESPONSIBILITY FOR IMPLEMENTING MANAGEMENT OF CHANGE PROCEDURES RELATIVE TO THE PROJECT.

Regulatory Citations

A complete text of the statutory requirements for Management of Change can be found in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) at Title 42 United States Code (U.S.C.) Sections 9601 through 9675; in the Resource Conservation and Recovery Act (RCRA) at Title 42 U.S.C. Sections 6901 through 692K; and in the New York Environmental Conservation Law, Articles 70 and 71.

Contacts

For additional information regarding management of change requirements or clarification of these requirements, contact the following agencies:

- For projects within the five boroughs, contact the Region 2 NYSDEC office located at Hunters Point Plaza, 47-40 21st Street, Long Island City, New York 11101 (718-482-4900). NYSDEC's web site can be found at www.dec.state.ny.us.

- For projects located in Dutchess, Orange, Rockland, or Westchester Counties, contact the Region 3 NYSDEC office at 21 South Putt Corners Road, New Paltz, NY 12561 (914-256-3000).

- For all projects, also contact the Region II office of the Environmental Protection Agency (EPA) located at 290 Broadway, New York, New York 10007 (212-637-3000). EPA's web site can be found at www.EPA.gov.

Overview

Materials handling can be accomplished in a variety of ways, lifted and moved both manually or using a mechanical means, such as a fork truck or crane. All types of material handling operations require safety planning and practices that are clearly defined.

Minimum Materials Handling Requirements

In order to perform work in any Con Edison facility or on any project, all contractors must, at least, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison and include a process to meet these requirements.

- Whenever possible, objects will be lifted and moved by mechanical devices (cranes, manually operated chain hoists, fork trucks, etc.) rather than by manual effort.
- The mechanical devices will be appropriate for the lifting or moving task and will be operated only by trained and authorized personnel.
- Objects that require special handling or rigging will only be moved under the guidance of a person who has been specifically trained to move such objects.
- Lifting devices will be inspected, certified, and labeled to confirm their weight capacities.
- All devices shall be inspected by a trained and qualified individual at least once a year and will be inspected prior to each use by the user.
- Defective equipment will be taken out of service immediately and repaired or destroyed.
- Personnel will not pass under a raised load, nor will a suspended load be left unattended.
- Personnel will not be carried on lifting equipment, unless it is specifically designed to carry passengers.
- The wheels of the truck being loaded or unloaded will be chocked to prevent movement.
- The lift and swing path of a crane will be watched and maintained clear of obstructions.
- Accessible areas within the swing radius of a crane will be guarded or barricaded.
- All reciprocating, rotating, or other moving parts will be guarded at all times.

- Accessible fire extinguishers will be available in all mechanical lifting devices.
- Lifting devices will never be left near the edge of excavations or unstable areas.
- Mobile lifting equipment, equipped with outriggers will be set before any work is begun.
- Operations near overhead power lines are prohibited unless the power source has been shut off and locked out/tagged out or the appropriate clearance distances are maintained.
- Cranes may only be moved when directed by a signal person.
- Wire ropes will be removed from service when any abrasion, scrubbing, peening, evidences of corrosion, kinking, crushing, bird caging, or other damage exists.
- Unsafe behavior while driving a fork truck is not permitted.
- Each fork truck will be provided with an overhead guard.
- All mobile lifting devices shall be equipped with an audible backup warning device.
- All traffic regulations shall be observed when a lifting device is in operation.
- Only authorized personnel shall refill liquefied petroleum gas (LPG) tanks on fork trucks.
- Employees involved in heavy lifting will be properly trained in lifting procedures and should be physically qualified to protect the person and the material.
- Tiered or stacked material will be stored within acceptable height limits to avoid falling. Only material that will be immediately used may be stored on scaffolds or runways.
- Personnel will be trained in the procedures used for material handling. This training will address the requirements of applicable regulations, for example the training of personnel who operate powered industrial trucks.

Regulatory Citations

A complete text of the requirements for Materials Handling can be found in Title 29 Code of Federal Regulations, Part 1910, Subpart N and Part 1926, Subparts H and O.

Contacts

For additional information regarding Materials Handling requirements or clarification of these requirements, contact the New York regional OSHA office located at 201 Varick Street, Room 670, New York, New York 10014 (212-337-2378), or visit the OSHA web site at: www.OSHA.gov.

Guide 19: Mechanical Equipment

Overview

Hand and power tools are commonplace on most project sites. OSHA requires that these tools be maintained in a safe condition to protect both the worker and the public from injury.

Minimum Requirements for Hand and Power Tools

In order to perform work on any Con Edison facility or project, all contractors must, at least, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison and include a process to meet these requirements.

- All contractor hand and power tools must be maintained in a safe condition and used properly.
- Only workers who have been trained in the use of a particular tool may operate that tool.
- All hand and power tools must be inspected prior to use to ensure proper operation and structural integrity.
- All hand and power tools that are damaged must be removed from the job site until they are repaired.
- Removing any guards from a power tool is prohibited and operating a power tool with any guards removed is prohibited.
- Moving parts of equipment (belts, pulleys, shafts, etc.) must have guards that comply with the appropriate American National Standards Institute (ANSI) standards.
- Workers who are exposed to flying objects, dust, fumes, vapors, etc. when using hand or power tools must wear the appropriate personal protective equipment (PPE).
- Wrenches of any kind must be removed from the project site when the jaws are worn to the point where slippage occurs.
- Mushroomed heads on impact tools (chisels, etc.) must be repaired or removed from the site.
- Wooden tool handles must be free of splinters and cracks and be tight in the tool.
- Electric hand tools must be double insulated or grounded and protected by a ground-fault circuit interrupter (GFCI).

- All fixed electric tools must have a disconnect switch that can be locked or tagged in the off position.
- Compressed air may only be used for cleaning when the pressure is set to less than 30 pounds per square inch (psi) and chip guards and PPE are used.
- The use of compressed air for personal cleaning is prohibited.
- All pneumatic hand tools must be equipped with a safety device on the mussel to prevent accidental discharge and be secured to the air line with a safety chain or other means to prevent accidental disconnect.
- Fuel-powered hand tools must be turned off when being refueled or serviced.
- Powder-actuated hand tools must be inspected tested and inspected daily prior to use to ensure proper working conditions.
- Grinding machines must be guarded in accordance with applicable ANSI standards.
- Work rests on stationary grinders must be within inch of the grinding wheel surface and the tongue guard must be within ¼ inch of the grinding wheel surface.
- The manufacturer's capacity rating must be marked on all jacks and must never be exceeded.
- As soon as a load has been raised by a jack, the load must be cribbed, blocked, or otherwise secured.

Regulatory Citations

A complete text of the requirements for Hand and Power Tools can be found in Title 29 Code of Federal Regulations, Part 1910, Subparts O and P, and Part 1926, Subpart I.

Contacts

For additional information regarding Hand and Power Tool requirements or clarification of these requirements, contact the New York regional OSHA office located at 201 Varick Street, Room 670, New York, New York 10014 (212-337-2378), or visit the OSHA web site at www.OSHA.gov.

Guide 21: Noise

Overview

Local laws and regulations require that the noise produced during construction/work activities is neither excessive nor intrusive. The contractor must identify the measures that will be taken to assure the noise limits for the area in which they are working will not be exceeded. The noise levels that are acceptable generally depend on the location where the noise is generated and the time of day. In general, most regulations require that facility and commercial operations do not produce unnecessary noise as compared to the surrounding community. For operations within a fixed facility (for example, a generating station), the noise levels measured at the facility perimeter are used to determine impacts on the community. For a discussion of worker protection from excessive noise, refer to the Hearing Conservation EH&S Work Plan Guide.

Prior to working in any Con Edison facility or on any Con Edison project, all contractors must, at a minimum, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison and include a process to meet these requirements.

Minimum Noise Requirements

- Local noise ordinances should be reviewed to determine the maximum levels of noise that can be generated at the job site during specific work periods.
- Local noise ordinances should be reviewed to determine whether octave band measurements are required.
- Noise measurements should be obtained by qualified personnel using the guidance of the American National Standards Institute (ANSI) standards and the results should be compared to the applicable ordinances.
- The sampling should be performed by a qualified person who is familiar with the make and type of equipment used in the measurements and experienced in general noise data collection procedures.
- To comply with ordinances, sampling should evaluate the sound levels associated with specific types of noise, for example:
    - Impulse noise is short bursts of noise.
    - Periodic noise is steady, high-level noise.
- The contractor is responsible for ensuring that all work performed by both his crew and subcontractors complies with applicable noise ordinances.

- Equipment and vehicles need to be maintained in good operating condition, ie. mufflers, belts and tune-ups.

Regulatory Citations

A complete text of the requirements for noise can be found in the:

- New York City Administrative Code and Charter, Title 24, Chapter 2, Subchapter 6.
- New York City Zoning Resolutions Section 42-21, Article IV.
- Rockland County Health Code, Article IX.
- Westchester County regulations which can be obtained from local townships.

Contacts

For additional information regarding noise requirements or clarification of these requirements, contact the following agencies:

- For projects within the five boroughs, contact the New York City Department of Environmental Protection (NYCDEP) office located at 59-17 Junction Boulevard, 10th Floor, Corona, NY 11368 (718-337-4375 or visit their walk-up One Stop Information and Referral Center at 96-05 Horace Harding Expressway, Corona, NY 11368. NYCEP's web site can be found at www.ci.nyc.ny.us.
- For projects located in Rockland County, contact the Rockland County Department of Health on Sanatorium Road, Pamona, NY 10970 (914-634-2500). Rockland County's web site can be found at www.co.rockland.ny.us.
- For information on standard practices for monitoring noise, contact the American National Standards Institute (ANSI) at 11 West 42nd Street, New York, NY 10036 (212-642-4900). ANSIs web site can be found at www.ansi.org.

Guide 24: Personal Protective Equipment

Overview

For many tasks, personal protective equipment (PPE) is as essential to the job as any tool. OSHA requires that every employer evaluate all tasks associated with a project to determine the hazards associated with these tasks and the appropriate PPE to be worn by each affected employee. This hazard assessment must be documented.

Minimum PPE Requirements

In order to perform work on any Con Edison facility or project, all contractors must, at least, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison and include a process to meet these requirements.

- All employers must conduct a hazard assessment prior to the start of every project and as conditions change on the project to determine the types of PPE necessary for each task.
- The results of the hazard assessment must be communicated to every employee on the project prior to the start of work and as conditions change.
- All workers must be trained to recognize the need for and types of PPE necessary, the proper use of PPE, the limitations of PPE, and proper care and disposal of PPE.
- All workers must be trained in the procedures for inspecting PPE prior to use to ensure it provides the required protection.
- All PPE used must meet applicable American National Standards Institute (ANSI) standards.
- All PPE must be maintained in a sanitary and reliable condition.
- Where employees supply their own PPE, the employer is responsible for ensuring the adequacy, maintenance, and sanitation of this PPE.
- Hard hats must never be changed or modified in any way and must be appropriate for the type of work being performed. White hard hats are not permitted on any Con Edison site.
- Eye protection must be appropriate for the type of work being performed, and must be equipped with side shields.
- Burning goggles must be equipped with appropriate filtering lenses for the work being performed.

- Gloves must provide adequate wrist and hand protection based on the tasks being performed, and must be compatible with and resistant to any potential hazard (sharps, chemical, electrical, etc.).
- Safety shoes or boots must be fitted with protective toe guards.
- Additional PPE may be necessary for certain situations, for example overboots or rubber boots should be worn for wet conditions or chemical spills, etc.
- Protective clothing (reusable or disposable) must be appropriate for the type of work being performed.
- Orange reflective vests, approved by the U.S. Department of Transportation, must be worn when working in areas exposed to or adjacent to vehicle traffic.
- Fall protection devices must meet the requirements defined in the Con Edison EHS Work Plan Guide for Working at Elevation which is Section 33 in this manual.
- Workers required to wear hearing protection must be allowed to select the type of device they wish to wear from a number of suitable devices.
- Flame resistant garments are required in areas where there is a potential for arc or flash.

Regulatory Citations

A complete text of the requirements for Personal Protective Equipment can be found in Title 29 Code of Federal Regulations, Part 1910, Subpart I, and Part 1926, Section 28 and Subpart E.

Contacts

For additional information regarding Personal Protective Equipment requirements or clarification of these requirements, contact the New York regional OSHA office located at 201 Varick Street, Room 670, New York, New York 10014 (212-337-2378). The OSHA website can be found at www.OSHA.gov.

Guide 26: Respiratory Protection Program

Overview

Respiratory protection is often necessary to allow employees to work safely in hazardous environments. When an airborne contaminant or oxygen-deficient atmosphere exceeds the regulated exposure limits, an employer must eliminate the hazard through engineering and administrative controls or use of the proper respiratory protective equipment.

Minimum Respiratory Protection Requirements

In order to perform work on any Con Edison facility or project, all contractors must, at least, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison and to include a procedure to meet these requirements.

- Contractor must have available a written Respiratory Protection Program (RPP).

- Perform Exposure Assessments to assess the need for respiratory protection based on limits established by OSHA, American Conference of Governmental Industrial Hygienist, National Institute of Occupational Safety and Health or Con Edison.
- Selection of the proper Air Purifying Respirators (APR) or Supplied Air Respirators (SAR) will depend on the characteristics of the workplace and the level of protection necessary. Characteristics include the concentration of airborne contaminants, immediately dangerous to life or health (IDLH) conditions, oxygen-deficient atmospheres, and the protection factor (PF) of each respirator.

- APR's will not be worn in oxygen-deficient atmospheres, IDLH conditions, when the contaminant exceeds the PF of the respirator, or when cartridges do not exist for a particular contaminant.

- Breathing air quality must meet the Compressed Gas Association's definition of "Grade D" air for all supplied air respirator use. This includes breathing air cylinders and 5-minute escape cylinders. Compressors shall meet applicable OSHA standards.

- In IDLH atmospheres prior to entry, a rescue plan shall be conveyed to crew members.

- The contractor will follow OSHA regulations regarding maintenance, inspection, proper use of cylinders, fittings, hoses, manifolds, etc., and recordkeeping.

- Self-Contained Breathing Apparatus (SCBA) shall be used in situations where the contaminant or concentration of a contaminant is unknown.

- Respirator use requires training with the properly selected respirator, medical evaluation to wear the respirator, and proper fit-testing of the respirator.

- Respirators shall be inspected, maintained, cleaned, disinfected, and stored according to the manufacturers' directions and applicable OSHA guidelines..

- Emergency equipment shall be inspected monthly and all records will be kept on file.

- The RPP administrator shall maintain results of periodic program review, and shall identify, based on the results of the review, any necessary changes which may need to be made to the respiratory program. Records shall identify the name of the person conducting the review, the date, and any observations made during the review.

- Based on the RPP outlined in this work plan guide, the program manager shall maintain the following records at all times:

    - Hazard Assessments.
    - Employee Training.
    - Fit-Testing.
    - Medical Surveillance.
    - Respirator and Fit-Test Equipment Maintenance and Repair.

Regulatory Citations

A complete text of the requirements for Respiratory Protection can be found in Title 29 Code of Federal Regulations, Part 1910, Section 134.

Contacts

For additional information regarding Confined Space requirements or clarification of these requirements, contact the New York regional OSHA office located at 201 Varick Street, Room 670, New York, New York 10014 (212-337-2378), or visit the OSHA web site at: www.OSHA.gov.

Guide 27: Sampling

Overview

Samples may be required to characterize a material or waste, to confirm the presence or absence of hazardous substances, to determine the extent of a spill or release, to confirm that cleanup standards have been met, and/or to comply with permit or regulatory criteria or standards. It is the contractor's responsibility to ensure that samples are properly managed and analyzed, collection methods are consistent with all regulatory protocols and good sampling practice and samples are representative of the material.

Minimum Sampling Requirements

Prior to working in any Con Edison facility or on a Con Edison project, all contractors must, at a minimum, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety (EH&S) Plan submitted to Con Edison and include a process to meet these requirements.

- The contractor must have a Sampling Plan including:
    - Sampling techniques that will be used.
    - A sampling summary, including sample matrices, parameters analyzed for, sample preparation, analytical method numbers, volumes and types of sample containers, sample preservation methods if required, and holding times allowed for the samples.
    - Sample handling procedures.
    - Quality Assurance /Quality Control procedures and Chain-of-Custody procedures.
    - Equipment and personnel decontamination procedures.
    - How wastes generated during the sampling effort will be managed.
    - Method detection limits, method quantification limits, and reporting limits.
    - Data validation procedures and record keeping and documentation procedures.

- The contractor shall identify the procedures used to ensure that representative samples will be collected, including the procedures to prevent cross-contamination of samples, to prevent the loss of volatile constituents when samples are handled and placed in jars, and collect homogeneous samples of materials.

- If composite samples are identified for collection in the EH&S Plan, the Contractor shall specify how many aliquots will be used to make up each composite sample.

- The contractor must identify how many and what types of quality assurance/quality control (QA/QC) samples (i.e., duplicate, field blank, rinsate blank, and trip blank samples) will be collected during the sampling event.

- The contractor must identify whether the laboratory that will analyze the samples is approved under New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) for the methods proposed. If the laboratory is ELAP-certified, the Contractor must provide the laboratory ELAP certification number.

- For asbestos sampling requirements, see the Con Edison Contractor EH&S Work Plan Guide for Asbestos.

Regulatory Citations

Documents prepared by United States Environmental Protection Agency (USEPA) and the New York State Department of Environmental Control (NYSDEC) governing the collection and analysis of environmental samples include:

- The Region II CERCLA Quality Assurance Manual, Revision 1, USEPA, October 1989,

- The NYSDEC Sampling Guidelines and Protocols, Division of Water, Bureau of Spill Prevention and Response, March 1991.

Contacts

For additional information regarding sampling requirements or clarification of these requirements, contact the following agencies:

- For projects within the five boroughs, contact the Region 2 NYSDEC office located at Hunters Point Plaza, 47-40 21st Street, Long Island City, New York 11101 (718-482-4900) "www.dec.state.ny.us".

- For projects located in Dutchess, Orange, Rockland, or Westchester Counties, contact the Region 3 NYSDEC office at 21 South Putt Corners Road, New Paltz, NY 12561 (914-256-3000) "www.dec.state.ny.us".

- For information on NYSDOH's ELAP program, contact the New York State Department of Health office in the Wadsworth Center, Empire State Plaza, Albany, NY 12201-0509 (518-485-5570) "www.health.state.ny.us".

- For all projects, also contact the Region II office of the EPA located at 290 Broadway, New York, New York 10007 (212-637-3000) "www.EPA.gov".

Guide 28: Vehicle Management

Overview

Vehicles may be used for personnel transport, equipment or soil hauling, earthmoving, and pile driving. OSHA has specific requirements designed to ensure that vehicles are maintained and operated in a safe condition to protect workers and the public. In addition, state licenses and department of motor vehicles regulations address the proper operation and maintenance of vehicles.

Minimum Vehicle Management Requirements

In order to perform work on any Con Edison facility or project, all contractors must, at least, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison and include a process to meet these requirements.

- Only properly trained personnel may operate the vehicles for which they are trained.
- All applicable personnel must possess valid Commercial Drivers Licenses.
- All vehicles must have a functioning service, emergency, and parking brake system and functioning brake lights.
- Vehicles will be inspected prior to use and removed from service if deficiencies exist.
- Vehicles used on public roads must have U.S. Department of Transportation approved flares, triangles, or other warning devices in the vehicle.
- Tools and materials carried in passenger compartments must be secured.
- Vehicles with cabs must have windshields and functioning powered wipers.
- All vehicles must have proper seats with seat belts for each person.
- Vehicles loaded by crane, loader, or similar equipment must have a cab shield or canopy. Equipment cabs must have safety glass that does not distort the driver's vision.
- All vehicles left near a highway at night must have appropriate warning devices.
- Workers must not work under or between equipment or vehicles suspended from slings, hoists, or jacks until the equipment is blocked or otherwise supported.

- All vehicles must be fully lowered and blocked during repair or when not in use.
- Parking brake must be set and wheels chocked when parked and on an incline.
- All vehicles must have functioning backup alarms.
- Loads/Material must be secured and covered if disturbed by winds while in transit.
- Vehicles and equipment designed to move slowly over public roads must display an appropriate slow-moving traffic identification symbol (orange triangle).
- Roadway weight limits will be adhered to.
- The following equipment must have Roll-Over Protection Structures (ROPS):
    - Rubber-tired scrapers, loaders, and dozers, Wheeled tractors;
    - Crawler tractors and loaders, and Motor graders.
- ROPS must be labeled appropriately.
- Fueling operations must be conducted in accordance with the requirements of the Con Edison EHS Work Plan Guide for Fire Protection and Prevention in this manual.

Regulatory Citations

A complete text of the requirements for Vehicle Management can be found in Title 29 Code of Federal Regulations, Part 1926, Subparts F and O.

Contacts

For additional information regarding Vehicle Management requirements or clarification of these requirements, contact the New York regional OSHA office located at 201 Varick Street, Room 670, New York, New York 10014 (212-337-2378), or visit the OSHA web site at: www.OSHA.gov.

Guide 29: Waste Management

Overview

Federal and State laws require that wastes be properly classified and managed as hazardous waste, solid waste, or universal waste. Waste classification will define the requirements for managing the materials. In general, waste management includes characterization, labeling, storage, transportation, disposal, personnel training, and reporting and recordkeeping.

Minimum Waste Management Requirements

Prior to working in any Con Edison facility or on any Con Edison project, all contractors must, at a minimum, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison, and include a process to meet these requirements.

- Contractors take title to all wastes generated if so stated in the specifications; however, CON EDISON RESERVES THE RIGHT TO TAKE TITLE TO ALL WASTES GENERATED BY THE CONTRACTOR'S ACTIVITIES AT CON EDISON FACILITIES AND WORK SITES.

- Contractor must have an active EPA waste generator identification for waste disposal.

- Contractor will comply with all applicable requirements for hazardous wastes generated, including:

    - Characterizing the waste, managing accumulated and stored waste.
    - Labeling of containers, storing the waste, inspecting the storage areas.
    - Filling out manifests and Land Disposal Restriction (LDR) forms.
    - Training of personnel concerning the proper procedures to use.
    - Ensuring that waste is disposed at a permitted facility.
    - Ensuring that reports and records are maintained.

- Contractor shall identify the procedures to classify wastes generated at the job site.

- Wastes shall be segregated when stored to prevent mixing of waste types.

- Storing of solid waste dumpsters will be properly maintained, able to store 150% of expected generation, and covered (with lids, doors, and/or tarps).

- Security measures will avoid non-authorized personnel from tampering with wastes.

- Contractor must evaluate the waste generated for recycling, instead of disposing of waste.

- Contractor must identify the transportation/disposal firms and their permit numbers to manage and transport Con Edison waste. Only permitted treatment/disposal facilities may be used to receive solid and hazardous wastes generated from a Con Edison job site.

- Department of Transportation (DOT) requirements will be adhered to for waste packaging, shipping, and transport, including container selection and vehicle placards.

- All hazardous and solid waste transporters must have the appropriate permits and certifications prior to hauling waste.

- The contractor shall provide copies of all shipping papers and certificates of disposal that are obtained and prepared for wastes generated at the job site.

Regulatory Citations

A complete text of the requirements for waste management can be found in:

- Title 40 CFR, US EPA, Parts 172, 173, 260 through 262, 264, 265, and 268;

- Title 6 NYCRR, Parts 360, 364, 367, 370 through 374, and 376;

- Title 6 Rules of the City of New York (RCNY) Chapter 2; Title 16 RCNY Chapter 1;

- Westchester County, Chapter 825 and Westchester County Local Law No. 14-1992;

- Dutchess County Local Law No. 4 of 1990.

Contacts

For additional information contact the following agencies:

- In five boroughs, contact the NYC Department of Sanitation at 125 Worth Street, NYC, NY 10013 (212-219-8090) www.ci.nyc.ny.us and Region 2 NYSDEC at 47-40 21st Street, Long Island City, NY 11101 (718-482-4900) "www.dec.state.ny.us".

- Projects in Westchester, Rockland and Dutchess Counties, contact the Region 3 NYSDEC office at 21 South Putt Corners Road, New Paltz, NY 12561 (914-256-3000). Projects in Westchester County, contact the local municipality. Projects in Rockland County, contact the Rockland County Department of Health on Sanatorium Road, Pamona, NY 10970 (914-634-2500) "www.co.rockland.ny.us". Projects in Dutchess County, contact the Dutchess County Health Department, Division of Environmental Health Services in Poughkeepsie, NY 12601 (914-486-3404) "www.dutchessny.gov".

Guide 32: Work Area Protection

Overview

Workers must not only be protected from hazards on the project site but also from hazards generated by nearby operations. Members of the public passing near work areas must also be protected from any site-generated hazards. It is therefore important that all work areas be properly barricaded and posted with warning signs and that signals be used to control nearby vehicle traffic. In addition to OSHA, local agencies may have specific requirements for work conducted in roadways or near pedestrian traffic.

Minimum Work Area Protection Requirements

In order to perform work on any Con Edison facility or project, all contractors must, at least, meet the following requirements. Please note that additional requirements may be necessary based on job-specific activities. It is the responsibility of each contractor to identify these requirements in the job-specific Environmental Health and Safety Plan submitted to Con Edison and include a process to meet these requirements.

- All work areas must be sufficiently barricaded to prevent unauthorized access and limit exposure of the public to work area hazards.
- Accident prevention signs (e.g., "Danger - Keep Out") must be visible when work is being performed and must be covered when hazards no longer exist.
- All signs must conform to the requirements specified by OSHA and be used only for their intended purpose.
- Traffic signs must be placed appropriately to control vehicle traffic on or near project sites and must conform to applicable American National Standards Institute (ANSI) standards.
- Flaggers must be used to control traffic when signs, signals and barricades do not provide the necessary protection.
- Flaggers and workers working near traffic must wear a reflective orange vest approved by the U.S. Department of Transportation.
- Only appropriately trained personnel may act as flaggers.
- Flashing warning lights must be placed on barriers during hours of darkness.
- Caution, warning, and construction information traffic signs must be displayed, as appropriate.
- Construction vehicles or equipment left or parked near a roadway must have appropriate

warnings displayed or barricades positioned.

- Disabled vehicles must display reflective triangles, warning lights, flags, or flares to warn traffic of their position.
- The arrangement of traffic control devices must be inspected periodically to ensure their effectiveness.
- Barricades must be weighted or supported to prevent their displacement.
- Workers responsible for placing traffic control devices must be trained in the use and placement of these devices.

Regulatory Citations

A complete text of the requirements for Work Area Protection can be found in Title 29 Code of Federal Regulations, Part 1910, Sections 144 and 145, and Part 1926, Subpart G.

Contacts

For additional information regarding Work Area Protection requirements or clarification of these requirements, contact:

- The New York regional OSHA office located at 201 Varick Street, Room 670, New York, New York (212-337-2378). The OSHA website can be found at www.OSHA.gov.
- The New York City Department of Transportation located at 40 Worth Street, Manhattan, New York (212-442-7070).
- The New York State Department of Transportation located at 47-40 21st Street, Long Island City, New York (718-482-4600).

Attachment B

Con Edison Utility Clearance Process
Checklist and Procedures/ARCADIS
BBL Underground and Overhead
Utility Check list

UTILITY CLEARANCE PROCESS FOR INTRUSIVE ACTIVITIES
E H&S REMEDIATION PROGRAM

1.0 INTRODUCTION

This document outlines the process that should be used to identify, locate and clear subsurface utilities as part of all Environmental Health and Safety Department's Remediation Section intrusive site investigations. The various activities that comprise this process are specified in efforts to eliminate or substantially reduce the risk of encountering a subsurface utility while performing intrusive activities. Where appropriate, reference is made to other existing safety procedures that should also be considered. **Note that modifications and additions to the text in this version of the process, relative to the topics outlined in Section 2.0, are italicized.**

Due to the potential presence of subsurface utilities and the inherent variable of their size, depth and layout, it is not possible to address all situations and circumstances that may be encountered during intrusive activities. However, adherence to the steps outlined here will effectively minimize physical impacts to subsurface utilities and prevent associated health and safety risks that might otherwise result from field investigation activities. The activities prescribed below should not be blindly followed. Rather, it is the intent of this document that **ALL FIELD PERSONNEL**:

1) Understand the terms of this process including all revised or added provisions;

2) Develop an awareness and be mindful of, the potential and actual risks associated with utilities and other related hazards at a site;

3) Become familiar with the location(s) and configuration(s) of all subsurface utilities at the site, as marked out and as delineated on available drawings;

4) Develop an awareness and understanding of the potential uncertainties associated with utility locations as marked out;

5) Maintain a high level of vigilance while implementing all components of intrusive fieldwork.

ALL FIELD PERSONNEL, including the Con Edison Project Manager (PM), Construction Management (CM), consultants and contractors should be familiar with the fundamental provisions of this utility clearance process PRIOR to engaging in any field activities.

The process described in the remainder of this document consists of the three (3) primary components summarized below. These components are designed for use in an integrated manner.

Process Narrative – The narrative provides detailed descriptions of the specific steps that should be taken prior to and during intrusive activities to minimize the potential of encountering subsurface utilities.

Utility Clearance Flow Chart: The key steps of the utility clearance process, as outlined in the narrative, are shown graphically on the flow chart provided in **Attachment A**. The flow chart serves as a guide and should not replace the narrative for developing an understanding of and/or implementing the process.

Utility Clearance Checklist - A key component of this process is the completion of the checklist provided in **Attachment B**. The checklist shall, be completed by the Con Edison PM. The intent of the checklist is to ensure that all appropriate steps of the process described herein have been completed. Secondly, it will be used to document that all reasonable steps were taken to prevent conditions that may be potentially harmful to the on-site workers and the surrounding community at large, and that might otherwise adversely impact the physical integrity of, or cause damage to, the utility. The completed checklist will be incorporated in the project files maintained by the Con Edison PM.

2.0 REVISIONS FROM PREVIOUS VERSION

This version (Revision 1) has been modified to incorporate additional provisions and or guidance based on lessons learned during implementation of the original version for intrusive activities at various sites. The key topics that have been added or modified are listed below and described in greater detailed in the referenced sections of this protocol.

- Use of private utility location contractors (Sections 4.2.1 and 4.2.2);
- Work around gas lines (Section 4.3 and 4.4); and
- Requirements for utility clearance in building basements (Section 4.4).

Modifications and additions to the text relative to the topics listed above are *italicized* (in addition to the website links in Section 4.1 which are also italicized).

3.0 APPLICABILITY

The utility clearance process shall be performed prior to and/or during the intrusive site investigation activities listed below.

- Excavation of Soil Borings
- Installation of Monitoring Wells
- Installation of Soil Gas Sampling Probe Points
- Excavation of Exploratory Test Pits/Trenches

4.0 SUBSURFACE UTILITY CLEARANCE PROCESS

The key activities that comprise the process are listed below and a detailed description of each is provided in the remainder of this document in the order in which they should be completed (as shown in the Utility Clearance Flow Chart in **Attachment A**).

- Obtain Plates, Drawings and Maps
- Notification to Con Edison Operating Groups and Submission of Site-Specific HASP for review and approval
- Code 753 Utility Mark-Out
- Site Walk
- Utility Clearance - Sample Location Confirmation
- Checklist Completion

It is noted that completion of some steps may not be warranted for all intrusive activities at all sites. The process is designed to be flexible and, thus, allows the Con Edison PM to incorporate those utility clearance activities that are appropriate for a set of site-specific conditions, knowledge of the site, previous work completed at a site, etc. Exceptions are summarized in Section 5.0 of this document. The key premise is that any deviations and the rationale for each are well documented and reflect sound judgment on the part of the Con Edison PM and other project personnel.

4.1 Obtain Plates, Drawings and Maps

Hard copies of available utility plates, drawings and/or maps should be obtained by the Con Edison PM. Drawings, plates, etc. should be reviewed as a preliminary step to determine the type and approximate size and location of utilities in the vicinity of the work site. The drawing title, most recent revision date shown on the drawings, approximate scale and source shall be documented in the appropriate space(s) on the Utility Clearance Checklist (**Attachment B**).

The source of the drawings may vary depending on whether the site is a Con Edison owned/operated facility, private/public property, or extends into a public street/sidewalk. The various sources for substation utility drawings are discussed below and listed in **Table 1**. Drawings for private properties and facilities, such as apartments, schools, churches, residences, etc., can typically be reviewed at, and/or obtained from, the property/facility manager and Department of Public Works and/or Department of Buildings in the municipality where the property is located.

NOTE: Copies of all drawings obtained during this step should be available at the site during all site walks/inspections and at all times during subsequent intrusive activities. The drawings should be reviewed immediately prior to implementing intrusive activities at each new site location where intrusive activities are to be performed.

Steam, Gas and Electric
All electric and gas plates are available on Con Edison's intranet by searching for 'maps' or accessing the Advanced Mapping System website listed below.

http://maps/AdvancedMappingHomePage.htm

Similarly, steam plates can be obtained by selecting "Active" and "Archived" Steam Plates from the website:

http://maps/steam.htm

Based on agreement between Transmission Operations and EH&S, Remediation personnel may access these intranet sites and print the plates using the facilities in the conference room in Building 97 in Astoria. In addition, a large format photocopier, which is also located in Building 97, is available for use by EH&S remediation. A log book, which is stored at the facility, should be completed each time the facilities (i.e., plotter, computer, and or photocopier) are used.

Conduit and Duct Occupancy (C&DO) utility plates should be obtained from the appropriate Con Edison engineering group(s) including, electric (e.g., distribution lines, transmission feeders, etc.) steam and gas by the Con Edison PM.

AFTER accessing the website and obtaining the required drawings, the appropriate party listed in **Table 1** may be contacted with inquiries regarding electric and steam plates or for questions regarding use of the Advanced Mapping System.

Sewer and Water
Drawings showing water and sewer utilities should be obtained from the New York City Department of Environmental Protection (NYCDEP). Drawings can be requested from the NYCDEP by completing the form provided in **Attachment C** and faxing or mailing it using the appropriate contact information listed on the request form. If you have questions you should contact the NYCDEP personnel at the telephone number listed in **Table 1**.

Subterranean Tunnels
Drawings showing locations and depths of tunnels including subways and automobile tunnels and related subsurface infrastructure should be obtained as appropriate by contacting the Metropolitan Transportation Authority as listed in **Table 1**. It is noted that if intrusive activities will be performed in the immediate vicinity of subsurface MTA structures, such as subway or automobile tunnels, a letter submitted to the MTA may be required to request a work permit from MTA. The letter should include a brief summary of the work and a map(s)/drawing(s) of the proposed work and will be submitted to:

Mr. Rajen Ydeshi
Outside Projects
New York City Transit
2 Broadway, 7th Floor
New York, New York 10004

Miscellaneous

Con Edison generally does not maintain plates and drawings showing detailed information of utility distribution on private property. However, as discussed above, facility managers, property owners, Department of Public Works and/or Department of Buildings of the municipality where the site is located, should be contacted in efforts to obtain available utility drawings for the facility. Contact information (e.g., telephone numbers, e-mail addresses, etc.) for municipalities can typically be obtained by accessing the municipality's website. The name, address and telephone numbers for the Department of Buildings in New York City are listed in **Table 1**.

4.2 Complete Utility Markouts

Due to the diversity and nature of sites investigated by the EH&S Remediation Group and the potential utilities at these sites, an effective mark out may require an M-scope survey by Con Edison, requesting a Code 753 utility survey and or a subsurface utility survey by a private utility-locating contractor. The applicability of each of these is discussed below.

4.2.1 Overview of Utility Markout Methods

Code 753

The Con Edison PM should instruct their consultant and/or contractor to request a Code 753 utility mark out as per the 16 New York City Rules and Regulations (NYCRR) Part 753. Consistent with the One-Call (also called Dig Safe New York) criteria, the request should be made at least 72 hours prior to initiating fieldwork. The telephone numbers of the various one-call systems are listed by region below.

New York City / Long Island:	(800) 272-4480
Westchester	(800) 962-7962

Confirmation that mark outs completed under Code 753, and as received by facsimile or telephone from the participating utility companies, should be documented on spaces provided on the Utility Clearance Checklist (**Attachment B**). The markouts should be maintained by the Con Edison PM or designated representative. If the physical markings on the street/sidewalk become faint or obscure they should be refreshed by over-painting with new paint as needed. When the utility markouts are being refreshed, typically by consultant, contractor, or other project personnel, a Con Edison representative or their designee **MUST** be present and observe this activity.

Con Edison M-Scope Survey

Con Edison engineering groups (see below for contacts) can conduct utility surveys using a 'M-Scope' on a case-by-case basis and will be limited to the engineering group' availability. This tool uses the magnetic susceptibility of subsurface features such as electrical conduits, electric cables, pipes, etc. This method of survey can be subject to interference by other conductive bodies at grade or in the subsurface, such as buried pieces of metal, rebar in concrete, iron-rich soil, etc., and may be ineffective or produce misleading results in these types of conditions. A utility survey using an M-Scope can be requested by contacting the appropriate party listed below. Note for markouts inside substations contact Mark Rimler at (212) 460-3921.

County	Contact Name	Telephone Number
Manhattan	Jane Shin	(212) 894-9345
Brooklyn & Queens	John Haas	(718) 348-6725
Bronx	Greg Kasbarian	(718) 904-4659
Westchester	Faney Bantin	(914) 789-6715
Staten Island	Joseph Nappi	(718) 890-6231

Private Utility Contractor

Prior to mobilizing to the site the following information MUST be provided to and reviewed by the Con Edison PM:

- *the name of the contractor;*
- *the name of technician(s) who will perform the utility surveys;*
- *for each technician, a summary of experience and training in conducting surveys in a setting similar that at the site (e.g., urban, inside buildings, etc.); and*
- *Summary of experience and training of each instrument.*

When using a private utility location contractor, the Con Edison PM shall diligently attempt to arrange for the facility or property manager and or engineer, who is most familiar with the utility layout and distribution in the building or on the property to participate in the site walk with the private utility locating contractor during on the first day of conducting the on-site utility survey.

Private utility contractors employ a variety of utility detection and location techniques, which may include:

- Ground Penetrating Radar (GPR)
- Magnetometer
- M-Scope
- Electrical Conductivity

- Electrical Resistance
- Acoustics

Use of multiple methods may permit the detection and surveying of conductive and non-conductive buried utilities.

*The utility location contractor **SHALL** specify which utility detection tool/techniques they plan to bring **AND** use at the site. In addition, they **SHALL** bring **ALL** support tools and equipment necessary to allow them access to manholes, vaults, circuit boxes, pipe clean-outs, etc.*

*At the commencement of a utility survey using a private utility location contractor **AND** prior to them deploying any survey equipment, the utility location contractor **SHALL**:*

1) *Review **ALL** utility drawings*
2) *Reconcile **ALL** drawings with markouts identified by the Code 753 survey at the property perimeter.*
3) *Determine presence and type nature of sub-slab utilities and diligently attempt to confirm their configuration during the utility survey.*
4) *Inspect the site to identify where **ALL** utility service enters and or leaves the property and or building. This **SHALL** include a thorough inspection of building basement(s); boiler and or machine room(s); externally-exposed utility infrastructure including manholes; vaults; electrical, gas, water valves and or meters; etc.*
5) *Visually identify, open and inspect **ALL** relevant utility access-ways including manholes, vaults, gas and or water valves boxes and telephone, cable and communication boxes.*
6) *Identify and document **ALL** apparent uncertainties such as manholes containing service lines that apparently go to the building or property, but that cannot be located within the basement of the building or on site.*

NOTE: In ALL cases, the private utility contractor shall diligently attempt to 'hook-onto' or 'tone' each conduit source (e.g., pertinent electrical conduits in basement, water and or gas valves in valve box, distribution lines in manhole, etc.). This may require opening manholes circuit electrical distribution 'trunk' boxes, moving equipment or stored materials at the facility or property to allow access. No project personnel shall enter a manhole or vault unless they are certified and trained in confined space access, have and know how to use ALL pertinent safety equipment, and approved by the Con Edison PM.

In some situations, multiple metallic conduits may be in direct contact in the subsurface. In this circumstance the signal of the locating tool may be transferred from the conduit being 'toned'

to an adjacent conduit(s) and may produce a 'secondary' signal. In efforts to understand and identify this occurrence, the location of each apparent signal shall be visually/physically marked using pieces of tape, paint or similar method. The sources being 'toned' shall be numbered and the corresponding signals associated with each signal source shall be marked with the corresponding number a teach location where the signals from each source is detected. Accordingly, the resulting mark outs will show apparent multiple conduits for a single source.

4.2.2 Applicability of Utility Clearance Resources

The use of the various utility markout resources that may be employed at various sites is summarized in the table below and discussed in the remainder of this section.

Site Setting	Utility Survey by Con Edison	Utility Survey by Private Contractor	Code 753 (1)
Con Edison Facility	X	X (optional)	X[1]
Street / Sidewalk	X (optional)	X (optional)	X
Private Property	X (optional)	X	X[1]

(1) At larger Con Edison Properties (e.g., Astoria) or large private or publicly owned properties, a Code 753 survey may not be warranted.

Con Edison Facility

Utility markouts at Con Edison facilities should be coordinated by the Con Edison PM with support from the Construction Management (CM) inspector assigned to the project (if any) and/or facility personnel, as appropriate. At a minimum, an M-Scope survey should be completed. In some circumstances, an independent utility locating contractor should also be used. The decision to use a utility contractor will be made by the Con Edison PM. The use of an independent utility mark-out contractor is strongly recommended at sites where a variety of utilities are known or suspected to be present and which may not be readily identified or mapped

using M-Scope alone. A benefit of using a utility locator contractor is that, as described above, they can provide a greater array of tools to locate a variety of subsurface utilities that are non-conductive, such as concrete sewer lines, PVC pipes, etc. in addition to identifying/confirming the presence and location of conductive utilities.

Private Property (including Soil Gas Sampling Probes)

An independent utility locator should be used for utility markouts on private properties. It is noted that utility markouts in basements or slab-on-grade constructed buildings may be inconclusive due to the presence of rebar or welders-mesh commonly used as reinforcement in concrete. Accordingly, a thorough inspection of the basement floor and walls should be performed to identify where utilities enter and leave the building, as well as how the utility (elctric, water gas, steam, etc.) are distributed in the vicinity of the sample locations. Sub- or in-

floor utilities often enter along the perimeter of the floor, at support columns, and/or along dividing walls. The observation of utilities entering the floor may indicate utilities that lie within or immediately beneath the concrete basement slab. If the location of the utility layout of any such sub- or in-floor utility cannot be effectively determined, then any intrusive work must be discussed with the Con Edison PM and may require that no intrusive activities be performed at that location. *However, this action should only be considered after all applicable survey tools and methods have been diligently deployed and or implemented.*

Public Street / Sidewalk

A combination of Con Edison utility survey staff and independent utility locator contractors may be used for work areas located in and along roadways. Since Con Edison maintains utilities in streets and along sidewalks, in addition to the mark outs performed through the Code 753 survey, an M-scope survey may also be requested within a 10 foot radius of each proposed sample location. It is noted that due to often heavy work loads of the M-Scope survey staff, this option may not always be available or practicable and should be considered optional.

4.3 Site Walk

After completion of the activities outlined above, a site walk shall be conducted by the Con Edison PM with participation from Construction Management (if it will be providing field oversight), contractors (drillers, soil gas, excavators, private utility location contractor, etc.), Con Edison facility managers, NYSDEC (as deemed appropriate by the Con Edison PM), and private facility managers/property owners. A list of the names and phone numbers of each participant at the site walk will be maintained by the Con Edison PM. The key objectives of the site walk are to:

- Review the all planned locations where invasive activities will be performed,
- Adjust the positions of the locations away from utilities as marked out (as necessary)
- Collectively determine the appropriate utility clearance activities (e.g., test pits, etc.) that will be performed at each location (as described in Section 3.4) and document all decisions and /or concerns using the Utility Clearance Checklist (as described in Section 4.0) and in **Table 2**.

Other site conditions and project issues assessed during the site walk should include:

- Presence and location of overhead utilities and/or obstructions that might prevent the safe operation of drilling /excavating equipment;
- Presence of, or need for, appropriate grounding for electrical equipment at the site;
- Site access to equipment;

- Storage of equipment/supplies overnight (e.g., establish a staging area);
- Storage and management of investigative derived waste (IDW);
- Hours of on-site work;
- Permits needed, if any;
- Review roles and responsibilities of all project personnel who will be onsite;
- Review site and emergency contacts; and
- Review anticipated schedule of work *and contingency action as deemed appropriate.*

4.4 Utility Clearance - Sample Location Confirmation

The appropriate actions necessary to confirm the location and/or absence of utilities, which are agreed on during the site walk and as documented in the Utility Clearance Checklist and in **Table 2**, will be implemented at each sample location during the investigation. As discussed above, and consistent with the Utility Clearance Process Flow Chart, the actions will generally include one or more of the following:

- Moving the location outside the **tolerance zone**, if possible. If no ***tolerance zone*** is marked out during the utility survey (i.e., only a utility center line is marked), the **tolerance zone** will be defined in the field as: **the distance of one-half of the known diameter of the utility plus two feet on either side of the centerline as marked out.**
- Performing a utility clearance test pit at each location where intrusive work will be performed; and/or
- Performing a utility clearance test pit using non-mechanical means to expose and physically verify the exact location and configuration of all nearby utilities.

Brief descriptions of the activities that will be completed during the various investigation activities are discussed below.

NOTE: When working within 25 feet of high pressure gas lines (i.e., 125 psig or greater), *Gas Emergency Response Center (ERC)* shall be contacted *[718-319-2330] and notified of the planned activities at least two days prior to start of intrusive work. If working within 5 feet of a transmission main or within 10 feet of the tolerance zone of a main* the gas line will be carefully excavated by hand in accordance with the Gas Operations Standard G-11863, titled "Inspection and Maintenance Requirements Associated with the Excavation Activities Near Gas Pipelines Operating at 125 psig and Above".

Soil Borings / Monitoring Wells

All locations within the tolerance zone should be moved outside the zone, if possible. After moving the location, a utility clearance test pit should be excavated to a minimum of 5-feet below ground surface using non-mechanical methods, such as hand auger, post-hole digger and/or vacuum truck. The diameter of the test pit should be at least two inches wider than the outer diameter (OD) of the mechanized drilling equipment. The 5-foot depth is consistent with the concept that most utilities are typically installed within the top five feet of the subsurface.

NOTE: Utilities may be deeper than five feet due to buildup of surface grade on properties and or streets or right-of-ways. Although the original depth of utilities is anticipated to be within the upper five feet, utilities that are buried in areas that have been built up will presently be deeper by the thickness of the built-up material.

Intrusive investigation locations where physical space prohibits the relocation of proposed sample locations outside the tolerance zone, the adjacent utility(ies) will be exposed by excavating using non-mechanical methods to visually confirm its physical location and configuration. This confirmatory excavation will be completed in addition, a 5-foot excavation at the specific location being investigated (e.g., soil boring, monitoring well boring, etc.), as described above.

Soil Gas Sampling

At soil gas sample locations, test pits will also be excavated to one foot below grade or below the bottom of a concrete floor, if present, prior to installation of soil gas sample probes points. The one-foot depth specified is consistent with the concept that most utilities that could be impacted by the advancement and emplacement of the probe points, such as telephone lines, local electric (e.g., for outdoor lighting), cable television, in-ground sprinkler lines, etc., are typically installed from grade to a depth of one foot.

Basements / Indoor Soil Borings and Monitoring Wells

Prior to installing a soil boring, monitoring well or soil gas sample probe point in the concrete slab of a basement and after identifying that no utilities are present in the floor of the basement or foundation slab (as per Section 3.2.2), an electric powered diamond core drill, concrete saw or jack hammer will be used to advance through the concrete and expose the underlying soil. *If sub-slab utilities are suspected of being present, but not confirmed during the utility location survey, the concrete shall be cored or saw cut to an estimated depth of approximately 2/3 the thickness of the concrete (if known). If the thickness of the concrete thickness is not known, it shall be assumed to 8-inches thick. Coring shall proceed at 1-inch increments, with the removal of each one-inch 'plug' of concrete and visual inspection of the core hole to verify the absence of utilities. The remaining 1/3 of the concrete shall be broken using electric jackhammer,, hammer drill or using hand tools. Appropriate safety equipment shall be worn during concrete removal actions.*

At each location where soil borings and/or monitoring wells will be installed, a hand excavated test pit will then be advanced to a depth of five feet below the bottom of concrete slab. This test pit should be excavated using hand auger, post-hole digger and/or vacuum truck in tandem with a

non-conductive probe rod, which can be used to confirm the absence of utilities to a depth of five feet below the bottom of the concrete slab.

NOTE: The use of a jack-hammer to loosen compact soil during hand excavating a utility clearance test pit is strictly prohibited, except as noted above.

Exploratory Test Pit/Trench

Exploratory test pits/trenches will be performed to identify the presence or absence of subsurface structures related to former operating facilities at the site, such as gas holder foundations at former manufactured gas plant (MGP) sites, and should not be confused with **utility clearance test pits** discussed above. The **exploratory test pits** or **trenches** will typical have dimensions of approximately five feet wide by 10 feet deep by 10 to 20 long, accordingly, excavating them by hand is impracticable. The excavation of **exploratory test pits/trenches** must be approached with heightened awareness as the potential for damaging subsurface utilities, if present, is great.

In efforts to develop a reasonable degree of confidence that utilities will not be encountered during excavation of **exploratory test pits/trenches**, a focused utility survey will be conducted in the area immediately surrounding the test pit or the area defined by a boundary established by measuring two feet perpendicular from all sides of the proposed exploratory test pit boundaries. For example, if the surface dimensions of the exploratory test pit are 10 feet long by 5 feet wide, the surrounding area of the focused utility survey will have dimensions 14 feet long by nine (9) feet wide. It is suggested that the focused utility survey should be completed after all other on-site surveys have been completed. This will allow the surveyor(s) to develop a better understanding of the site-wide subsurface utility configuration.

Following completion of the focused utility survey, **utility clearance test pits** will be excavated by hand to confirm the presence of any and all utilities identified within five feet from the exploratory test pit/trench. After exposing the utilities, the excavator can proceed to excavate the **exploratory test pit/trench**, however, the operator should be experienced with digging in areas where underground utilities may be present and should use the utmost care when performing the excavation. Excavation should proceed slowly enough so that any obstruction/structure encountered can be evaluated and to confirm that the structure is not a utility.

5.0 CHECKLIST COMPLETION

The Utility Clearance Checklist (**Attachment B**), as well as the overall Utility Clearance Process to locate and clear utilities was designed to be dynamic. Accordingly the Utility Clearance Checklist should be updated throughout the process as each utility clearance activity is completed. During the site walk and after all utility-related issues at each location have been identified and addressed to the satisfaction of all project personnel, the relevant portions of the Utility Clearance Checklist will be completed by the Con Edison PM. It is noted that the Utility Clearance Checklist will be considered complete only after all proposed utility clearance actions identified during the site walk have been successfully implemented and all pertinent information and activities have been documented.

6.0 EXCEPTIONS TO REQUIREMENTS OF THE UTILITY CLEARANCE PROCESS

Due to the inherent diversity and conditions present at project sites, some general exceptions to the utility clearance process are identified below.

- Sites where extensive utility mapping has been completed and/or where extensive intrusive activities have already been performed.
- Locations where facility layout is well documented and understood.
- Sites or portions of large sites (e.g., Astoria facility) where utilities are known not to exist currently or to not have ever existed throughout the life of the facility, property or site.

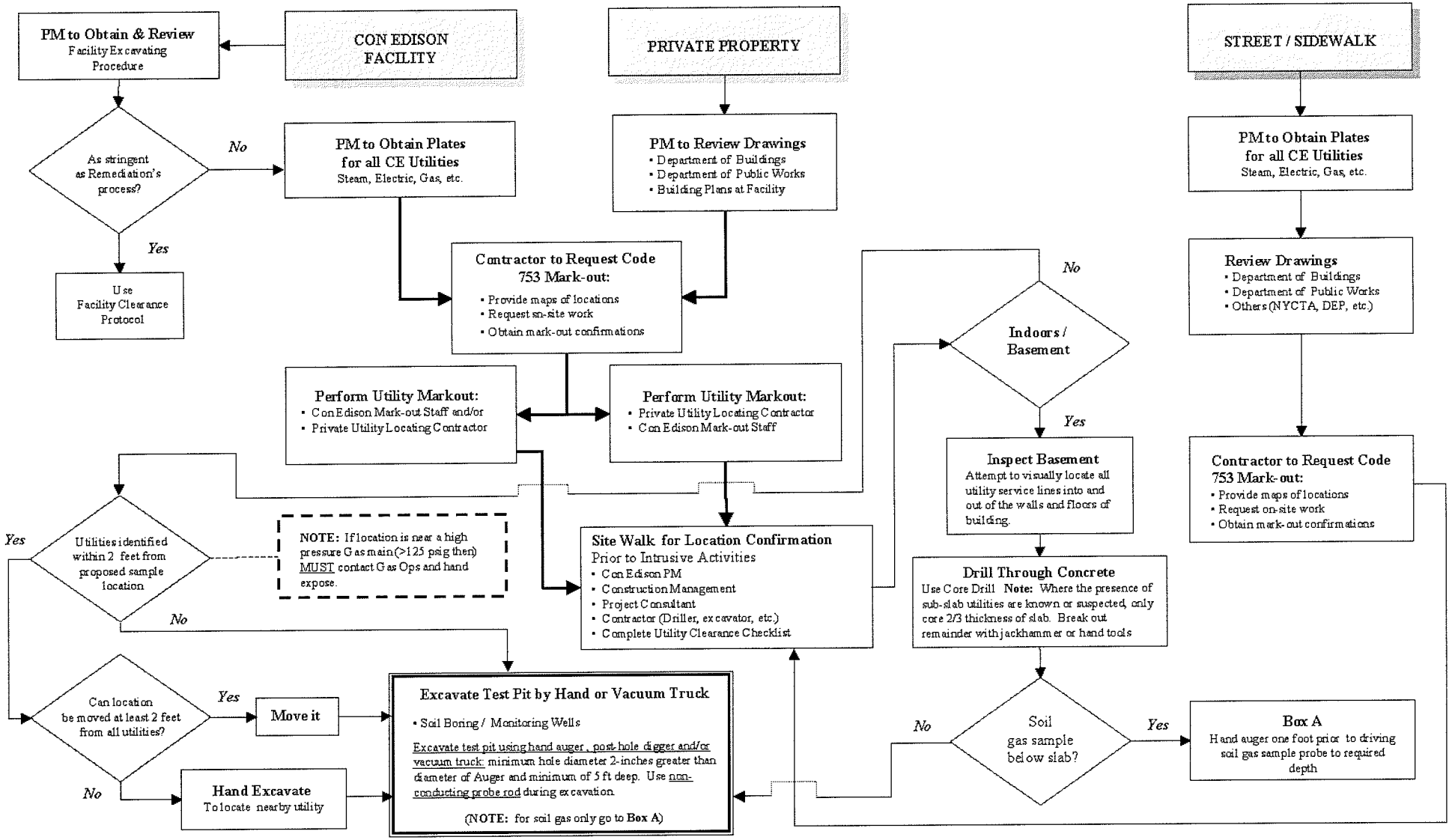
All circumstances where one or more steps of this process are not being implemented must be discussed with the Con Edison PM and must be duly documented. Regardless of whether or not exceptions are made during the utility clearance process, a Utility Clearance Checklist should always be completed for each site, in accordance with the terms outlined in Section 4.0 of this document.

ATTACHMENT A

Utility Clearance Process Flow Chart

Utility Clearance Process During Intrusive Activities
E H & S – Remediation Group

10/08/03
Rev. 1



ATTACHMENT B

Utility Clearance Process Checklist

CHECKLIST FOR INTRUSIVE FIELDWORK

PROJECT BACKGROUND INFORMATION

Site Name: _____ Job No. _____

Site Address: _____

Con Edison Project Manager: _____ Phone: _____

Con Edison Site Manager: _____ _____

Consultant Project Manager: _____ Phone: _____

Consultant Site Manager _____ Phone: _____

Subcontractor (driller, excavation, etc): _____

Subcontractor's Contact Person: _____ Phone _____

Meeting / Start Date _____ Time _____

HEALTH AND SAFETY PLAN REVIEW

Name: _____ Organization: _____ Date: _____

Name: _____ Organization: _____ Date: _____

Name: _____ Organization: _____ Date: _____

Health and Safety Form Completed: _____ Date _____

Site Drawings (yes/no/NA): _____ (Attach site figure with proposed boring locations)

CODE 753 UTILITY MARK-OUT REQUESTED? Y / N

Called by: _____ Organization: _____

Date: _____ Time _____ Initials _____

Reference # _____

Utility Drawings Received: _____ (Attach copy of utility maps)

UTILITY INVENTORY

Above Ground Services:

Utility	Utility Company Name	Depth (ft)	Phone	Date Notified	Notification Method	Marked
Electric		NA				Y / N
Telephone		NA				Y / N
Cable		NA				Y / N
Overhead Supports		NA				Y / N
Traffic light cables		NA				Y / N

Drawings/Plates Obtained (List) _____

Notes: _____

UTILITY INVENTORY (continued)

Below Ground Services:

Drawings/Plates Obtained (List) _____

Utility	Utility Company Name	Depth (ft)	Phone	Date Notified	Notification Method	Marked
Electric						Y / N
Telephone						Y / N
Cable						Y / N
Gas						Y / N
Water						Y / N
UST System						Y / N
Storm						Y / N
Sanitary						Y / N
Steam						Y / N
Pipeline Companies						Y / N
Other (Tunnels, etc.)						Y / N

PRIVATE UTILITY LOCATING SERVICE RETAINED? Y / N

Date _____ Time _____ Initials _____

Name of Locating Service: _____

Telephone #/ contact: _____

Name of Operator(s)/Type of sensing equipment used _____

METAL DETECTOR SURVEY

Drilling location cleared by _____ (Consultant/Contractor) with a metal detecto

Consultant / Contractor Name _____ By (initials): _____ Date: _____

INTRUSIVE SAMPLING LOCATIONS MARKED, M-SCOPED AND CLEARED

Locations Marked by: _____ Date(s): _____

_____ Date(s): _____

M-Scope performed by: _____ Date: _____

Conduct Site Walk and Complete Site Walk Table

ACKNOWLEDGEMENT

The parties listed on the attached Site Walk Sign-In Sheet have participated in a site walk at _____ to review proposed intrusive sampling locations and to evaluate the presence, configuration and identification of utilities at this site, as marked out. The parties have agreed with the proposed activities that will be completed prior to conducting intrusive work. The utility clearance activities will be completed as summarized in Table A (attached).

ADDITIONAL COMMENTS / NOTES: _____

Site Walk Sign-In Sheet

Project Name: _____

Date of Site Walk: _____

Name:	Organization:	Phone No.

Utility Clearance
Site Walk Summary Table

Sampling Location	Nearest Utility Distance	Nearest Utility Type	Depth	Clearance Required (Y/N)	Accepted Clearance Method	Rationale for Clearance Method	Depth of Clearance	Date Utility Cleared	Findings /Comments

Signature of Site Walk Participants -

Remediation PM: _____

Construction Management: _____

Consultant PM: _____

Contractor: _____

Date Site Walk Conducted:

Vincent J. Soriano, Chief
New York City Department of Environmental Protection
Bureau of Water and Sewer Operations
Central Mapping and Records
59-17 Junction Boulevard, 12th Floor
Corona, New York 11368

UPDATED PROCEDURES FOR REQUESTING INFORMATION

Effective immediately, the guidelines listed below are to be followed when requesting information pertaining to the water and sewer system. Water information pertaining to water main size and location is processed by this office. Sewer information pertaining to requests for drainage plans (used in sewer design work, drainage work, a drainage plan will **not** tell you the location of the sewer), interceptors and schematic Inflow/Infiltration (I/I) maps are processed through this office. **Requests for information pertaining to the locations of sewers, which are derived from as built drawings, sewer house connections, and water house (tap) connections will not be processed by this office. You must contact the specific borough Permitting and Connection office. Also requests for flow tests are not processed in this office.** Requests for information can be mailed to the above address or faxed to (718) 595-5781. **Information is not given nor are requests taken over the telephone.** A taped message of instructions can be heard by dialing (718) 595-5779. Please do not leave requests at the end of this tape, as they will not be processed.

1) All requests must clearly clarify the locations and work that is being done. Specific limits or a clear site plan must be provided. Project limits marked or highlighted on a Hagstrom map, or references to address or block/lot will **not** be processed. Hagstroms are often illegible and our records are not filed by address and block and lot. You must submit a separate request for each borough. With the increasing amount of work being processed by the Records Unit a completed request form (a blank is attached) must be attached to each request and be completely filled out, especially the description of work being done.

2) All corporate requests must be submitted on official company or agency letterhead. Copies of letterhead submitted via fax are acceptable.

3) All requests must be submitted to this office at least ten days before the work is to be started by your company/agency. Complexity of a request, DEP emergencies to name two situations can cause a slight backlog and a delay in response time. There is also closer scrutiny in the information that is requested and released. While it is understood each job is important to the individual asking for the information, requests are processed in the order in which they are received. This office will make every attempt to meet your needs, but labeling a request an "emergency" or "need it ASAP" will not help the processing, and it is unfair to the other clients.

4) If you are faxing your request to our office please do not follow up with a hard copy request later on. With the amount of work performed, there have been instances where staff time is used processing the same request twice.

5) If you request to have your records picked up after the research is done rather than have them mailed, please check off the appropriate box on the request form. Our office will hold the package for TWO business days only, and then it will be automatically mailed out. However it is stressed for you to wait for someone from the Records Unit to call and tell you the information package is ready before you come down. This will save you a needless trip if the information is not yet available.

6) **Walk in requests are no longer accepted.**

7) Requests covering large areas can no longer be processed. We ask that you break them down and submit them separately for an area no larger than eight blocks. If you have numerous locations please prioritize them and submit the requests to us in the order for the areas you need first.

Please pass this along to colleagues in your company that might also make requests to this office. I thank you in advance for your cooperation.

Vincent J. Soriano

Vincent J. Soriano, Chief
BW&SO Mapping/Records

REV 7/02

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER AND SEWER OPERATIONS CENTRAL MAPPING AND RECORDS
59-17 JUNCTION BLVD. - 12TH FL. CORONA, N.Y. 11368 FAX: (718)595-5781

REQUEST FOR INFORMATION FORM

NAME _____

FIRM/AGENCY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

TELEPHONE # _____ FAX # _____

BOROUGH (Check one)

BRONX ( )
BROOKLYN ( )
MANHATTAN ( )
QUEENS ( )
STATEN ISLAND ( )

PURPOSE OF REQUEST FOR WATER RECORDS (WORK BEING DONE)

DRILLING/BORING/EXCAVATION( ) SURVEY( )
DESIGN( ) PLANNING/ANALYSIS( ) OTHER( ) _____

PURPOSE OF REQUEST FOR SEWER RECORDS

SEWER DESIGN( ) Provide latest adopted drainage plan unless otherwise noted for the following sewer type
STORM( ) SANITARY( ) COMBINED( )
INFLOW/INFILTRATION ANALYSIS( )
INTERCEPTOR INFORMATION( ) OTHER( ) _____

IF YOU HAVE BEEN RETAINED BY A CITY, STATE OR FEDERAL AGENCY INDICATE NAME BELOW

_____

AGENCY CONTRACT NUMBER _____

PROVIDE A BRIEF DESCRIPTION OF THE PROJECT YOU ARE WORKING ON THAT REQUIRES THE ABOVE INFORMATION. For example, designing a new 10" sanitary sewer, excavation, drilling contract, etc. NO REQUEST WILL BE PROCESSED WITHOUT AN EXPLANATION.

_____

_____

IN HOUSE STAFF ONLY
PROJECT FOLDER _____ DATE LOANED _____ DATE RETURNED _____

LOCATION STREET NAME	FROM	TO

PLEASE CALL TO HAVE INFORMATION PICKED UP IN PERSON( )

FOR OFFICE USE ONLY
DATE IN _____ DATE OUT _____ ASSIGNED TO _____
RECORDS SENT:

ATTACHMENT C

Instructions for Obtaining Drawings for Sewer and Water Utilities

From the NYC DEP

Steps for obtaining DEP water maps

1) Fill out a "Request for Information Form" for the NYC DEP Bureau of Water and Sewer Operations Central Mapping and Records. Specify the purpose of request and the street names. For faster result, indicate preference for picking up in person.
2) Fax the request form to NYC DEP at (718) 595-5781
3) If pick up requested, you will receive a phone call when the water maps are ready. The package can be picked up at 59-17 Junction Blvd., 12th Floor, Corona, NY 11368.
4) If not picked up after 2 business days, or if pick up was not requested, the package will be mailed to the address provided.

Note: These maps are based on the best information available for the water mains and appurtenances in the streets contiguous to the area specified. Water mains are normally installed at depths ranging from 42" to 48".

Steps for obtaining DEP sewer maps

1) Contact NYC DEP Queens borough office at 120-55 Queens Blvd., Kew Garden, NY 11424 at (718) 286-2600. [Teresa Lin]
2) Arrange an appointment or best time to stop by their office (1st Floor – Room 802). Office hours are Monday to Friday 8:00am – 4:00pm.
3) Prepare a sewer map request memo, using company letter head, justifying the reason for the request and signed by the project manager. Bring company ID card.
4) When arrive at the office, provide them with the request memo, then fill out a slip with applicant information, site location information, and the Index Map # from their hanging map for the specific streets locations.
5) Using the Index Map # or #s to get the index maps for sanitary, storm or combined sewers.
6) Find the streets on the index maps and record the stick numbers and/or file names marked on those streets.
7) Go to the map files room in the back of the office.
8) Look for the respective draws that hold each respective stick numbers. The maps are rolled tightly onto a specific numbered stick. Always look for the "Final Map". Photocopies can be made using their copying machine.
9) Roll the Map back tightly onto the respective stick and place it back to the correct drawer.
10) For the file names, look into the large drawers in the middle of the room. They should be in alphabetical order. Also, place the file back after use to the respective drawer.

Table 1 - Summary Table of Resources for Obtaining Subsurface Utility Plates and Drawings

Utility Type	County	Company	Organization	Name	Telephone Number
Electric	All	Con Edison	Electric Engineering	http://maps/AdvancedMappingSystem.htm[1]	
			For Questions contact:	John Ensemplare (Mgr. – B&Q)	(718) 802-5540
				Mike Mitchell (Mgr. – Manhattan)	(212) 460-1119
				Richard Mariani (Mgr. – Westchester)	(914) 925-6026
Gas	All	Con Edison	Gas Engineering	http://maps/steam.htm[1]	--
			For Questions contact:	Mike Verlizzo (Mgr.)	(718) 319-2357
Steam	All	Con Edison	Steam Engineering	http://maps/steam.htm[1]	--
			For Questions contact:	Tony Barbera	(212) 460-4843
Sewer /Water	NYC	NYC DEP /	Bureau of Water and Sewer Operations	Vincent Soriano/ Doug Greely	(718) 595-5330
Tunnels	Subway Crossing the East River	MTA	Outside Projects – Adjacent Work	Vasanth Battu/ Rajen Ydeshi / [If drilling in immediate vicinity of MTA structure, e.g., subway tunnel, car tunnel, etc., you will need submit a letter and plan drawing(s) to Mr. Ydeshi]	(646) 252-4473 (646) 252-3641
	Crossing the Hudson River	Port Authority of NY/NJ	Surveying	Richard Danko (rdanko@panynj.gov) Bill Kane (wkane@panynj.gov)	(201) 595-4841 (201) 595-4842

(1) "Maps" website listed is accessible on the Con Edison Intranet.

ARCADIS BBL
Infrastructure, environment, facilities

Underground / Overhead Utility Checklist

Project Name:	**Date:**
Project Number:	**Location:**
Prepared By:	**Project Manager:**

This checklist must be completed for any intrusive subsurface work such as excavation or drilling. It documents that overhead and underground utilities in the work area are identified and located. The Project Manager shall request utility markouts before the start of field operations to allow the client and utility companies sufficient time to provide them. If complete information is not available, a magnetometer or other survey shall be performed to locate obstacles prior to intrusive subsurface activities.

Procedure: A diagram of the work area depicting the proposed location of intrusive subsurface work sites (i.e., boring locations, excavation locations) must be attached to this form. The diagram must clearly indicate the areas checked for underground structures / utilities, and overhead power lines. This form and the diagram must be signed by the ARCADIS BBL Project Manager (if present), the ARCADIS BBL Site Supervisor, and the client representative.

Type of Structure	Present	Not Present	Method of Markout
Electric Power Line			
Natural Gas Line			
Telephone Line			
Water Line			
Product Line			
Sewer Line			
Steam Line			
Drain Line			
Underground Tank			
Underground Cable			
Overhead Power Line			
Overhead Product Line			
Other (Specify)			

Reviewed By		
Name:	Job Title:	Date:
	Client Representative	
	ARCADIS BBL Project Manager	
	ARCADIS BBL Site Supervisor	

Attachment C

Material Safety Data Sheets

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: o-Xylene **CAS Number:** 95-47-6
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_4(CH_3)_2$
EINECS Number: 202-422-2
ACX Number: X1001538-4
Synonyms: BENZENE,1,2-DIMETHYL-; 1,2-DIMETHYLBENZENE; O-DIMETHYLBENZENE; O-METHYLTOLUENE; 1,2-XYLENE; O-XYLENE; 2-XYLENE; O-XYLENE; ORTHO-XYLENE; O-XYLOL
General Use: Used as a general solvent in the manufacture of paints, varnishes, lacquers, thinners, inks, rubber, pesticides, herbicides and paint strippers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
o-xylene	95-47-6	>95

OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

NIOSH REL
TWA: 100 ppm (435 mg/m^3); STEL: 150 ppm (655 mg/m^3).

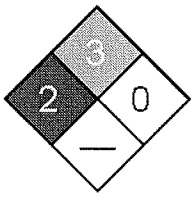
DFG (Germany) MAK
TWA: 100 ppm; PEAK: 200 ppm; skin.

ACGIH TLV
TWA: 100 ppm; STEL: 150 ppm.

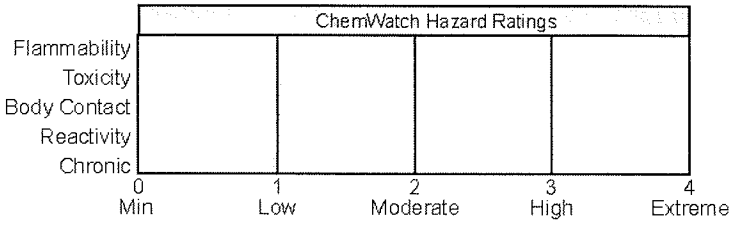
IDLH Level
900 ppm.

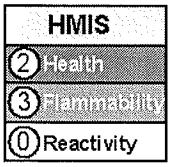
EU OEL
TWA: 50 ppm; STEL: 100 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, sweet smelling liquid. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, nausea, drowsiness. Chronic Effects: dermatitis, kidney/liver/peripheral nerve damage. May cause birth defects based on animal data. Flammable.

Potential Health Effects

Target Organs: central nervous system (CNS), eyes, gastrointestinal (GI) tract, liver, kidneys, skin
Primary Entry Routes: inhalation, skin absorption (slight), eye contact, ingestion
Acute Effects

Inhalation: Xylene is a central nervous system depressant. The vapor is discomforting to the upper respiratory tract and may be harmful if inhaled.
Inhalation hazard is increased at higher temperatures.
Toxic effects are increased by consumption of alcohol.
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.

Headache, fatigue, lassitude, irritability and gastrointestinal disturbances (e.g., nausea, anorexia and flatulence) are the most common symptoms of xylene overexposure. Injury to the heart, liver, kidneys and nervous system has also been noted among workers. Transient memory loss, renal impairment, temporary confusion and some evidence of disturbance of liver function was reported in three workers overcome by gross exposure to xylene (10000 ppm). One worker died and autopsy revealed pulmonary congestion, edema, and focal alveolar hemorrhage.

Volunteers inhaling xylene at 100 ppm for 5 to 6 hours showed changes in manual coordination, reaction time and slight ataxia. Tolerance developed during the workweek but was lost over the weekend. Physical exercise may antagonize this effect. Xylene body burden in humans exposed to 100 or 200 ppm xylene in air depends on the amount of body fat with 4% to 8% of total absorbed xylene accumulating in human adipose tissues.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is highly discomforting to the eyes.

Corneal changes have been reported in furniture polishers exposed to xylene.

Skin: The liquid is highly discomforting to the skin and may cause drying of the skin, which may lead to dermatitis and it is absorbed by the skin.

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 skin condition.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid is highly discomforting and toxic if swallowed.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; 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.

Small excess risks of spontaneous abortion and congenital malformation was reported among women exposed to xylene in the first trimester of pregnancy. In all cases however the women had also been exposed to other substances. Evaluation of workers chronically exposed to xylene has demonstrated a lack of genotoxicity. Exposure to xylene has been associated with increased risks of hemopoietic malignancies but, again simultaneous exposure to other substances (including benzene) complicate the picture. A long-term gavage study of mixed xylenes (containing 17% ethyl benzene) found no evidence of carcinogenic activity in rats and mice of either sex.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush 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. 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 xylene:

1.Gastrointestinal absorption is significant with ingestions.

For ingestions exceeding 1-2 mL (xylene)/kg, intubation and lavage with cuffed endotracheal tube is recommended.

The use of charcoal and cathartics is equivocal.

2. Pulmonary absorption is rapid with about 60-65% retained at rest.

3. Primary threat to life from ingestion and/or inhalation is respiratory failure.

4. 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.

5. 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.

6. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7. 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.

BIOLOGICAL EXPOSURE INDEX - BEI

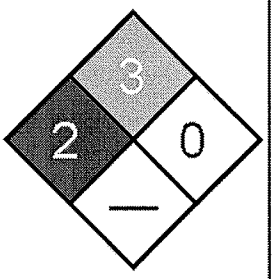
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Methylhippuric acids in urine	1.5 gm/gm creatinine	End of shift	
	2 mg/min	Last 4 hrs of shift.	

Section 5 - Fire-Fighting Measures

Flash Point: 32 °C Closed Cup
Autoignition Temperature: 463 °C
LEL: 1.0% v/v
UEL: 7% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
Other combustion products include carbon dioxide (CO_2).
Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Fire-Fighting Instructions: Contact 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 waterways.
If safe, switch off electrical equipment until vapor 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.

See DOT ERG



Fire Diamond

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.
Contact 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 waterways.
No smoking, bare 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 labeled 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 all personal contact, including inhalation.
Wear protective clothing when risk of overexposure 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 or ignition sources.
Avoid generation of static electricity. DO NOT use plastic buckets.
Ground all lines and equipment. Use spark-free tools when handling.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
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.
Plastic containers may only be used if approved for flammable liquids.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
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.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
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; Butyl rubber gloves or Neoprene gloves or PVC gloves.
Safety footwear.
Do NOT use this product to clean the skin.
Other: Overalls. Impervious protective clothing.
Eyewash unit.
Ensure there is ready access to an emergency shower.
Glove Selection Index:
PVA ..... Best selection
VITON ..... Best selection

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless flammable liquid with aromatic odor. Miscible in most organic solvents. Odor threshold: 0.2 to 2 ppm.

Physical State: Liquid
Odor Threshold: 0.05 ppm
Vapor Pressure (kPa): 0.5 at 15 °C
Vapor Density (Air=1): 3.66 at 15 °C
Formula Weight: 106.18
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 15 °C
Evaporation Rate: 0.7 Bu Ac=1

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 144.4 °C (292 °F) at 760 mm Hg
Freezing/Melting Point: -25 °C (-13 °F)
Volatile Component (% Vol): 100
Water Solubility: 0.02% by weight

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity
Inhalation (human) LC_{Lo}: 6125 ppm/12h
Intraperitoneal (mouse) LD_{50}: 1364 mg/kg
Paternal effects recorded.

Irritation
Nil reported

See *RTECS* ZE 2450000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Most is released into the atmosphere where it may photochemically degrade by reaction with hydroxyl radicals (half-life 1.5-15 hr). The dominant removal process in water is volatilization. It is moderately mobile in soil and may leach into groundwater where it has been known to be detectable for several years, although there is some evidence that it biodegrades in both soil and groundwater. Bioconcentration is not expected to be significant.
Ecotoxicity: LC_{50} Poecilia reticulata (guppy) 35 ppm/7 days /Conditions of bioassay not specified; LC_{50} Morone saxatilis (bass) 11.0 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Cancer magister (crab larvae stage I) 6 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 1.3 ppm/96 hr /Conditions of bioassay not specified
Henry's Law Constant: 5.1×10^{-3}
BCF: eels 1.33
Biochemical Oxygen Demand (BOD): 0 lb/lb, 5 days
Octanol/Water Partition Coefficient: log K_{ow} = 3.12
Soil Sorption Partition Coefficient: K_{oc} = soils 48 to 68

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Xylenes
ID: UN1307
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:**

Shipping Name and Description: Xylenes
ID: UN1307
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: III - Minor Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: B1, IB3, T2, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 203 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 60 L **Cargo aircraft only:** 220 L
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 1000 lb (453.5 kg)
SARA 40 CFR 372.65: 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 Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: m-Xylene **CAS Number:** 108-38-3
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_4(CH_3)_2$
EINECS Number: 203-576-3
ACX Number: X1001540-4
Synonyms: BENZENE,1,3-DIMETHYL-; 1,3-DIMETHYLBENZENE; M-DIMETHYLBENZENE; M-METHYLTOLUENE; 1,3-XYLENE; M-XYLENE; M-XYLENE; META-XYLENE; M-XYLOL
General Use: Used as a general solvent in the manufacture of paints, varnishes, lacquers, thinners, inks, rubber, pesticides, herbicides and paint strippers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
m-xylene	108-38-3	>95

OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

ACGIH TLV
TWA: 100 ppm; STEL: 150 ppm.

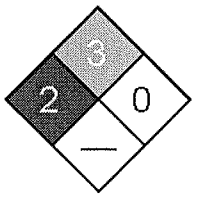
EU OEL
TWA: 50 ppm; STEL: 100 ppm.

NIOSH REL
TWA: 100 ppm (435 mg/m^3); STEL: 150 ppm (655 mg/m^3).

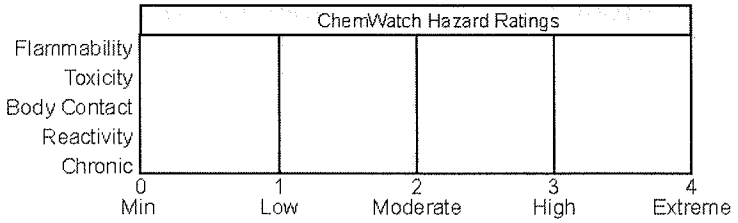
IDLH Level
900 ppm.

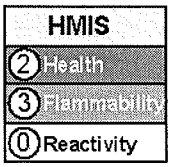
DFG (Germany) MAK
TWA: 100 ppm; PEAK: 200 ppm; skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, sweet smelling liquid. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, nausea, drowsiness. Chronic Effects: dermatitis, kidney/liver/peripheral nerve damage. May cause birth defects (animal data). Flammable.

Potential Health Effects

Target Organs: central nervous system (CNS), eyes, gastrointestinal (GI) tract, liver, kidneys, skin
Primary Entry Routes: inhalation, skin absorption (slight), eye contact, ingestion
Acute Effects
Inhalation: Xylene is a central nervous system depressant. The vapor is discomforting to the upper respiratory tract and may be harmful if inhaled.
Inhalation hazard is increased at higher temperatures.
Toxic effects are increased by consumption of alcohol.
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.

Headache, fatigue, lassitude, irritability and gastrointestinal disturbances (e.g., nausea, anorexia and flatulence) are the most common symptoms of xylene overexposure. Injury to the heart, liver, kidneys and nervous system has also been noted amongst workers. Transient memory loss, renal impairment, temporary confusion and some evidence of disturbance of liver function was reported in three workers overcome by gross exposure to xylene (10000 ppm). One worker died and autopsy revealed pulmonary congestion, edema, and focal alveolar hemorrhage.

Volunteers inhaling xylene at 100 ppm for 5 to 6 hours showed changes in manual coordination, reaction time and slight ataxia. Tolerance developed during the workweek but was lost over the weekend. Physical exercise may antagonize this effect. Xylene body burden in humans exposed to 100 or 200 ppm xylene in air depends on the amount of body fat with 4% to 8% of total absorbed xylene accumulating in human adipose tissues.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is highly discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Corneal changes have been reported in furniture polishers exposed to xylene.

Skin: The liquid is highly discomforting to the skin and may cause drying of the skin, which may lead to dermatitis and it is absorbed by the skin.

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 skin condition.

The material may produce severe skin irritation after prolonged or repeated exposure, and may produce a contact dermatitis (nonallergic).

This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis.

Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Prolonged contact is unlikely, given the severity of response, but repeated exposures may produce severe ulceration.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid is highly discomforting and toxic if swallowed.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Small excess risks of spontaneous abortion and congenital malformation was reported among women exposed to xylene in the first trimester of pregnancy. In all cases however the women had also been exposed to other substances. Evaluation of workers chronically exposed to xylene has demonstrated a lack of genotoxicity. Exposure to xylene has been associated with increased risks of hemopoietic malignancies but, again simultaneous exposure to other substances (including benzene) complicate the picture. A long-term gavage study of mixed xylenes (containing 17% ethyl benzene) found no evidence of carcinogenic activity in rats and mice of either sex.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

See DOT ERG

Eye Contact: Immediately hold the eyes open and flush 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.

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 xylene:

1. Gastrointestinal absorption is significant with ingestions.

For ingestions exceeding 1-2 mL (xylene)/kg, intubation and lavage with cuffed endotracheal tube is recommended.

The use of charcoal and cathartics is equivocal.

2.Pulmonary absorption is rapid with about 60-65% retained at rest.
3.Primary threat to life from ingestion and/or inhalation is respiratory failure.
4.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.
5.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.
6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
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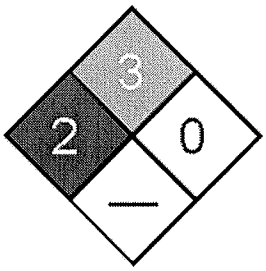
Autoignition Temperature: 527 °C
LEL: 1.1% v/v
UEL: 7.0% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
Other combustion products include carbon dioxide (CO_2).
Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Fire-Fighting Instructions: Contact 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 waterways.
If safe, switch off electrical equipment until vapor 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.

See DOT ERG



Fire Diamond

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.
Large Spills: Clear area of personnel and move upwind.
Contact 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 waterways.
No smoking, bare 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.

See DOT ERG

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 labeled 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 all personal contact, including inhalation.
Wear protective clothing when risk of overexposure 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 or ignition sources.
Avoid generation of static electricity. DO NOT use plastic buckets.
Ground all lines and equipment. Use spark-free tools when handling.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. 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.
Plastic containers may only be used if approved for flammable liquids.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
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.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
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; Butyl rubber gloves or Neoprene gloves or PVC gloves.
Safety footwear.
Do NOT use this product to clean the skin.
Respiratory Protection:
Exposure Range >100 to <900 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 900 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Other: Overalls. Impervious protective clothing.
Eyewash unit.
Ensure there is ready access to an emergency shower.
Glove Selection Index:
PVA ..... Best selection
VITON ..... Best selection

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless flammable liquid with aromatic odor. Miscible in most organic solvents. Odor threshold: 0.2 to 2 ppm. Vapor is heavier than air.

Physical State: Liquid
Odor Threshold: 4.00×10^{13} mol/cc
Vapor Pressure (kPa): 0.5 at 15 °C
Vapor Density (Air=1): 3.66 at 15 °C
Formula Weight: 106.18
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 15 °C

Evaporation Rate: 0.7 Bu Ac=1
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 139.3 °C (283 °F)
Freezing/Melting Point: -47.8 °C (-54.04 °F)
Volatile Component (% Vol): 100
Water Solubility: Slight

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 5000 mg/kg
Intraperitoneal (mouse) LD_{50}: 1739 mg/kg
Dermal (rabbit) LD_{50}: 14100 mg/kg

Effects on fertility, specific developmental abnormalities (craniofacial) recorded.

Irritation
Skin (rabbit): 0.01 mg/24h(open)
SEVERE
Skin (rabbit): 20 mg/24h - mod
Eye (rabbit): 5 mg/24h - SEVERE

See *RTECS* ZE 2275000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Most is released into the atmosphere where it may photochemically degrade by reaction with hydroxyl radicals (half-life 1-10 hr). The dominant removal process in water is volatilization. It is moderately mobile in soil and may leach into groundwater where it is known to persist for several years despite some evidence that it biodegrades in both soil and groundwater. Bioconcentration is not expected to be significant.
Ecotoxicity: LC_{50} Poecilia reticulata (guppy) 38 ppm/14 days /Conditions of bioassay not specified; LC_{100} Tetrahymena pyriformis (ciliate) 3.77 mmole/l/24 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 3.7 ppm/96 hr /Conditions of bioassay not specified; LD_{50} Goldfish 16 mg/l/24 hr /Modified ASTM D 1345 method; LC_{50} Morone saxatilis (striped bass) 9.2 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Cancer magister (crab larvae-stage I) 12 ppm/96 hr /Conditions of bioassay not specified
Henry's Law Constant: 0.314
BCF: eels 1.37
Biochemical Oxygen Demand (BOD): 0 lb/lb, 5 days
Octanol/Water Partition Coefficient: log K_{ow} = 3.20

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Xylenes
ID: UN1307
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L

Vessel Stowage: **Location:** B **Other:**

Shipping Name and Description: Xylenes
ID: UN1307
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: III - Minor Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: B1, IB3, T2, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 203 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 60 L **Cargo aircraft only:** 220 L
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 1000 lb (453.5 kg)
SARA 40 CFR 372.65: 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 Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Xylene **CAS Number:** 1330-20-7
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_4(CH_3)_2$
EINECS Number: 215-535-7
ACX Number: X1001166-8
Synonyms: BENZENE,DIMETHYL-; COMPONENT 1 (83%): XYLENES; COMPONENT 2 (17%): ETHYL BENZENE; DIMETHYLBENZENE; DIMETHYLBENZENES; EPA PESTICIDE CHEMICAL CODE 086802; KSYLEN; METHYL TOLUENE; METHYLTOLUENE; VIOLET 3; XILOLI; XYLENE; XYLENEN; XYLOL; XYLOLE
General Use: A strong solvent for general use in the manufacture of paints, varnishes, lacquers, thinners, inks, rubber, pesticides, herbicides and paint strippers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
xylene	1330-20-7	> 95

OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

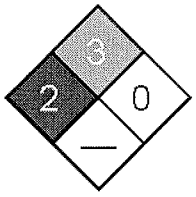
NIOSH REL
TWA: 100 ppm, 435 mg/m^3; STEL: 150 ppm, 655 mg/m^3.

DFG (Germany) MAK
TWA: 100 ppm; PEAK: 200 ppm; skin.

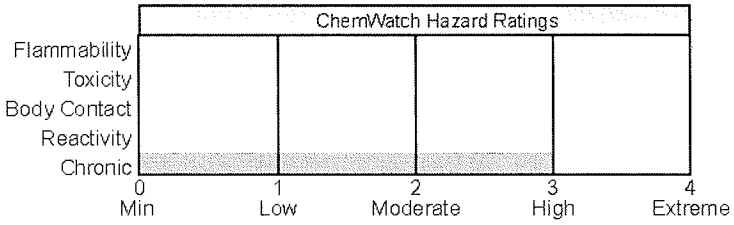
ACGIH TLV
TWA: 100 ppm; STEL: 150 ppm.

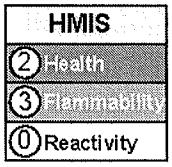
EU OEL
TWA: 50 ppm; STEL: 100 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, sweet smelling liquid. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, nausea, drowsiness. Chronic Effects: dermatitis, kidney/liver/peripheral nerve damage. May cause birth defects (animal data). Flammable.

Potential Health Effects

Target Organs: central nervous system (CNS), eyes, gastrointestinal (GI) tract, liver, kidneys, skin
Primary Entry Routes: inhalation, skin absorption (slight), eye contact, ingestion
Acute Effects
Inhalation: Xylene is a central nervous system depressant. The vapor is discomforting to the upper respiratory tract and may be harmful if inhaled.
Inhalation hazard is increased at higher temperatures.
Toxic effects are increased by consumption of alcohol.
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.
Headache, fatigue, lassitude, irritability and gastrointestinal disturbances (e.g., nausea, anorexia and flatulence) are the most common symptoms of xylene overexposure. Injury to the heart, liver, kidneys and nervous system has also been noted among workers. Transient memory loss, renal impairment, temporary confusion and some evidence of disturbance of liver function was reported in three workers overcome by gross exposure to xylene (10000 ppm). One worker died and autopsy revealed pulmonary congestion, edema, and focal alveolar hemorrhage.
Volunteers inhaling xylene at 100 ppm for 5 to 6 hours showed changes in manual coordination, reaction time and slight ataxia. Tolerance developed during the workweek but was lost over the weekend. Physical exercise may antagonize this effect. Xylene body burden in humans exposed to 100 or 200 ppm xylene in air depends on the amount of body fat with 4% to 8% of total absorbed xylene accumulating in human adipose tissues.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.
The vapor is highly discomforting to the eyes.
The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
Corneal changes have been reported in furniture polishers exposed to xylene.

Skin: The liquid is highly discomforting to the skin and may cause drying of the skin, which may lead to dermatitis and it is absorbed by the skin.
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 skin condition.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

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.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; 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.
Small excess risks of spontaneous abortion and congenital malformation was reported amongst women exposed to xylene in the first trimester of pregnancy. In all cases however the women had also been exposed to other substances.
Evaluation of workers chronically exposed to xylene has demonstrated a lack of genotoxicity. Exposure to xylene has been associated with increased risks of hemopoietic malignancies but, again simultaneous exposure to other substances (including benzene) complicate the picture. A long-term gavage study of mixed xylenes (containing 17% ethyl benzene) found no evidence of carcinogenic activity in rats and mice of either sex.
Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis).

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If available, administer medical oxygen by trained personnel.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

See DOT ERG

Eye Contact: Immediately hold the eyes open and flush 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.
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 xylene:
1. Gastrointestinal absorption is significant with ingestions.

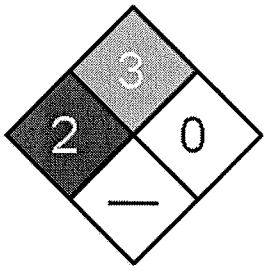
For ingestions exceeding 1-2 mL (xylene)/kg, intubation and lavage with cuffed endotracheal tube is recommended. The use of charcoal and cathartics is equivocal.
2.Pulmonary absorption is rapid with about 60-65% retained at rest.
3.Primary threat to life from ingestion and/or inhalation is respiratory failure.
4.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.
5.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.
6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7.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.
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Methylhippuric acids in urine	1.5 gm/gm creatinine	End of shift	
	2 mg/min	Last 4 hrs of shift.	

Section 5 - Fire-Fighting Measures

Flash Point: 25.6 °C
Autoignition Temperature: 241 °C
LEL: 1.0% v/v
UEL: 7.0% v/v
Extinguishing Media: Alcohol stable foam; dry chemical powder; carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
Other combustion products include carbon dioxide (CO_2).
Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Fire-Fighting Instructions: Contact 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 waterways.
If safe, switch off electrical equipment until vapor 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.

See DOT ERG



Fire Diamond

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.
Large Spills: Clear area of personnel and move upwind.
Contact 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 waterways.
No smoking, bare lights or ignition sources. Increase ventilation.

See DOT ERG

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 labeled 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 all personal contact, including inhalation.
Wear protective clothing when risk of overexposure 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 or ignition sources.
Avoid generation of static electricity. DO NOT use plastic buckets.
Ground all lines and equipment. Use spark-free tools when handling.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
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.
Plastic containers may only be used if approved for flammable liquids.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
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.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
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; Butyl rubber gloves or Neoprene gloves or PVC gloves.
Safety footwear.
Do NOT use this product to clean the skin.
Other: Overalls. Impervious protective clothing.
Eyewash unit.
Ensure there is ready access to an emergency shower.
Glove Selection Index:

PE/EVAL/PE	Best selection
PVA	Best selection
VITON	Best selection
TEFLON	Best selection
PVDC/PE/PVDC	Poor to dangerous choice for other than short-term immersion
NATURAL+NEOPRENE	Poor to dangerous choice for other than short-term immersion
NEOPRENE/NATURAL	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
HYPALON	Poor to dangerous choice for other than short-term immersion
NAT+NEOPR+NITRILE	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion
BUTYL/NEOPRENE	Poor to dangerous choice for other than short-term immersion

NITRILE ..... Poor to dangerous choice for other than short-term immersion
NEOPRENE ..... Poor to dangerous choice for other than short-term immersion
PVC ..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear colorless flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid
Odor Threshold: 5.00 x10^{-5} ppm
Vapor Pressure (kPa): 0.5 at 15 °C
Vapor Density (Air=1): 3.66 at 15 °C
Formula Weight: 106.18
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 15 °C
Evaporation Rate: 0.7 Bu Ac=1

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 137 °C (279 °F) to 140 °C (284 °F)
Freezing/Melting Point: -47 °C (-53 °F)
Volatile Component (% Vol): 100
Water Solubility: Practically insoluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity
Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 4300 mg/kg
Inhalation (human) TC_{Lo}: 200 ppm
Inhalation (man) LC_{Lo}: 10000 ppm/6h
Inhalation (rat) LC_{50}: 5000 ppm/4h
Reproductive effector in rats

Irritation
Skin (rabbit):500 mg/24h moderate
Eye (human): 200 ppm irritant
Eye (rabbit): 87 mg mild
Eye (rabbit): 5 mg/24h SEVERE

See *RTECS* ZE 2100000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Most of the xylenes are released into the atmosphere where they may photochemically degrade by reaction with hydroxyl radicals (half-life 1-18 hr). The dominant removal process in water is volatilization. Xylenes are moderately mobile in soil and may leach into groundwater where they are known to persist for several years, despite some evidence that they biodegrade in both soil and groundwater. Bioconcentration is not expected to be significant.

Ecotoxicity: LC_{50} Rainbow trout 13.5 mg/l/96 hr /Conditions of bioassay not specified; LD_{50} Goldfish 13 mg/l/24 hr /Conditions of bioassay not specified

Henry's Law Constant: 0.22

BCF: estimated at 2.14 to 2.20

Octanol/Water Partition Coefficient: log K_{ow} = 3.12 to 3.20

Soil Sorption Partition Coefficient: K_{oc} = 48 to 68

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Xylenes
ID: UN1307
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:**

Shipping Name and Description: Xylenes
ID: UN1307
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: III - Minor Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: B1, IB3, T2, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 203 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 60 L **Cargo aircraft only:** 220 L
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U239 Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 100 lb (45.35 kg)
SARA 40 CFR 372.65: 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 Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Toluene **CAS Number:** 108-88-3
Chemical Formula: C_7H_8
Structural Chemical Formula: $C_6H_5CH_3$
EINECS Number: 203-625-9
ACX Number: X1001512-0
Synonyms: ANTISAL 1A; BENZENE,METHYL-; CP 25; METHACIDE; METHANE,PHENYL-; METHYL BENZENE; METHYL BENZOL; METHYLBENZENE; METHYLBENZOL; PHENYL METHANE; PHENYLMETHANE; TOLUEEN; TOLUEN; TOLUENE; TOLUENO; TOLUOL; TOLUOLO; TOLU-SOL
General Use: Used as a solvent for paint, resins, lacquers inks & adhesives. Component of solvent blends and thinners; in gasoline and aviation fuel. Used in the manufacture of chemicals, dyes, explosives, benzoic acid.
Some grades of toluene may contain traces of xylene and benzene.
Odor threshold: 2 ppm approx. Odor is not a reliable warning property due to olfactory fatigue.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
toluene	108-88-3	> 99.5

OSHA PEL
TWA: 200 ppm; Ceiling: 300 ppm; 500 ppm, 10-minute maximum peak.

ACGIH TLV
TWA: 50 ppm; skin.

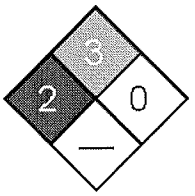
EU OEL
TWA: 192 mg/m^3 (50 ppm); STEL: 384 mg/m^3 (100 ppm).

NIOSH REL
TWA: 100 ppm (375 mg/m^3); STEL: 150 ppm (560 mg/m^3).

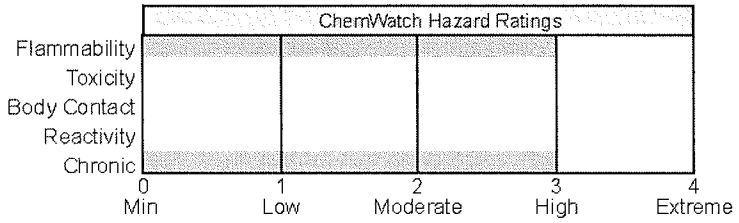
IDLH Level
500 ppm.

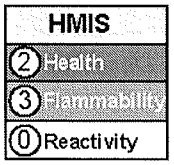
DFG (Germany) MAK
TWA: 50 ppm; PEAK: 200 ppm; skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sickly, sweet odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: weakness, headache, dizziness, confusion, insomnia. Chronic Effects: liver/kidney damage, may cause birth defects. Flammable.

Potential Health Effects

Target Organs: Skin, liver, kidneys, central nervous system.
Primary Entry Routes: Inhalation, skin contact/absorbtion.
Acute Effects
Inhalation: The vapor is highly discomforting to the upper respiratory tract.
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.
Central nervous system (CNS) depression may include nonspecific discomfort, symptoms of giddiness, headache, dizziness, nausea, anesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal.

Eye: The liquid produces a high level of eye discomfort and is capable of causing pain and severe conjunctivitis.
Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.
The vapor is discomforting to the eyes if exposure is prolonged.
The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.
Defatting and/or drying of the skin may lead to dermatitis and it is absorbed by skin.
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 skin condition.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

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.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.
Chronic toluene habituation occurs following intentional abuse (glue-sniffing) or from occupational exposure. Ataxia, incoordination and tremors of the hands and feet (as a consequence of diffuse cerebral atrophy), headache, abnormal speech, transient memory loss, convulsions, coma, drowsiness, reduced color perception, frank blindness, nystagmus (rapid, involuntary eye-movements), decreased hearing leading to deafness and mild dementia have all been associated with chronic abuse.
Peripheral nerve damage, encephalopathy, giant axonopathy, electrolyte disturbances in the cerebrospinal fluid and abnormal computer tomographic (CT) scans are common amongst toluene addicts. Although toluene abuse has been linked with kidney disease, this does not commonly appear in cases of occupational toluene exposures. Cardiac and hematological toxicity are however associated with chronic toluene exposure. Cardiac arrhythmia, multifocal and premature ventricular contractions and supraventricular tachycardia are present in 20% of patients who abused toluene-containing paints.
Previous suggestions that chronic toluene inhalation produced human peripheral neuropathy have largely been discounted. However central nervous system (CNS) depression is well documented where blood toluene levels exceed 2.2 mg%. Toluene abusers can achieve transient circulating concentrations of 6.5 mg%. Amongst workers exposed for a median time of 29 years to toluene no subacute effects on neurasthenic complaints and pyschometric test results could be established.
The prenatal toxicity of very high toluene concentrations has been documented for several animal species and man. Malformations indicative of specific teratogenicity have not generally been found. The toxicity described in the literature takes the form of embryo death or delayed fetal growth and delayed skeletal system development. Permanent damage of children has been seen only when mothers had suffered from chronic intoxication as a result of "sniffing".

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 flush 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.
Do NOT induce vomiting. Give a glass of water.
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Following acute or short-term repeated exposures to toluene:
1. Toluene is absorbed across to alveolar barrier, the blood/air mixture being 11.2/15.6 (at 37 °C) The order of toluene, in expired breath, is of the order of 18 ppm following sustained exposure to 100 ppm.
The tissue/blood proportion is 1/3 except in adipose where the proportion is 8/10.
2.Metabolism by microsomal mono-oxygenation, results in the production of hippuric acid. This may be detected in the urine in amounts between 0.5 and 2.5 g/24hr which represents, on average 0.8 gm/gm of creatinine.
The biological half life of hippuric acid is in the order of 1-2 hours.
3.Primary threat to life from ingestion and/or inhalation is respiratory failure.
4.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.
5.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.
6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7.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.
8.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

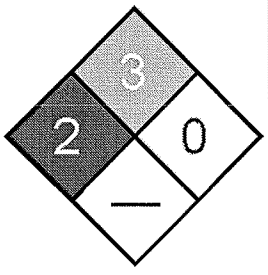
Determinant	Index	Sampling Time	Comments
Hippuric acid in urine	2.5 gm/gm creatinine	End of shift Last 4 hrs of shift	B,NS
Toluene in venous blood	1 mg/L	End of shift	SQ
Toluene in end-exhaled air		End of shift	SQ

NS: Non-specific determinant; also observed after exposure to other material
SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.
B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - Fire-Fighting Measures

Flash Point: 4 °C Closed Cup
Autoignition Temperature: 480 °C
LEL: 1.2% v/v
UEL: 7.1% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
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) and carbon dioxide (CO_2).

See DOT ERG



Fire Diamond

Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Nitric acid with toluene, produces nitrated compounds which are explosive.
Fire-Fighting Instructions: Contact 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 waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control the 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 protective 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.
Contact 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 waterways. Consider evacuation.
No smoking, bare 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 labeled 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 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; Metal safety cans. Packing as supplied by manufacturer.
Plastic containers may only be used if approved for flammable liquid.
Check that containers are clearly labeled and free from leaks.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area; local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in special circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator. Correct fit is essential to ensure adequate protection.
Provide adequate ventilation in warehouses and enclosed storage areas.

In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; chemical goggles. Full face shield.

DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

Respiratory Protection:

Exposure Range >200 to <500 ppm: Air Purifying, Negative Pressure, Half Mask

Exposure Range 500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: black

Other: Overalls. Barrier cream. Eyewash unit.

Glove Selection Index:

PE/EVAL/PE	Best selection
VITON/CHLOROBUTYL	Best selection
VITON	Best selection
PVA	Best selection
TEFLON	Satisfactory; may degrade after 4 hours continuous immersion
SARANEX-23 2-PLY	Poor to dangerous choice for other than short-term immersion
CPE	Poor to dangerous choice for other than short-term immersion
VITON/NEOPRENE	Poor to dangerous choice for other than short-term immersion
SARANEX-23	Poor to dangerous choice for other than short-term immersion
NEOPRENE/NATURAL	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
NITRILE	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid

Odor Threshold: 2.14 ppm

Vapor Pressure (kPa): 2.93 at 20 °C

Vapor Density (Air=1): 3.2

Formula Weight: 92.14

Specific Gravity (H_2O=1, at 4 °C): 0.87 at 20 °C

Evaporation Rate: 2.4 (BuAc=1)

pH: Not applicable

pH (1% Solution): Not applicable.

Boiling Point: 111 °C (232 °F) at 760 mm Hg

Freezing/Melting Point: -95 °C (-139 °F)

Volatile Component (% Vol): 100

Water Solubility: < 1 mg/mL at 18 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from strong oxidizers.

Section 11 - Toxicological Information

Toxicity

Oral (human) LD_{Lo}: 50 mg/kg

Oral (rat) LD_{50}: 636 mg/kg

Inhalation (human) TC_{Lo}: 100 ppm

Inhalation (man) TC_{Lo}: 200 ppm

Inhalation (rat) LC_{50}: > 26700 ppm/1h

Dermal (rabbit) LD_{50}: 12124 mg/kg

Reproductive effector in rats

Irritation

Skin (rabbit): 20 mg/24h-moderate

Skin (rabbit): 500 mg - moderate

Eye (rabbit): 0.87 mg - mild

Eye (rabbit): 2 mg/24h - SEVERE

Eye (rabbit): 100 mg/30sec - mild

See *RTECS* XS 5250000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be lost by evaporation from near-surface soil and by leaching to the groundwater. Biodegradation occurs both in soil and groundwater, but it is apt to be slow especially at high concentrations, which may be toxic to microorganisms. The presence of acclimated microbial populations may allow rapid biodegradation. It will not significantly hydrolyze in soil or water under normal environmental conditions. If released into water, its concentration will decrease due to evaporation and biodegradation. This removal can be rapid or take several weeks, depending on temperature, mixing conditions, and acclimation of microorganisms. It will not significantly adsorb to sediment or bioconcentrate in aquatic organisms. If released to the atmosphere, it will degrade by reaction with photochemically produced hydroxyl radicals (half-life 3 hr to slightly over 1 day) or be washed out in rain. It will not be subject to direct photolysis.

Ecotoxicity: LC_{50} Aedes aegypti-4th instar (mosquito larvae) 22 mg/l /Conditions of bioassay not specified; LC_{50} Cyprinodon variegatus (sheepshead minnow) 277-485 mg/l 96 hr /Conditions of bioassay not specified; LC_{50} Calandra granaria (grain weevil) 210 mg/l /in air; LC_{50} Cancer magister (crab larvae stage I) 28 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 4.3 ppm 96 hr /Conditions of bioassay not specified; LC_{50} Artemia salina (brine shrimp) 33 mg/l 24 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (striped bass) 7.3 mg/l 96 hr /Conditions of bioassay not specified; LC_{50} Pimephales promelas (fathead minnows) 55-72 mg/l (embryos), 25-36 mg/l (1-day posthatch protolarvae), and 26-31 mg/l (30-day-old minnows)/ 96 hour /Conditions of bioassay not specified

Henry's Law Constant: 0.0067

BCF: eels 13.2

Biochemical Oxygen Demand (BOD): 0%, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 2.69

Soil Sorption Partition Coefficient: K_{oc} = silty loam 37

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Toluene
ID: UN1294
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U220 Toxic Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Material Safety Data Sheet Collection
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1171 RiverFront Center, Amsterdam, NY 12010
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Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Sodium Cyanide **CAS Number:** 143-33-9
Chemical Formula: CNNa
Structural Chemical Formula: NaCN
EINECS Number: 205-599-4
ACX Number: X1000111-9
Synonyms: CIANURO DI SODIO; M-44 CYANIDE CAPSULES; CYANIDE OF SODIUM; CYANOBRIK; CYANOGRAN; CYANURE DE SODIUM; CYMAG; EPA PESTICIDE CHEMICAL CODE 074002; HYDROCYANIC ACID,SODIUM SALT; KYANID SODNY; SODIUM CYANIDE; SODIUM SALT OF HYDROCYANIC ACID
Derivation: By absorption of hydrogen cyanide in a solution of sodium hydroxide with subsequent vacuum evaporation; by heating sodium amide with carbon; or by melting sodium chloride and calcium cyanamide together in an electric furnace.
General Use: In the heat treatment of metals (case-hardening), the extraction of gold and silver from ores, electroplating operations (coppering, zincing), the manufacture of dyes, pigments, hydrogen cyanide, hydrocyanic acid, and mirrors; cleaning metals; insecticides; formerly for fumigation of citrus and other fruit trees, railway cars, ships, and warehouses; nylon intermediates; for ore flotation; and as a chelating compound.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Sodium Cyanide	143-33-9	95-98% wt

Mixtures of sodium cyanide with sodium chloride or carbonate for special uses are also marketed, as well as other grades, including 30% solution; 73-75%; 96-98%; reagent; technical; and granular briquettes.

OSHA PEL
TWA: 5 mg/m^3; skin, as CN.

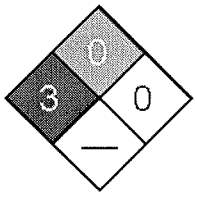
ACGIH TLV
Ceiling: 5 mg/m^3; skin.

NIOSH REL
Ceiling: 5 mg/m^3 (4.7 ppm) (10-minute).

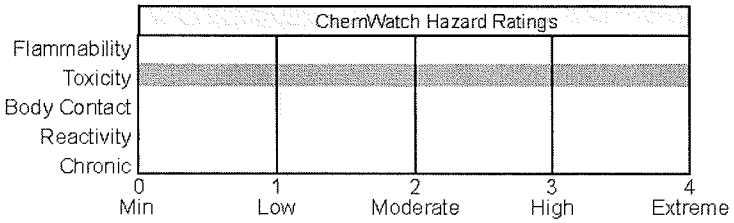
IDLH Level
25 mg/m^3 (as CN).

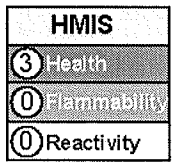
DFG (Germany) MAK
TWA: 3.8 mg/m^3; PEAK: 3.8 mg/m^3; skin; measured as inhalable fraction of the aerosol.

Section 3 - Hazards Identification

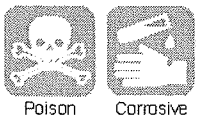


Fire Diamond





ANSI Signal Word
Danger!


Poison Corrosive

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White, granular or crystalline solid; faint, almond-like odor, odorless when dry. Corrosive to eyes/skin; irritating to respiratory tract. Poison. Produces hydrogen cyanide gas upon contact with acid/water.

Potential Health Effects

Target Organs: Eyes; skin; upper respiratory, cardiovascular, and central nervous systems; thyroid; blood.
Primary Entry Routes: Inhalation; skin absorption; skin and/or eye contact; ingestion.
Acute Effects
Inhalation: Irritation of the nose and throat. Systemic symptoms like those seen via ingestion may also be caused by absorption through the mucous membranes. Nose irritation leading to obstruction, bleeding, sloughs, and in some cases septum perforation has been reported in workers in the electroplating industry.

Eye: Irritation and possible burns. Dilated pupils are common in severe poisoning. Corneal edema (swelling) may occur. Human poisoning cases due to eye exposure only have not been reported.

Skin: Itching, irritation, discoloration (bright pink color), dermatitis, rash, or corrosion (burns) may occur. Systemic symptoms like those seen via ingestion may also be caused by skin absorption. Mild systemic symptoms such as headache and dizziness have been caused by solutions as dilute as 0.5% sodium cyanide.

Ingestion: Chemical asphyxia and death may occur without warning from severe exposure. Initial symptoms of lesser exposure include burning, acrid, bitter taste upon ingestion, weakness, headache, flushing, dizziness, confusion, salivation, nausea and vomiting, hyperventilation, bradycardia (slowed heart beat), hypertension (high blood pressure), and anxiety. These may progress to increased rate and depth of respiration, slow and gasping respiration, pulmonary edema (fluid in lungs), lactic acidosis (abnormal accumulation of lactic acid in blood resulting in a metabolic derangement), stupor, seizures, coma, apnea (absence of breathing), tachycardia (rapid heart beat), hypotension (low blood pressure), and death.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Not listed; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Disorders of the skin, thyroid, and cardiovascular, upper respiratory, and central nervous systems.

Chronic Effects: Dermatitis, scarlet rash and papules, and itching have been reported in workers in the electroplating industry. Other symptoms may include headache, weakness, nausea, dizziness, loss of appetite, insomnia, memory loss, tremors, functional changes in hearing, enlarged thyroid gland, folate abnormalities, palpitations, chest discomfort, upper respiratory tract irritation, nose bleeds, and eye irritation.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: *Note!* The odor of bitter almonds may be noted on the breath or vomitus. Remove exposed person to fresh air and immediately begin therapy with 100% oxygen.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist immediately if irritation or pain develop.

Skin Contact: *Quickly* remove contaminated clothing. Speed is extremely important. Rinse with flooding amounts of water for at least 15 min. Wash exposed area extremely thoroughly with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, *do not* induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Determine hemoglobin, arterial blood gases, venous pO_2 or measured versus $\%O_2$ saturation, serum lactate, electrolytes, and whole blood cyanide levels. If the victim is unconscious, bradycardia and absence of cyanosis may be key diagnostic signs. For cases of ingestion, perform gastric lavage with a large bore tube after endotracheal intubation.

Special Precautions/Procedures: Note! *In all cases of exposure where absorption may occur (i.e. inhalation, skin contact, and ingestion), administer 100% oxygen immediately and obtain and prepare the cyanide antidote kit for use in symptomatic patients.*

To prevent self-poisoning, avoid mouth-to-mouth resuscitation during CPR. To avoid becoming a secondary victim, *do not* enter areas with high potent ial airborne concentrations without donning a self-contained breathing apparatus (SCBA). Give specific and detailed instructions on the use of cyanide antidote kits to all persons working with an d around sodium cyanide.

Section 5 - Fire-Fighting Measures

See DOT ERG

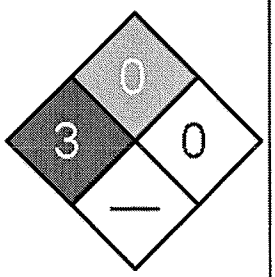
Flash Point: Noncombustible

Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.

Extinguishing Media: Use extinguishing media suitable for the surrounding fire. Do not use water directly on spilled sodium cyanide. *Do not* use carbon dioxide extinguishers; this can liberate hydrogen cyanide by the action of the dissolved carbon dioxide.



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Nitrogen and sodium oxides and cyanide. Containers may explode violently in the heat of fire. Material may be transported in a molten form.

Fire-Fighting Instructions: If feasible and without undue risk, move containers from fire hazard area. *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing is *not* effective for sodium cyanide. Remove and isolate contaminated clothing at the site.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel immediately, evacuate all unnecessary personnel, and isolate and ventilate area. Cleanup personnel should wear fully-encapsulating protective clothing to protect against inhalation and skin and eye contact.

Small Spills: Neutralize with a strong alkali solution of calcium hypochlorite. Carefully scoop up the spilled sodium cyanide and place in dry containers for disposal or reclamation. For sodium cyanide solution spills, take up with a noncombustible, absorbent material such as sand or vermiculite and place in containers for later disposal.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. Prompt cleanup and removal are necessary. To avoid generating dust, *do not* sweep! Remove residue by vacuuming (with an appropriate HEPA filter) or flushing with a liberal quantity of water.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all contact with sodium cyanide. Use only with ventilation sufficient to reduce airborne concentrations to nonhazardous levels. Wear appropriate personal protective equipment to protect against skin and eye contact. Make cyanide antidote kits readily available in all areas where sodium cyanide is used. Replace ingredients of kits every 1-2 yr to ensure freshness. Practice good personal hygiene procedures to avoid inadvertently ingesting sodium cyanide.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using sodium cyanide, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from water, acids, carbon dioxide, oxidizers, and other incompatibles (Sec. 10). Protect from physical damage. Keep containers covered or in exhausted hood when not in use.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose all operations to avoid dust dispersion into the workplace. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical exams with emphasis on the cardiovascular, upper respiratory, and nervous systems, skin, and thyroid. Maintain pertinent medical records for 5 years following the last exposure. Educate workers about the hazards of sodium cyanide and train in emergency first aid procedures for cyanide poisoning.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. With breakthrough times of > 8 hr, natural rubber, Neoprene, nitrile rubber, and polyvinyl chloride are recommended materials for PPE for sodium cyanide (solid). Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For concentrations <= 25 mg/m^3, wear a supplied-air respirator or any SCBA with a full facepiece. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode or any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure- demand or other positive-pressure mode. If respirators are used, OSHA requires a written respiratory protection program.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove sodium cyanide from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: White, deliquescent, powder, granular, egg-shaped, or flake form. It is odorless when dry, but may have the characteristic cyanide almond odor when wet.

Physical State: Solid

Vapor Pressure (kPa): ~0 mm Hg at 68 °F (20 °C); 1 mm Hg at 1503 °F (817 °C); 0.76 mm Hg at 1472 °F (800 °C)

Formula Weight: 49.01

Specific Gravity (H_2O=1, at 4 °C): 1.60 at 77 °F (25 °C) (solid)

Refractive Index: 1.452

pH: Aqueous solutions are strongly alkaline.

Boiling Point: 2725 °F (1496 °C)

Freezing/Melting Point: 1047 °F (563 °C)

Viscosity: 26% aqueous solution: 4 cP at 86 °F (30 °C) **Other Solubilities:** Slightly soluble in alcohol.
Water Solubility: Soluble

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Sodium cyanide is stable at room temperature in closed containers under normal storage and handling conditions. A solution of sodium cyanide in water slowly decomposes to release ammonia. Hazardous polymerization cannot occur. Avoid contact with acids and acid fumes and other incompatibles.

Storage Incompatibilities: Violent reactions occur with fluorine, magnesium, nitrates, nitric acid, and nitrites. It explodes when melted with nitrite or chlorate at about 842 °F (450 °C). Sodium cyanide reacts with acids (even weak) or acid fumes to release highly toxic hydrogen cyanide gas and sodium oxide. Hydrogen cyanide gas is also released when sodium cyanide is dissolved in and reacts with water. However, unless this occurs in a closed space, the amount is too small to be hazardous. Sodium cyanide also reacts with carbon dioxide in the air to release hydrogen cyanide gas. It is corrosive to aluminum.

Hazardous Decomposition Products: Thermal oxidative decomposition of sodium cyanide can produce nitrogen and sodium oxides and cyanide.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD_{50}: 6440 µg/kg.
Man, TD_{Lo}: 714 µg/kg caused hallucinations, distorted perceptions, and muscle weakness.
Human, LD_{Lo}: 2857 µg/kg.

Other Effects:

Hamster, implant: 5999 mg/kg administered to a female during 6-9 days of pregnancy caused fetotoxicity and specific developmental abnormalities of the musculoskeletal and cardiovascular systems.
D. melanogaster: 200 ppb inhaled caused sex chromosome loss/nondisjunction.

See *RTECS* VZ7525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: Fathead minnows, TL_m, 96 hr: 0.23 ppm. Bluegill, TL_m, 96 hr: 0.15 ppm. Trout, lethal, 1 hr: 2 ppm.

Section 13 - Disposal Considerations

Disposal: Add sodium cyanide with stirring to a strong alkaline solution of calcium hypochlorite. Let stand 24 hr and route to sewage plant (only with approval from local municipality). Sodium cyanide is a poor candidate for incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. Handle empty containers carefully as hazardous residues may remain.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Sodium cyanide
ID: UN1689
Hazard Class: 6.1 - Poisonous materials
Packing Group: I - Great Danger
Symbols:
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: B69, B77, IB7, IP1, N74, N75, T14, TP2, TP13
Packaging: **Exceptions:** None **Non-bulk:** 211 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 kg **Cargo aircraft only:** 50 kg
Vessel Stowage: **Location:** B **Other:** 52

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed P106
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 10 lb (4.535 kg)
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Listed
RQ: 10 lb
TPQ: 100 lb
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 Collection
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Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Potassium Cyanide **CAS Number:** 151-50-8
Chemical Formula: CKN
Structural Chemical Formula: KCN
EINECS Number: 205-792-3
ACX Number: X1000070-3
Synonyms: M-44 CAPSULES (POTASSIUM CYANIDE); CYANIDE OF POTASSIUM; CYANURE DE POTASSIUM; EPA PESTICIDE CHEMICAL CODE 599600; HYDROCYANIC ACID,POTASSIUM SALT; KALIUM CYANID; POTASSIUM CYANIDE; POTASSIUM SALT OF HYDROCYANIC ACID
Derivation: By absorption of hydrogen cyanide in potassium hydroxide.
General Use: In the extraction of gold and silver from ores; metal cleaning; heat treatment of metals; electroplating; as a reagent in analytical chemistry; raw material in the manufacture of dyes, pigments, nylon, and chelating agents; an insecticide; and a fumigant.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Potassium Cyanide		ca 95 % wt (commercial); other grades include pure, solution, and reagent. Trace Impurities: potassium carbonate, formate, and hydroxide.

OSHA PEL
TWA: 5 mg/m^3; skin, as CN.

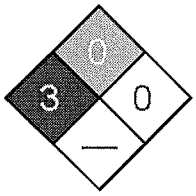
ACGIH TLV
Ceiling: 5 mg/m^3; skin.

NIOSH REL
Ceiling: 5 mg/m^3 (4.7 ppm) (10-minute).

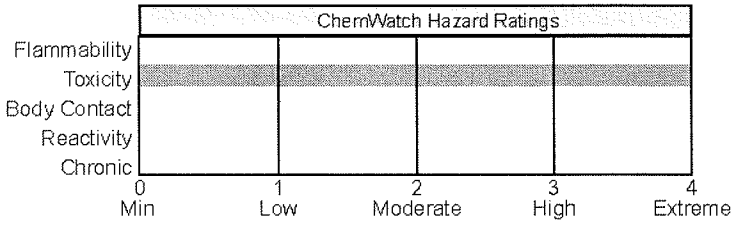
IDLH Level
25 mg/m^3 (as CN).

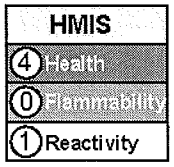
DFG (Germany) MAK
TWA: 5 mg/m^3; PEAK: 5 mg/m^3; skin; measured as inhalable fraction of the aerosol.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


Poison Corrosive

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆
White, amorphous, deliquescent lumps or a crystalline mass; faint odor of bitter almonds. Corrosive to eyes/skin. Poison. Reacts with water.

Potential Health Effects

Target Organs: Eyes; skin; upper respiratory, cardiovascular, and central nervous systems; thyroid; blood.
Primary Entry Routes: Inhalation; skin absorption; skin and/or eye contact; ingestion.
Acute Effects
Inhalation: Irritation of the nose and throat and systemic symptoms like those seen via ingestion may also be caused by absorption through the mucous membranes. Nose irritation leading to obstruction, bleeding, sloughs, and in some cases septum perforation has been reported in workers in the electroplating industry.
Eye: Irritation and possible burns. Dilated pupils are common in severe poisoning. Corneal edema (swelling) may occur. Human poisoning cases due to eye exposure only have not been reported.
Skin: Itching, irritation, discoloration (bright pink color), dermatitis, rash, or corrosion (burns) may occur. Systemic symptoms like those seen via ingestion may also be caused by skin absorption. Mild systemic symptoms such as headache and dizziness have been caused by solutions as dilute as 0.5% potassium cyanide.

Ingestion: Chemical asphyxia and death may occur without warning from severe exposure. Initial symptoms of lesser exposure include burning, acrid, bitter taste upon ingestion, weakness, headache, flushing, dizziness, confusion, salivation, nausea and vomiting, hyperventilation, bradycardia (slowed heart beat), hypertension (high blood pressure), and anxiety. These may progress to increased rate and depth of respiration, slow and gasping respiration, pulmonary edema (fluid in lungs), lactic acidosis (abnormal accumulation of lactic acid in the blood resulting in a metabolic derangement), stupor, seizures, coma, apnea (absence of breathing), tachycardia (rapid heart beat), hypotension (low blood pressure), and death.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Disorders of the skin, thyroid, and cardiovascular, upper respiratory, and central nervous systems.

Chronic Effects: Dermatitis, scarlet rash and papules, and itching have been reported in workers in the electroplating industry. Other symptoms may include headache, weakness, nausea, dizziness, loss of appetite, insomnia, memory loss, tremors, functional changes in hearing, enlarged thyroid gland, folate abnormalities, palpitations, chest discomfort, upper respiratory tract irritation, nose bleeds, and eye irritation.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: *Note!* The odor of bitter almonds may be noted on the breath or vomitus. Remove exposed person to fresh air and immediately begin therapy with 100% oxygen.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist immediately if irritation or pain develop.

Skin Contact: *Quickly* remove contaminated clothing. Speed is extremely important. Rinse with flooding amounts of water for at least 15 min. Wash exposed area extremely thoroughly with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, *do not* induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Determine hemoglobin, arterial blood gases, venous pO_2 or measured versus $\%O_2$ saturation, serum lactate, electrolytes, and whole blood cyanide levels. If the victim is unconscious, bradycardia and absence of cyanosis may be key diagnostic signs. For cases of ingestion, perform gastric lavage with a large bore tube after endotracheal intubation.

Special Precautions/Procedures: To prevent self-poisoning, avoid mouth-to-mouth resuscitation during CPR. To avoid becoming secondary victims, do not enter areas with high potential airborne concentrations without donning a self-contained breathing apparatus (SCBA). Give specific and detailed instructions on the use of cyanide antidote kits to all persons working with and around potassium cyanide.

Section 5 - Fire-Fighting Measures

See DOT ERG

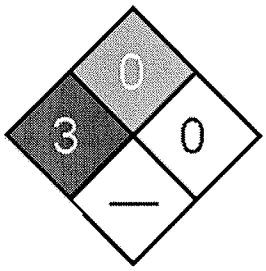
Flash Point: Noncombustible

Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.

Extinguishing Media: Use extinguishing media suitable for surrounding fire. Do not use carbon dioxide extinguisher; this can liberate hydrogen cyanide by the action of the dissolved carbon dioxide. Water may be used on surrounding fires *not* involving potassium cyanide. Use alkali dry chemical. Keep fire-exposed containers cool with water spray.



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Nitrogen oxides and cyanide. Potassium cyanide reacts with water or any acid-releasing flammable hydrogen cyanide.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing is *not* effective for potassium cyanide.

Section 6 - Accidental Release Measures

See DOT ERG

Spill/Leak Procedures: Notify safety personnel immediately, evacuate all unnecessary personnel, and isolate and ventilate area. Cleanup personnel should wear fully-encapsulating protective clothing to protect against inhalation, skin and eye contact.

Small Spills: Carefully scoop up the spilled potassium cyanide and place in dry containers for disposal or reclamation. For potassium cyanide solution spills, take up with a noncombustible, absorbent material such as sand or vermiculite and place in containers for later disposal. Neutralize with a strong alkali solution of calcium hypochlorite.

Large Spills: For large dry spills, cover with a plastic sheet to avoid dust dispersion until later disposal. For large solution spills, dike far ahead for later disposal. Do not release into sewers or waterways. Prompt cleanup and removal are necessary. To avoid generating dust, *do not* sweep! Remove residue by vacuuming (with an appropriate HEPA filter) or mopping with a liberal quantity of water.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all contact with potassium cyanide. Use only with ventilation sufficient to reduce airborne concentrations to nonhazardous levels. Wear appropriate personal protective equipment to protect against skin and eye contact. Make cyanide antidote kits readily available in all areas where potassium cyanide is used. Replace ingredients of kits every 1-2 yr to ensure freshness. Practice good personal hygiene procedures to avoid inadvertently ingesting potassium cyanide.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using potassium cyanide, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, dry, well-ventilated area away from light, acids, water, carbon dioxide, and other incompatibles (Sec. 10). Outside or detached storage is preferred. Protect from physical damage. Keep containers covered or in an exhausted hood when not in use.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose all operations to avoid dust dispersion into the workplace. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical exams with emphasis on the cardiovascular, upper respiratory, and nervous systems, skin, and thyroid. Maintain pertinent medical records for 5 years following the last exposure. Educate workers about the hazards of potassium cyanide and train in emergency first aid procedures for cyanide poisoning.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Polyvinyl chloride, Neoprene, butyl rubber, fluoronitrile carbon rubber, nitrile rubber, and chlorinated polyethylene are recommended materials for PPE. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For concentrations <= 25 mg/m^3, wear a supplied-air respirator or any SCBA with a full facepiece. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure- demand or other positive-pressure mode. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove potassium cyanide from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: White lumps or colorless crystals; faint odor of bitter almonds.

Physical State: Solid

Vapor Pressure (kPa): ~0 mm Hg at 68 °F (20 °C)

Formula Weight: 65.11

Specific Gravity (H_2O=1, at 4 °C): 1.55

Refractive Index: 1.410

pH: (0.1N aqueous solution) 11.0

Boiling Point: 2957 °F (1625 °C)

Freezing/Melting Point: 1173 °F (634 °C)

Water Solubility: Soluble

Other Solubilities: Soluble in 100 parts alcohol, soluble in 25 parts methanol, and soluble in 2 parts glycerol.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Potassium cyanide is stable at room temperature in closed containers under normal storage and handling conditions. It absorbs moisture and carbon dioxide from the air and slowly decomposes. Hazardous polymerization cannot occur. Avoid contact with acids, water, and other incompatibles.

Storage Incompatibilities: Potassium cyanide is incompatible with acids (releases highly toxic hydrogen cyanide gas), metallic salts, permanganates, peroxides, perchloryl fluoride, chlorates (potassium cyanide and sodium chlorate explode when heated), nitrites, oxidizing agents, nitrogen trichloride, iodine, alkaloids, ammoniacal silver, mercury (II) nitrate, and chromium tetraoxide. Hydrogen cyanide gas is also released when sodium cyanide is dissolved in and reacts with water. However, unless this occurs in a closed space, the amount is too small to be hazardous. Potassium cyanide also reacts with carbon dioxide in the air to release hydrogen cyanide gas.

Hazardous Decomposition Products: Thermal oxidative decomposition of potassium cyanide can produce nitrogen oxides and cyanide gas.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD_{50}: 5 mg/kg.

Man, oral, TD_{Lo}: 13699 µg/kg caused convulsions or effect on seizure threshold, coma, and metabolic acidosis.

Woman, oral, TD_{Lo}: 100 mg/kg caused convulsions or effect on seizure threshold, increased pulse rate without fall in blood pressure, and blood pressure lowering not characterized in autonomic section.

Human, oral, LD_{Lo}: 2857 µg/kg.

Other Effects:

Rat, oral: 31500 mg/kg/50 weeks/continuous caused changes in urine composition and thyroid weight and weight loss or decreased weight gain.

Rat, oral: 65 g/kg administered to a female 14 days prior to mating and during the 1-22 day of pregnancy caused toxic effects on fertility.

Mouse, lymphocyte: 1 mmol/L caused DNA inhibition.

See *RTECS* TS8750000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Potassium cyanide will readily dissociate in water and may then form hydrogen cyanide or react with various metals present in natural water. Complex metallocyanides may form if the cyanide ion is present in excess, but if metals are prevalent, simple metal cyanides may form. Bioconcentration: 0.3 (calculated from water solubility by regression equations). 3.0 (calculated from water solubility by regression equations).

Ecotoxicity: TL_m (fresh water Bluegill): 0.16 ppm for 48 hr; TL_m (salt water adult Zebrafish): 0.49 ppm for 48 hr

Section 13 - Disposal Considerations

Disposal: Add potassium cyanide with stirring to a strong alkaline solution of calcium hypochlorite. Let stand 24 hr and route to sewage plant (only with approval from local municipality). Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Potassium cyanide
ID: UN1680
Hazard Class: 6.1 - Poisonous materials
Packing Group: I - Great Danger
Symbols:
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: B69, B77, IB7, IP1, N74, N75, T14, TP2, TP13
Packaging: **Exceptions:** None **Non-bulk:** 211 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 kg **Cargo aircraft only:** 50 kg
Vessel Stowage: **Location:** B **Other:** 52

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed P098
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 10 lb (4.535 kg)
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Listed
RQ: 10 lb
TPQ: 100 lb
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 Collection
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Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Naphthalene **CAS Number:** 91-20-3
Chemical Formula: $C_{10}H_8$
EINECS Number: 202-049-5
ACX Number: X1001294-7
Synonyms: ALBOCARBON; CAMPHOR TAR; DEZODORATOR; FAULDING NAPHTHALENE FLAKES; MIGHTY 150; MIGHTY RD1; MOTH BALLS; MOTH FLAKES; MOTHBALLS; NAFTALEN; NAPHTHALENE; NAPHTHALIN; NAPHTHALINE; NAPHTHENE; TAR CAMPHOR; WHITE TAR
Derivation: From coal tar; from petroleum fractions after various catalytic processing operations.
General Use: Used as a moth repellent, an antiseptic, toilet bowl deodorant, heat transfer agent, fungicide, smokeless powder, cutting fluid, lubricant, wood preservative; an intermediate for naphthol, phthalic anhydride, chlorinated naphthalenes, Tertralin, Decalin, naphthyl and naphthol derivatives, and dyes; in synthetic resins, synthetic tanning, textile chemicals, scintillation counters, and emulsion breakers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Naphthalene	91-20-3	ca 100% wt.

Grade - By melting point, 165 °F (74 °C) min (crude) to greater than 174 °F (79 °C) (refined); scintillation 176-177 °F (80-81 °C)

OSHA PEL
TWA: 10 ppm; 50 mg/m^3.

NIOSH REL
TWA: 10 ppm (50 mg/m^3); STEL: 15 ppm (75 mg/m^3).

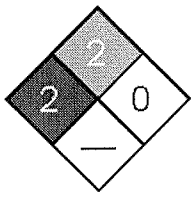
DFG (Germany) MAK
Skin.

ACGIH TLV
TWA: 10 ppm; STEL: 15 ppm; skin.

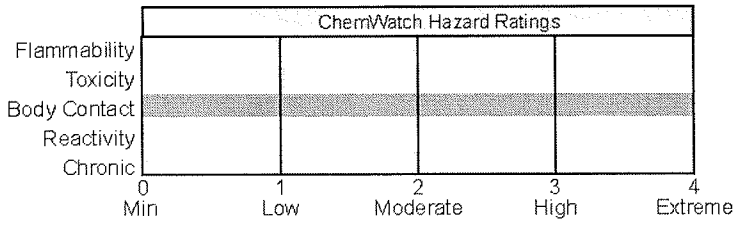
IDLH Level
250 ppm.

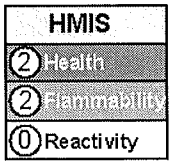
EU OEL
TWA: 10 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆
White crystalline solid; "moth ball" or coal-tar odor. Irritating to eyes/skin/respiratory tract. Toxic by ingestion. Combustible solid. Dust may form explosive mixtures in air.

Potential Health Effects

Target Organs: Blood (red blood cell effects), eyes, skin, central nervous system (CNS), liver and kidneys
Primary Entry Routes: Inhalation, skin absorption, skin and/or eye contact
Acute Effects
Inhalation: Vapor inhalation causes headache, confusion, nausea, sometimes vomiting, loss of appetite, extensive sweating, dysuria (painful urination), hematuria (blood in the urine), and hemolysis (destruction of red blood cells).
Eye: Irritation, conjunctivitis, and corneal injury upon prolonged contact.
Skin: Irritation and hypersensitivity dermatitis.

Ingestion: Unlikely. However, ingestion causes irritation of the mouth and stomach, hemolytic anemia with hepatic and renal lesions and vesical congestion, kidney failure, hematuria, jaundice, depression of CNS, nausea, vomiting, abdominal pain, blue face, lips, or hands, rapid and difficult breathing, headache, confusion, excitement, malaise, fever, perspiration, urinary tract pain, dizziness, convulsions, coma, and death. Symptoms may appear 2 to 4 hours after exposure.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Diseases of the blood, liver and kidneys; individuals with a hereditary deficiency of the enzyme glucose-6-phosphate dehydrogenase in red blood cells are particularly susceptible to the hemolytic properties of naphthalene metabolites.

Chronic Effects: May cause optical neuritis, corneal injuries, cataracts, kidney damage. There are two reports of naphthalene crossing the placenta in humans.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove exposed person to fresh air and support breathing as needed. Contact a physician immediately if symptoms of systemic poisoning are present.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain, irritation, swelling, or photophobia persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area thoroughly with soap and water. For reddened or blistered skin, consult a physician. Contact a physician immediately if symptoms of systemic poisoning are present.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the conscious and alert person drink 1 to 2 glasses of water, then induce vomiting. Contact a physician immediately.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Obtain baseline CBC, electrolytes, liver and renal function tests, glucose-6-phosphatase dehydrogenase level, urinalysis, and benzidine dipstick to check for hemoglobinuria. Urinary metabolite, 1-naphthol or mercapturic acid, may help confirm the diagnosis.

Section 5 - Fire-Fighting Measures

See DOT ERG

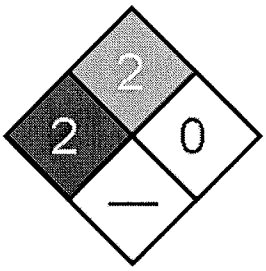
Flash Point: 174 °F (79 °C) OC; 190 °F (88 °C) CC

Autoignition Temperature: 979 °F (526 °C)

LEL: 0.9% v/v

UEL: 5.9% v/v

Flammability Classification: Combustible solid



Fire Diamond

Extinguishing Media: Use dry chemical, foam, carbon dioxide (CO_2), or water spray. Water or foam may cause frothing. Use water spray to keep fire-exposed containers cool.

General Fire Hazards/Hazardous Combustion Products: Toxic vapors including carbon monoxide. Volatile solid that gives off flammable vapors when heated. Dust may explode in air if an ignition source is provided.

Fire-Fighting Instructions: Move containers from the fire area if it can be done without risk. Otherwise cool fire-exposed containers until well after the fire is extinguished. Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Wear full protective clothing. Structural clothing is permeable, remain clear of smoke, water fall out, and water run off.

Section 6 - Accidental Release Measures

See DOT ERG

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Stop leak if you can do it without risk. Use spark-proof tools and explosion proof equipment. Cleanup personnel should wear personal protective equipment to protect against exposure.

Small Spills: Do not sweep! Carefully scoop up or vacuum (with a HEPA filter). Absorb liquid spill with an inert, noncombustible absorbent such as sand or vermiculite.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: To avoid vapor inhalation use only with ventilation sufficient to reduce airborne concentrations to nonhazardous levels. Avoid skin and eye contact. Wear personal protective clothing and equipment to prevent any contact with skin and eyes (see Sec. 8). Practice good personal hygiene procedures to prevent inadvertently ingesting this material.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed, explosion-proof containers in a cool, well-ventilated area away from heat, ignition sources, and incompatibles (see Sec. 10). May be stored under nitrogen gas. Protect containers against physical damage. Use monitoring equipment to measure the extent of vapor present in any storage facility containing naphthalene because of potential fire and explosion hazards.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid vapor and dust dispersion into the work area. Ventilate at the site of chemical release. During the fractional distillation of naphthalene and in any operation entailing the heating or volatilization of naphthalene, enclosed apparatus should be employed. Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with naphthalene. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on the eyes, skin, liver, kidneys, CBC (RBC count, WBC count, differential count of a stained smear, hemoglobin, and hematocrit), and urinalysis including at a minimum specific gravity, albumin, glucose, and a microscopic examination on centrifuged sediment.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Teflon is recommended. *Do not* use butyl rubber, natural rubber, neoprene or polyvinyl chloride. Wear chemical dust-proof safety goggles and face shield, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove naphthalene from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: White volatile flakes, cakes, cubes, spheres, or powder; strong coal-tar or moth ball odor.

Physical State: Crystalline solid

Odor Threshold: < 0.3 ppm

Vapor Pressure (kPa): 0.05 mm Hg at 68 °F (20 °C); 1.0 mm Hg at 127 °F (53 °C)

Formula Weight: 128.2

Density: 1.145 g/cm^3 at 68 °F (20 °C)

Boiling Point: 424 °F (218 °C)

Freezing/Melting Point: 176 °F (80.2 °C)

Water Solubility: Insoluble [31.7 mg/L at 68 °F (20 °C)]

Other Solubilities: Benzene, absolute alcohol; very soluble in ether, chloroform, carbon disulfide, hydronaphthalenes, fixed and volatile oils

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Naphthalene is stable at room temperature in closed containers under normal storage and handling conditions. It volatilizes at room temperature. Hazardous polymerization cannot occur. Exposure to heat and ignition sources, incompatibles.

Storage Incompatibilities: Include aluminum chloride, benzoyl chloride, chromic acid, chromium trioxide, oxidizers. Explosive reaction with dinitrogen pentaoxide. Melted naphthalene will attack some forms of plastics.

Hazardous Decomposition Products: Thermal oxidative decomposition of naphthalene can produce toxic fumes including carbon monoxide.

Section 11 - Toxicological Information

Acute Oral Effects:
Rat, oral, LD_{50}: 490 mg/kg.
Mouse, oral, LD_{50}: 533 mg/kg.
Human (child), oral, LD_{Lo}: 100 mg/kg.

Acute Inhalation Effects:
Rat, inhalation, LC_{50}: >340 mg/m^3 produced lacrimation and somnolence.

Irritation Effects:
Rabbit, eye, standard Draize test: 100 mg produced mild irritation.
Rabbit, skin, open Draize test: 495 mg produced mild irritation.

Other Effects:
Rat, oral: 4500 mg/kg administered on gestational days 6-15 produced fetotoxicity and other developmental abnormalities.
Man, unreported, LD_{Lo}: 74 mg/kg.
Mouse, inhalation: 30 ppm/6 hr/2 yr administered intermittently produced toxic effects: tumorigenic - neoplastic by RTECS criteria; lungs, thorax, or respiration - tumors.
Hamster, ovary: 15 mg/L induced sister chromatid exchange.

See *RTECS* QJ0525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, naphthalene rapidly photodegrades with a half-life of 3-8 hr. Volatilization, photolysis, adsorption, and biodegradation are important loss mechanisms for naphthalene discharged into water. Depending on local conditions, the half-lives range from a couple of days to a few months. If released on land, it is adsorbed moderately to soil, undergoes biodegradation; but in some cases biodegradation may still occur if conditions are aerobic. Bioconcentration occurs to a moderate extent, but is a temporary problem since depuration and metabolism readily proceed in aquatic organisms.

Ecotoxicity: *Oncorhynchus gorbuscha* (pink salmon): 1.37 ppm/96 hr at 39 °F (4 °C). *Pimephales promelas* (fathead minnow): 7.76 mg/L/24 hr.

Octanol/Water Partition Coefficient: log K_{ow} = 3.30

Section 13 - Disposal Considerations

Disposal: Consider rotary kiln or fluidized bed incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Naphthalene, crude *or* Naphthalene, refined
ID: UN1334
Hazard Class: 4.1 - Flammable solid
Packing Group: III - Minor Danger
Symbols:
Label Codes: 4.1 - Flammable Solid
Special Provisions: A1, IB8, IP3
Packaging: **Exceptions:** 151 **Non-bulk:** 213 **Bulk:** 240
Quantity Limitations: **Passenger aircraft/rail:** 25 kg **Cargo aircraft only:** 100 kg
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U165 Toxic Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)
SARA 40 CFR 372.65: 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 Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Mercury **CAS Number:** 7439-97-6
Chemical Formula: Hg
EINECS Number: 231-106-7
ACX Number: X1002555-9
Synonyms: COLLOIDAL MERCURY; HYDRARGYRUM; KWIK; LIQUID SILVER; MERCURE; MERCURIO; MERCURY; MERCURY (ELEMENTAL); MERCURY METAL: COLLOIDAL MERCURY; MERCURY,METALLIC; METALLIC MERCURY; QUECKSILBER; QUICK SILVER; QUICKSILVER; QUICKSILVER SYNONYMS OF; RTEC
Derivation: Obtained by roasting cinnabar (mercury sulfide) and purified by distillation, or as a by-product of gold mining.
General Use: Used in agricultural poisons, anti-fouling paint, dental amalgams, mining amalgamation (to remove gold and other metals from ore), thermometers, barometers, dry cell batteries, chlorine and caustic soda production, electrical apparatus, and as a neutron absorber in nuclear power plants.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Mercury		ca 100% wt

OSHA PEL
Ceiling: 0.1 mg/m^3.

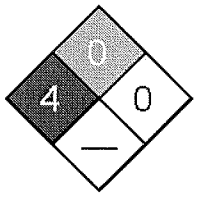
ACGIH TLV
TWA: 0.025 mg/m^3; skin.

NIOSH REL
Hg Vapor: TWA: 0.05 mg/m^3; skin; Ceiling: 0.1 mg/m^3; skin.

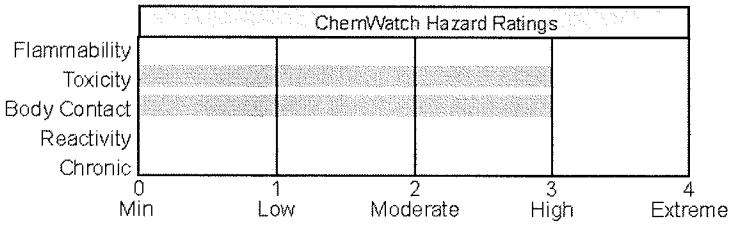
IDLH Level
10 mg/m^3 (as Hg).

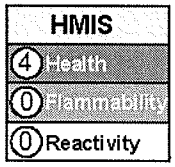
DFG (Germany) MAK
TWA: 0.1 mg/m^3; PEAK: 0.8 mg/m^3; danger of sensitization of the skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


Poison Corrosive

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆
Heavy silver-white liquid metal; odorless. Corrosive. Poison. Other Acute Effects: irreversible nervous system damage.

Potential Health Effects

Target Organs: Central nervous system, eyes, skin, respiratory system, liver, kidneys.
Primary Entry Routes: Inhalation, eye and skin contact/absorption.

Acute Effects The onset of signs and symptoms usually is prompt, but may be delayed up to 12 hr.

Systemic Effects by all routes: Nausea, vomiting, abdominal pain, diarrhea, excessive salivation, sweating, headache, giddiness, vertigo (dizziness), weakne ss, blurring or dimness of vision, miosis or mydiasis (dilatation of the pupils), tearing, bradycardia (slow heart beat), tachycardia (fast heart beat), cardiac irregularities (arrhythmias, compl ete heart block), loss of muscle coordination, slurred speech, muscle twitching (particularly tongue and eyelids), generalized profound weakness, confusion, disorientation, drowsiness, difficulty in breathing, excessive secretion of saliva and mucus, cyanosis, rales, high blood pressure, random jerky movements, incontinence, convulsions, coma, and death due to respiratory paralysis.

Inhalation: Exposure to high vapor concentrations can cause severe respiratory damage. Other symptoms include wakefulness, muscle weakness, anorexia, headache, ringing in the ear, headache, diarrhea, liver changes, fever, gingivitis, chest pain, difficulty breathing, cough, inflammation of the mouth (stomatitis), salivation, bronchitis, and pneumonitis. Acrodynia (pink or Swifts disease), characterized by redness and peeling of the skin on the toes and fingers, was commonly seen in children in the 1950s and is still *infrequently* seen in workers.

Eye: Irritation and corrosion.

Skin: Skin can become severely irritated if allowed to remain in contact with mercury. Skin absorption will occur at 2.2% of the rate of absorption through the lungs.

Ingestion: Mercury generally passes through the digestive tract uneventfully. However, large amounts may get caught up in the intestine and require surgical removal. If an abscess or other perforation is present along the digestive tract, absorption into the blood stream with subsequent mercury poisoning is possible.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Central nervous system disorders.

Chronic Effects: Chronic exposure appears more common than acute and is primarily associated with central nervous system damage which can be permanent (ex. paresthesia of the hands, lips, feet). Early signs of toxicity include weakness, fatigue, anorexia, weight loss, and gastrointestinal disturbances. If exposure levels are high, characteristic tremors of the fingers, eyelids, and lips occur with progression to generalized tremors of the entire body. Psychic disorders are noticeable and characterized by behavior and personality changes, increased excitability, memory loss, insomnia, and depression. In severe cases, delirium and hallucinations may occur. Kidney damage is observed with oliguria (decreased urine output) progressing to anuria (urine cessation) and may require dialysis. The cornea and lens of the eyes may take on a brownish discoloration and the extraocular muscles may be damaged. This syndrome has been termed *Asthenic-Vegetative Syndrome* or *Micromercurialism.* Chronic symptoms occur increasingly with exposures to 0.1 mg/m^3 or higher. *Mutation:* Aneuploidy and other chromosomal aberrations have been observed in the lymphocytes from whole blood cultures in workers exposed to mercury. *Reproductive:* Mercury has been detected in stillborn babies of women treated with mercury for syphilis. In a study of six men acutely exposed (occupationally) to mercury levels as high as 44 mg/m^3, all suffered impaired sexual function. Repeated skin contact may cause allergic dermatitis in some individuals.

Note: Spilled mercury will release sufficient vapor over time to produce chronic poisoning.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water and then wash exposed area with soap. For reddened or blistered skin, consult a physician.

See DOT ERG

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. In general, mercury will pass through the digestive tract uneventfully.

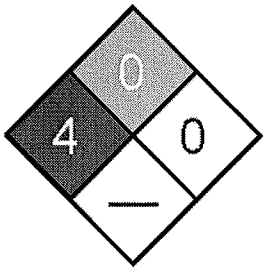
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: BEI: *blood* (15 µg/L), *urine*: (35 µg/g creatinine). Extremely high urine levels of 0.5 to 0.85 mg Hg/L are indicative of polyneuropathy. 0.4 to 22 µg/L is reported to be the human lethal blood level. Obtain urinalysis including at a minimum: albumin, glucose, and a microscopic examination of centrifuged sediment. Use BAL or 2, 3-dimercaptosuccinic acid as chelators. *Do not* use calcium sodium EDTA because of nephrotoxicity. An electromyograph may determine extent of nerve dysfunction. It has been noted that exposure to mercury may predispose persons to development of carpal tunnel syndrome.

Section 5 - Fire-Fighting Measures

Flash Point: Nonflammable
Autoignition Temperature: Nonflammable
LEL: None reported.
UEL: None reported.
Extinguishing Media: Use agents suitable for surrounding fire.
General Fire Hazards/Hazardous Combustion Products: Toxic mercury vapor and mercuric oxide.
Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

See DOT ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Keep a mercury spill kit readily available in areas where mercury is used. Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind.
Small Spills: Small and Large Spills: Follow instructions on mercury spill kit. Most kits come with an aspiration-driven vacuum trap with a mercury "sweeper" (copper or copper-plated brush). Wash spill area with a dilute calcium sulfide or nitric acid solution. If spill cannot be taken up readily, dust the top of the spill with flowers of sulfur or preferably, calcium polysulfide. This will produce a surface coating of mercury sulfide which will reduce mercury vapor dispersion into the air.
Large Spills: No data found.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See DOT ERG

Section 7 - Handling and Storage

Handling Precautions: Use appropriate PPE when working with mercury. *Do not* use on porous work surfaces (wood, unsealed concrete, etc.) to prevent spills from lodging in cracks.
Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.
Recommended Storage Methods: Store in a cool, dry, well-ventilated area away from heat and incompatibles (Sec. 10). Store on non- porous floors and wash them regularly with a dilute calcium sulfide solution. Because mercury will form amalgamations with most metals except iron, metal shelves should be painted with a sufficiently thick coating to prevent this from happening.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Wherever possible, enclose processes to prevent mercury vapor dispersion into work area. Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.
Administrative Controls: Consider pre-placement and periodic medical exams of exposed workers with emphasis on the skin, eyes, central nervous system, liver, and kidneys.
Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets made of butyl rubber, nitrile rubber, fluorocarbon rubber, neoprene rubber, polyvinyl chloride, chlorinated polyethylene, or polycarbonate to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.
Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For <= 0.5 mg/m^3, use any chemical cartridge respirator with cartridges providing protection against mercury and equipped with an ESLI (end of service life indicator), any SCBA, or any SAR (supplied-air respirator). For <= 1.25 mg/m^3, use any SAR operated in continuous-flow mode, any PAPR (powered, air-purifying respirator) with an ESLI. For <= 2.5 mg/m^3, use any SCBA or SAR with a full facepiece, any SAR with a tight-fitting facepiece and operated in continuous-flow mode, or any chemical cartridge respirator with a full facepiece, chemical cartridges providing protection against mercury, and equipped with an ESLI. For <=28 mg/m^3, use any SAR operated in pressure- demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA with full facepiece and operated in pressure-demand or other positive pressure mode. *Warning! Air- purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Silvery-white, odorless.
Physical State: Liquid metal
Vapor Pressure (kPa): 0.0018 mm Hg at 77 °F (25 °C)
Formula Weight: 200.59
Density: 13.534 g/cm^3 at 77 °F (25 °C)
Boiling Point: 674.09 °F (356.72 °C)
Freezing/Melting Point: -37.97 °F (-38.87 °C)
Viscosity: 15.5 mP at 77 °F (25 °C)
Surface Tension: 484 dyne/cm at 77 °F (25 °C)
Critical Temperature: 2664 °F (1462 °C)
Critical Pressure: 1587 atm
Water Solubility: 0.28 µmol/L at 77 °F (25 °C)
Other Solubilities: Soluble in boiling sulfuric acid, nitric acid (reacts); slightly in lipids, and 2.7 mg/L in pentane. Insoluble in alcohol, ether, cold sulfuric acid, hydrogen bromide, and hydrogen iodide.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Mercury does not tarnish at ordinary temperatures but when heated to near its boiling point, it slowly oxidizes to mercuric oxide. Hazardous polymerization does not occur. Exposure to high temperatures, metal surfaces or incompatibles.
Storage Incompatibilities: Mercury forms alloys (amalgamates) with most metals except iron. It is incompatible with oxidizers such as bromine, 3-bromopropyne, methylsilane + oxygen, chlorine, chlorine dioxide, nitric acid, or peroxyformic acid; tetracarbonyl nickel + oxygen, alkynes + silver perchlorate, ethylene oxide, acetylenic compounds (explosive), ammonia (explosive), boron phosphodiiodide, methyl azide, nitromethane, and ground sodium carbide.
Hazardous Decomposition Products: Thermal oxidative decomposition of mercury can produce mercuric oxide.

Section 11 - Toxicological Information

Acute Oral Effects:
Man, oral, TD_{Lo}: 43 mg/kg caused tremor and jaundice or other liver changes.
Acute Inhalation Effects:
Woman, inhalation, TC_{Lo}: 150 µg/m^3/46 days caused anorexia, diarrhea, and wakefulness.
Man, inhalation, TC_{Lo}: 44300 µg/m^3/8 hr caused muscle weakness, liver changes, and increased body temperature.
Acute Skin Effects:
Man, skin, TD_{Lo}: 129 mg/kg for 5 continuous hours caused ringing in the ears, headache, and allergic dermatitis.
Other Effects:
Rat, inhalation: 1 mg/m^3/ 24 hr for 5 continuous weeks caused proteinuria.
Rat, inhalation: 890 ng/m^3/24 hr for 16 weeks prior to mating had an effect on spermatogenesis.

See *RTECS* OV4550000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Mercury is expected to volatilize rapidly when deposited on soil surfaces. Once in the air, it can be transported long distances before being redeposited on soil or in water. In water, mercury appears to bind to particulates where it eventually becomes deposited on the bed sediment. In general, mercury entering the environment can be deposited and revolatilized several times.
Ecotoxicity: Catfish, LC_{50} = 0.35 mg/L/96 hr; mollusk (*Modiolus carvalhoi*), LC_{50} = 0.19 ppm/96 hr: tadpole (*Rana hexadactyla*), LC_{50} = 0.051 ppm/96 hr. Mercury is transformed to methyl mercury by bacteria in the environment and undergoes bioaccumulation readily. BCF for freshwater fish = 63,000; for saltwater fish = 10,000; and for marine and freshwater invertebrates = 100,000.

Section 13 - Disposal Considerations

Disposal: Incineration is *not* an appropriate disposal method. Wastewater may be treated by addition of chlorine to oxidize the mercury to its ionic state. The water can then be passed through an absorbent (an activated charcoal concentrate with a sulfur coating or peanut shell charcoal) to collect the ionic mercury, followed by distillation to recover the mercury. Sodium borohydride, a reducing agent, can be used to precipitate mercury from waste solutions. Bioremediation, using *Pseudomonas putida*, has also been suggested. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Mercury
ID: UN2809
Hazard Class: 8 - Corrosive material
Packing Group: III - Minor Danger
Symbols: A W
Label Codes: 8 - Corrosive
Special Provisions:
Packaging: **Exceptions:** 164 **Non-bulk:** 164 **Bulk:** 240
Quantity Limitations: **Passenger aircraft/rail:** 35 kg **Cargo aircraft only:** 35 kg
Vessel Stowage: **Location:** B **Other:** 40, 97

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U151 Toxic Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a), per CAA Section 112 1 lb (0.454 kg)
SARA 40 CFR 372.65: 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 Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Lead **CAS Number:** 7439-92-1
Chemical Formula: Pb
Structural Chemical Formula: Pb
EINECS Number: 231-100-4
ACX Number: X1000227-2
Synonyms: C.I. 77575; C.I. PIGMENT METAL 4; GLOVER; KS-4; LEAD; LEAD FLAKE; LEAD INORGANIC; LEAD METAL; LEAD S2; LEAD SZ; OLOW; OMAHA & GRANT; PB-S 100; PLUMBUM
General Use: Used as a construction material in chemical reaction equipment (tank piping,etc.); manufacture of tetraethyl lead; pigments for paints.
Used in pottery glazes, glass, ceramics, bearing metal and alloys, solder and other lead alloys.
Also used in metallurgy of steel and other metals, cable sheathing, storage batteries, radiation shielding and ammunition.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
lead	7439-92-1	>99

OSHA PEL
TWA: 0.05 mg/m^3; as Pb inorganic.

ACGIH TLV
TWA: 0.05 mg/m^3.

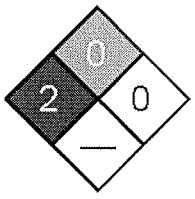
EU OEL
TWA: 0.1 mg/m^3.

NIOSH REL
TWA: 0.050 mg/m^3.

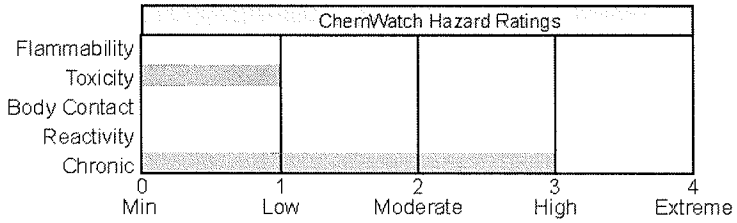
IDLH Level
100 mg/m^3 (as Pb).

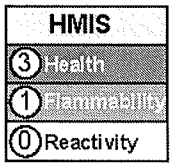
DFG (Germany) MAK
TWA: 0.1 mg/m^3; PEAK: 8 mg/m^3; measured as inhalable fraction of the aerosol; Excluding lead arsenate and lead chromate.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


Poison

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Bluish-white, silvery, or gray metal. Cumulative poison. Chronic Effects: severe neurological effects, blood/kidney damage, sterility, decreased fertility, developmental damage to fetus. Possible cancer hazard.

Potential Health Effects

Target Organs: blood, central nervous system (CNS), peripheral nervous system, kidneys, gastrointestinal (GI) tract
Primary Entry Routes: inhalation, ingestion
Acute Effects
Inhalation: The dust may be discomforting to the upper respiratory tract and may be harmful if inhaled.
Eye: The dust may be discomforting to the eyes.
Skin: The material may be mildly discomforting to the skin.
Prolonged exposure may cause skin reactions.
Skin absorption is not considered a significant route of exposure.
Ingestion: The material is moderately discomforting to the gastrointestinal tract and may be harmful if swallowed.

In rats intestinal lead absorption is bidirectional and does not follow a linear relationship with oral dose.
Acute effects of exposure are generally minor because of its relative insolubility and physical form. Unusual instances of exposure have been reported in inadequately ventilated indoor firing ranges (as fume), in the application of surma, a mascara-like cosmetic agent, to the conjunctival surfaces in Asian countries and in lead-smelting and associated occupations.
In humans lead metabolism fits into a three compartment model. The first compartment in which lead has a half-life of about 35 days includes the blood; it receives blood from the gut and delivers some of it to the urine and communicates with the other two pools. The second compartment in which lead has a similar half-life includes the soft tissues which contain about half the blood level; they share lead with hair, nails, sweat, saliva, bile and other digestive secretions. The skeleton is the third compartment and contains the vast bulk of the total body burden, possesses a very long half-life and demonstrates a difference between the dense and less dense components to bind lead.

Carcinogenicity: NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: Symptoms of exposure include headache, fatigue, sleep disturbances, abdominal pains and decreased appetite. Overexposure to lead in the form of dust has toxic effects on the lungs and kidneys and on the nervous system resulting in mental disturbances and anemia.
Skin absorption is not considered to be a significant route of exposure.
Worker exposure to lead must be kept to a minimum, especially in cases where lead is worked at temperatures whereby lead vapors are evolved e.g. metal refining.
Lead is an accumulative poison and exposure even to small amounts can raise the body's content to toxic levels.
Potential adverse effects on the offspring of pregnant workers have been cited in the literature.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If available, administer medical oxygen by trained personnel.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush 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: Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.

Ingestion: Rinse mouth out with plenty of water.
Seek medical attention if irritation or discomfort persist.

After first aid, get appropriate in-plant, paramedic, or community medical support.

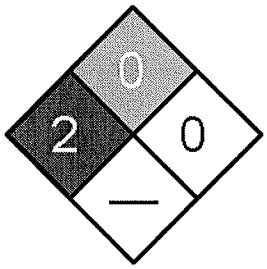
Note to Physicians: 1.Gastric acids solubilize lead and its salts and lead absorption occurs in the small bowel.
2.Particles of less than 1um diameter are substantially absorbed by the alveoli following inhalation.
3.Lead is distributed to the red blood cells and has a half-life of 35 days.
It is subsequently redistributed to soft tissue & bone-stores or eliminated.The kidney accounts for 75% of daily lead loss; integumentary and alimentary losses account for the remainder.
4.Neurasthenic symptoms are the most common symptoms of intoxication.
Lead toxicity produces a classic motor neuropathy.
Acute encephalopathy appears infrequently in adults.
Diazepam is the best drug for seizures.
5.Whole-blood lead is the best measure of recent exposure; free erythrocyte protoporphyrin (FEP) provides the best screening for chronic exposure. Obvious clinical symptoms occur in adults when whole-blood lead exceeds 80 ug/dL.
6.British Anti-Lewisite is an effective antidote and enhances fecal and urinary excretion of lead. The onset of action of BAL is about 30 minutes and most of the chelated metal complex is excreted in 4-6 hours, primarily in the bile.
Adverse reaction appears in up to 50% of patients given BAL in doses exceeding 5 mg/kg. CaNa2EDTA has also been used alone or in concert with BAL as an antidote.
D-penacillamine is the usual oral agent for mobilization of bone lead; its use in the treatment of lead poisoning remains investigational.
2-3-dimercapto-1-propanesulfonic acid (DMPS) and dimercaptosuccinic acid (DMSA) are water soluble analogues of BAL and their effectiveness is undergoing review.
As a rule, stop BAL if lead decreases below 50 ug/dL; stop CaNa2EDTA if blood lead decreases below 40 ug/dL or urinary lead drops below 2 mg/24 hrs.
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Lead in blood	50 ug/100 mL	Not Critical	B
Lead in urine	150 ug/gm creatinine	Not critical	B
Zinc Protoporphyrin in blood	250 ug/100 mL erythrocytes OR 100 ug/100 mL blood	After 1 month exposure	B

B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - Fire-Fighting Measures

Flash Point: Not available; probably noncombustible
Autoignition Temperature: Not applicable
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: There is no restriction on the type of extinguisher which may be used.
General Fire Hazards/Hazardous Combustion Products: Noncombustible.
Not considered to be a significant fire risk; however, containers may burn.
Moderate fire hazard, in the form of dust, when exposed to heat or flames.
Decomposition products may include toxic lead dust and lead oxide fumes.
Fire Incompatibility: Incompatible with strong acids, oxidants, ammonium nitrate, chlorine trifluoride and sodium azide.



Fire Diamond

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Use fire fighting procedures suitable for surrounding area.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.
If safe to do so, remove containers from path of fire.
Cool fire-exposed containers with water spray from a protected location.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.
Wear protective clothing, gloves, safety glasses and dust respirator.
Use dry clean-up procedures and avoid generating dust.
Vacuum up.
Place spilled material in clean, dry, sealable, labeled container.
Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
Control personal contact by using protective equipment and dust respirator.
Prevent spillage from entering drains, sewers or waterways.
Recover product wherever possible. Avoid generating dust. Sweep / shovel up.
If required, wet with water to prevent dusting.
Put residues in labeled plastic bags or other containers for disposal.
Wash area down with large quantity of water 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: Limit all unnecessary personal contact.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.

Keep containers securely sealed when not in use. 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 are maintained.
Recommended Storage Methods: Check that containers are clearly labeled.
Packaging as recommended by manufacturer.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions.
If risk of overexposure exists, wear NIOSH-approved dust respirator.
Correct fit is essential to obtain adequate protection.
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: Impervious gloves; rubber gloves.
Rubber boots.
Protective footwear.
Respiratory Protection:
Exposure Range >0.05 to 0.5 mg/m^3: Air Purifying, Negative Pressure, Half Mask
Exposure Range >0.5 to 2.5 mg/m^3: Air Purifying, Negative Pressure, Full Face
Exposure Range >2.5 to 50 mg/m^3: Powered Air Purifying Respirator, Half or Full Facepiece or Hood
Exposure Range >50 to 100 mg/m^3: Supplied Air Respirator with Full Facepiece, Hood, Helmet, or Suit, operated in a Positive Pressure Mode
Exposure Range >100 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: magenta (P100)
Note: (29CFR 1910.1025) for general industry
Other: Overalls. Eyewash unit. Skin cleansing cream.
Provide adequate ventilation in warehouse or closed storage areas.
General and local exhaust ventilation usually required to maintain airborne dust levels to safety levels.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Bluish-white, silvery-gray metal. Malleable, lustrous when freshly cut and tarnishes when exposed to air. Reacts with strong acids like nitric acid, sulphuric or hydrochloric acid. Attacked by water in presence of oxygen. Poor electrical conductor. Lead fumes are formed at temperatures above 500-700 °C.

Physical State: Divided solid
Vapor Pressure (kPa): 0.24 at 1000 °C
Vapor Density (Air=1): Not applicable
Formula Weight: 207.19
Specific Gravity (H_2O=1, at 4 °C): 11.34
Evaporation Rate: Not applicable
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 1740 °C (3164 °F)
Freezing/Melting Point: 327.4 °C (621.32 °F)
Volatile Component (% Vol): Not applicable
Water Solubility: Insoluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur. Stable under normal storage conditions.
Storage Incompatibilities: Avoid storage with strong acids, oxidants, ammonium nitrate, chlorine trifluoride and sodium azide.

Section 11 - Toxicological Information

Toxicity
Oral (woman) TD_{Lo}: 450 mg/kg/6 years
Inhalation (human) TC_{Lo}: 0.01 mg/m^3
WARNING: Lead is a cumulative poison and has the potential to cause abortion and intellectual impairment to unborn children of pregnant workers.

Irritation
Nil Reported

See *RTECS* OF 7525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released or deposited on soil, it will be retained in the upper 2-5 cm of soil, especially soils with at least 5% organic matter or a pH 5 or above. Leaching is not important under normal conditions although there is some evidence to suggest that it is taken up by some plants. Generally, the uptake from soil into plants is not significant. It is expected to slowly undergo speciation to the more insoluble sulfate, sulfide, oxide, and phosphate salts. It enters water from atmospheric fallout, runoff or wastewater; little is transferred from natural ores. It is a stable metal and adherent films of protective insoluble salts form that protect the metal from further corrosion. That which dissolves tends to form ligands. It is effectively removed from the water column to the sediment by adsorption to organic matter and clay minerals, precipitation as insoluble salt (the carbonate or sulfate, sulfide), and reaction with hydrous iron and manganese oxide. Under most circumstances, adsorption predominates. It does not appear to bioconcentrate significantly in fish but does in some shellfish such as mussels. When released to the atmosphere, it will generally be in dust or adsorbed to particulate matter and subject to gravitational settling and be transformed to the oxide and carbonate.

Ecotoxicity: LC_{50} Japanese quail (Coturnix japonica), males or females, 14 days old, oral (5-day ad libitum in diet) >5,000 ppm; at 1000, 2236 & 5000 onset of toxic signs began at 7, 7 & 7 days and remissed at 11, 11 & 12 days, respectively, no mortality was observed; control references were dieldrin & dicrotophos; corn oil diluent was added to diet at ratio of 2:98 by wt; (extreme concentrations: 1,000-5,000 ppm)

BCF: freshwater fish 1.38 to 1.65

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: None

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed
CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 10 lb (4.535 kg)
SARA 40 CFR 372.65: 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 Collection
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1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111
Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Fluorene **CAS Number:** 86-73-7
Chemical Formula: $C_{13}H_{10}$
EINECS Number: 201-695-5
ACX Number: X1003048-3
Synonyms: 2,3-BENZINDENE; O-BIPHENYLENEMETHANE; O-BIPHENYLMETHANE; ALPHA-DIPHENYLENEMETHANE; DIPHENYLENEMETHANE; ALPHA-DIPHENYLENEMETHANE-9H-FLUORENE; 9H-FLUORENE; FLUORENE; METHANE,DIPHENYLENE-; 2,2'-METHYLENEBIPHENYL
Derivation: Fluorene is derived from coal tar; from acetylene and hydrogen in a red-hot tube; from charcoal by boiling and fuming with HNO_3; from 2,2'-dibromodiphenylmethane on boiling with hydrazine hydrate in the presence of palladium; or by reduction of diphenylene ketone with zinc.
General Use: Fluorene is used in the formation of polyradicals for resins, and in resinous products and dyestuffs. Derivatives of fluorene show activity as herbicides and growth regulators.

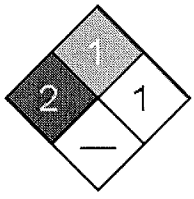
Section 2 - Composition / Information on Ingredients

Name	CAS	%
Fluorene	86-73-7	ca 98% wt

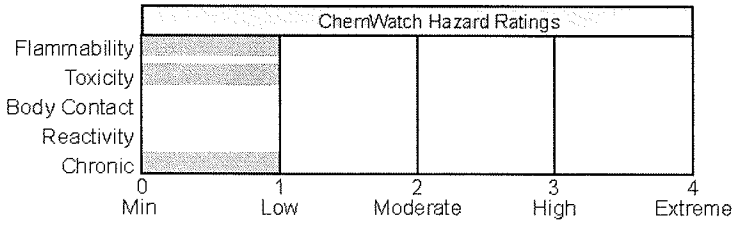
OSHA PEL **NIOSH REL**

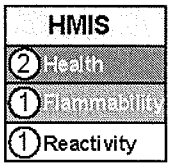
ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Dazzling white leaflets or flakes, fluorescent when impure. Irritating to eyes/skin/respiratory tract. Chronic effects: mutation effects. Combustible.

Potential Health Effects

Target Organs: Skin, eyes, respiratory system
Primary Entry Routes: Inhalation and skin/eye contact
Acute Effects The toxicological properties of fluorene have not been thoroughly investigated. The following effects are for those of polycyclic aromatic hydrocarbons (PAHs) in general.
Inhalation: Causes irritation to the respiratory system.
Eye: Contact causes irritation.
Skin: Contact causes irritation.
Ingestion: Causes irritation.
Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.
Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Include photosensitivity and irritation of the eyes; irritation of the respiratory system with cough, bronchitis, and chance of bronchogenic cancer; leukoplakia and cancers of the lip and oral cavity; dermal burns, "coal tar warts" (precancerous lesions enhanced by UV light exposure), erythema, acneiform lesions, and irritation; mild hepatoxicity; hematuria; and an increased chance of cancer of the skin, kidney, bladder, lung and gastrointestinal tract. Fluorinated PAHs may cross the placenta.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Administer 100% humidified supplemental oxygen with assisted ventilation as required. If bronchospasm and wheezing occur, consider treatment with inhaled sympathomimetic agents.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain, irritation, swelling, lacrimation or photophobia persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. Treat dermal irritation or burns with a standard topical therapy. Patients developing dermal hypersensitivity reactions may require treatment with systemic or topical corticosteroids or antihistamines. Avoid direct exposure of affected skin to sunlight and UV sources.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water. *Do not* induce vomiting. Gastric lavage and routine use of cathartics are not recommended.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Chronic effects, particularly cancer, are more common than acute toxicity. Acute respiratory effects in persons are typically due to other toxic agents at the worksite. Carefully observe patients with inhalation exposure for the development of any systemic signs or symptoms and administer symptomatic treatment as necessary. Monitor arterial blood gases, pulmonary function, and chest x-ray for patients with significant exposure.

Section 5 - Fire-Fighting Measures

Flash Point: Data not found; combustible

Autoignition Temperature: Data not found.

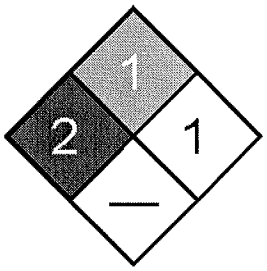
LEL: Data not found.

UEL: Data not found.

Extinguishing Media: Extinguish with water spray, carbon dioxide, dry chemical or appropriate foam.

General Fire Hazards/Hazardous Combustion Products: When heated to decomposition it emits acrid smoke and toxic fumes of carbon monoxide and carbon dioxide.

Fire-Fighting Instructions: *Do not* breathe the dust. *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Wear protective clothing including rubber boots and heavy rubber gloves to prevent contact with skin and eyes.



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Cleanup personnel should protect against exposure (Sec. 8).

Small Spills: If in solid form, *do not* sweep! Avoid raising dust. Carefully scoop up or vacuum (with a HEPA filter). Absorb liquid spill with an inert, noncombustible absorbent such as sand or vermiculite. Wash spill site after material pickup is complete.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Wear personal protective clothing and equipment to prevent dust inhalation and contact of solid or liquid with skin or eyes (Sec. 8).

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from heat, light, ignition sources, and incompatibles.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid dust dispersion into the work area. Provide local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with this material. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams including a complete blood count, hepatic and renal function test, dermal assessments, chest x-ray and pulmonary function tests.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not protective eye devices. Appropriate eye protection must be worn instead of, or in conjunction with, contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For 'normal' uses an air-purifying toxic dust* mask for particulates, and an organic vapor with toxic dust* pre-filters for vapors, dusts, and mists (* = purple or magenta color cartridge). Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: White. Fluorescent when impure.

Physical State: Solid; crystalline powder or small crystalline plates; leaflets or flakes from alcohol. Sublimes easily in high vacuum.

Vapor Pressure (kPa): 0.013 mm Hg at 68 °F (20 °C)

Formula Weight: 166.21

Density: 1.202 g/mL

Specific Gravity (H_2O=1, at 4 °C): 1.203 at 0 °C/4 °C

Boiling Point: 563 °F (295 °C) (decomposes)

Freezing/Melting Point: 237 to 241 °F (114 to 116 °C)

Ionization Potential (eV): 7.89 +/-0.2 eV

Water Solubility: Insoluble; 1.98 mg/kg

Other Solubilities: Freely soluble in glacial acetic acid; soluble in hot 95% ethanol, acetone, benzene, carbon disulfide, carbon tetrachloride, ether, pyridine, and toluene.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Fluorene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Avoid contact with chemical incompatibles, heat, and sources of ignition. Avoid heating to decomposition.

Storage Incompatibilities: Include strong oxidizing agents.

Hazardous Decomposition Products: Thermal oxidative decomposition of fluorene can produce acrid smoke and toxic fumes of carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Other Effects:

Genetic Effects: Mouse, lymphocyte, 150 µmol/L induced DNA damage.
Mouse, lymphocyte, 19500 nmol/L (+S9) induced mutations in microorganisms.
Mouse, lymphocyte, 584 µmol/L induced mutations in mammalian somatic cells.
Hamster, lung, 25 mg/L induced cytogenetic analysis.
Mouse, mammary gland, 1 µg/L induced morphological transformation.
Mouse, intraperitoneal, LD_{50}: >2 g/kg.

See *RTECS* LL5670000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, fluorene will exist primarily in the vapor phase where it will degrade readily by photochemically produced hydroxyl radicals (estimated half-life of 29 hr). If released to soil or water, fluorene will biodegrade readily (aerobically) in the presence of acclimated microbes; microbial adaptation is an important fate process. Biodegradation can be slow in pristine soils or waters (or under conditions of limited oxygen). Strong adsorption to soil and water sediment is an important transport process. Log K_{ow}: 4.18 to 4.38

Ecotoxicity: TL_m *Neanthes arenaceodentata* LC_{50}/1.0 ppm/96 hr at 72 °F (22 °C) in a static bioassay, seawater
Henry's Law Constant: 0.0001
BCF: 1288 (fathead minnow)
Soil Sorption Partition Coefficient: K_{OC} = log 3.70 to 4.21

Section 13 - Disposal Considerations

Disposal: Dissolve or mix fluorene with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. The particle-bound portion of polycyclic aromatic hydrocarbons (PAH) can be removed by sedimentation, flocculation, and filtration processes. The remaining dissolved polynuclear aromatic hydrocarbons usually require oxidation for partial removal/transformation. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain. Triple rinse containers and dispose of wash wastewater appropriately.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Not specifically listed.

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 5000 lb (2268 kg)
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 Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Ethylbenzene **CAS Number:** 100-41-4
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_5 \cdot C_2H_5$
EINECS Number: 202-849-4
ACX Number: X1003016-1
Synonyms: AETHYLBENZOL; BENZENE,ETHYL-; EB; ETHYL BENZENE; ETHYLBENZEEN; ETHYLBENZENE; ETHYLBENZOL; ETILBENZENE; ETYLOBENZEN; PHENYLETHANE
General Use: Used in the manufacture of cellulose acetate, styrene and synthetic rubber; solvent or diluent; component of automotive and aviation gasoline.
Component of many petroleum hydrocarbon solvents, thinners.
The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
ethylbenzene	100-41-4	>95

OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

ACGIH TLV
TWA: 100 ppm; STEL: 125 ppm.

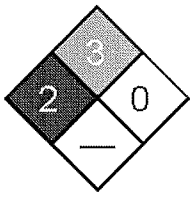
EU OEL
TWA: 100 ppm; STEL: 200 ppm.

NIOSH REL
TWA: 100 ppm (435 mg/m^3); STEL: 125 ppm (545 mg/m^3).

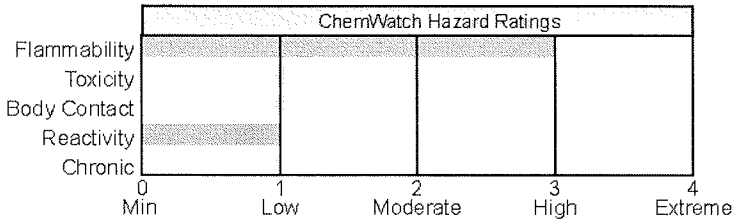
IDLH Level
800 ppm (10% LEL).

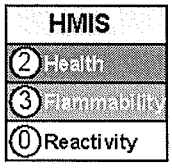
DFG (Germany) MAK
Skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; pungent odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: chest constriction, vertigo, narcosis, cramps, respiratory paralysis. Chronic Effects: fatigue, sleepiness, headache, blood disorders, lymphocytosis. Flammable.

Potential Health Effects

Target Organs: eyes, respiratory system, skin, central nervous system (CNS), blood
Primary Entry Routes: inhalation, skin contact, eye contact
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract.
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.
Inhalation of vapor may aggravate a pre-existing respiratory condition such as asthma, bronchitis, emphysema.
When humans were exposed to the 100 and 200 ppm for 8 hours about 45-65% is retained in the body. Only traces of unchanged ethyl benzene are excreted in expired air following termination of inhalation exposure.
Humans exposed to concentrations of 23-85 ppm excreted most of the retained dose in the urine (mainly as metabolites).
Guinea pigs that died from exposure had intense congestion of the lungs and generalized visceral hyperemia. Rats exposed for three days at 8700 mg/m^3 (2000 ppm) showed changes in the levels of dopamine and noradrenaline in various parts of the brain.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.
The vapor is discomforting to the eyes.
The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
Two drops of the material in to the conjunctival sac produced only slight irritation of the conjunctival membrane but no corneal injury.

Skin: The liquid is discomforting to the skin if exposure is prolonged and is capable of causing skin reactions which may lead to dermatitis.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.
The mean rate of absorption of liquid ethyl benzene applied to 17.3 cm2 area of the forearm of seven volunteers for 10-15 minutes was determined to be 38 mg/cm2/hr. Immersion of the whole hand in aqueous solutions of ethyl benzene (112-156 mg/l) for 1 hour yielded mean absorption rates of 118 and 215.7 ug/cm2/hr. The rate of absorption is thus greater than that of aniline, benzene, nitrobenzene, carbon disulfide and styrene.
Repeated application of the undiluted product to the abdominal area of rabbits (10-20 applications over 2-4 weeks) resulted in erythema, edema and superficial necrosis. The material did not appear to be absorbed through the skin in sufficient quantity to produce outward signs of toxicity.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The liquid may produce considerable gastrointestinal discomfort and may be harmful or toxic if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; 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.
Industrial workers exposed to a maximum level of ethyl benzene of 0.06 mg/l (14 ppm) reported headaches and irritability and tired quickly. Functional nervous system disturbances were found in some workers employed for over 7 years whilst other workers had enlarged livers.

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 flush 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: Rinse mouth out with plenty of water. DO NOT induce vomiting.
Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink.
Transport to hospital or doctor without delay.

After first aid, get appropriate in-plant, paramedic, or community medical support.

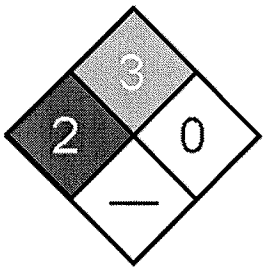
Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

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: 12.8 °C Closed Cup
Autoignition Temperature: 432 °C
LEL: 1.6% v/v
UEL: 7% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
May emit clouds of acrid smoke.

See DOT ERG



Fire Diamond

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
Fire-Fighting Instructions: Contact 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 waterways.
If safe, switch off electrical equipment until vapor 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.
Contact 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 waterways.
No smoking, bare 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 labeled 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.
General exhaust is adequate under normal operating conditions.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
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 Nitrile gloves.
Protective footwear.
Respiratory Protection:
Exposure Range >100 to <800 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 800 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Other: Overalls. Eyewash unit.
Glove Selection Index:
VITON ..... Best selection
TEFLON ..... Best selection

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid; floats on water. Aromatic solvent odor. Soluble in alcohol, benzene, carbon tetrachloride and ether.

Physical State: Liquid
Odor Threshold: 8.7 to 870.0 mg/m^3
Vapor Pressure (kPa): 1.333 at 25.9 °C
Vapor Density (Air=1): 3.66
Formula Weight: 106.17
Specific Gravity (H_2O=1, at 4 °C): 0.8670 at 20 °C
Evaporation Rate: Fast
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 136.2 °C (277 °F) at 760 mm Hg
Freezing/Melting Point: -95 °C (-139 °F)
Volatile Component (% Vol): 100
Water Solubility: 0.01% by weight

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 3500 mg/kg
Inhalation (human) TC_{Lo}: 100 ppm/8h
Inhalation (rat) LC_{Lo}: 4000 ppm/4h
Intraperitoneal (mouse) LD_{50}: 2642 mg/kg~
Dermal (rabbit) LD_{50}: 17800 mg/kg~
Liver changes, utheral tract, effects on fertility, specific developmental abnormalities (musculoskeletal system) recorded.
NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

Irritation
Skin (rabbit): 15 mg/24h mild
Eye (rabbit): 500 mg - SEVERE

See *RTECS* DA 0700000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, it exist predominantly in the vapor phase based on its vapor pressure where it will photochemically degrade by reaction with hydroxyl radicals (half-life 0.5 to 2 days) and partially return to earth in rain. It will not be subject to direct photolysis. Releases into water will decrease in concentration by evaporation and biodegradation. The time for this decrease and the primary loss processes will depend on the season, and the turbulence and microbial populations in the particular body of water. Representative half-lives are several days to 2 weeks. Some may be adsorbed by sediment but significant bioconcentration in fish is not expected to occur based upon its octanol/water partition coefficient. It is only adsorbed moderately by soil. It will not significantly hydrolyze in water or soil.

Ecotoxicity: LC_{50} Cyprinodon variegatus (sheepshead minnow) 275 mg/l 96 hr in a static unmeasured bioassay; LC_{50} Pimephales promelas (fathead minnow) 12.1 mg/l/96 hr (confidence limit 11.5 - 12.7 mg/l), flow-through bioassay with measured concentrations, 26.1 °C, dissolved oxygen 7.0 mg/l, hardness 45.6 mg/l calcium carbonate, alkalinity 43.0 mg/l; Toxicity threshold (cell multiplication inhibition test): Pseudomonas putida (bacteria) 12 mg/l ; LC_{50} Palaemonetes pugio (grass shrimp, adult) 14,400 ug/l/24 hr in a static unmeasured bioassay; LC_{50} Palaemonetes pugio (grass shrimp, larva) 10,200 ug/l/24 hr in a static unmeasured bioassay; Toxicity threshold (cell multiplication inhibition test): Microcystis aeruginosa (algae) 33 mg/l; Scenedesmus quadricauda (green algae) > 160 mg/l

Henry's Law Constant: 8.44×10^{-3}

BCF: goldfish 1.9

Biochemical Oxygen Demand (BOD): theoretical 2.8%, 5 days

Octanol/Water Partition Coefficient: log $K_{ow} = 3.15$

Soil Sorption Partition Coefficient: $K_{OC} = 164$

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Ethylbenzene
ID: UN1175
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:**

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per CWA Section 307(a) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: 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 Collection
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1171 RiverFront Center, Amsterdam, NY 12010
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Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Chromium **CAS Number:** 7440-47-3
Chemical Formula: Cr
Structural Chemical Formula: Cr
EINECS Number: 231-157-5
ACX Number: X1002501-1
Synonyms: CHROM; CHROME; CHROMIUM; CHROMIUM METAL
General Use: Used in the manufacture of chrome-steel or chrome-nickel-steel alloys (stainless steel); for greatly increasing resistance and durability of metals; for chrome-plating of other metals.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
chromium	7440-47-3	> 99.5

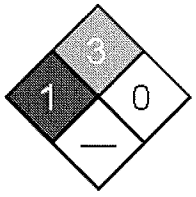
OSHA PEL
TWA: 1 mg/m^3.

NIOSH REL
TWA: 0.5 mg/m^3.

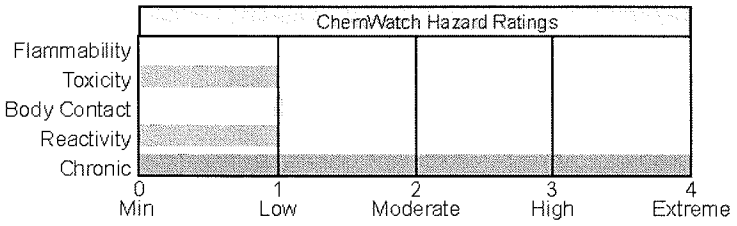
ACGIH TLV
TWA: 0.5 mg/m^3.

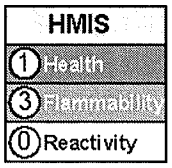
IDLH Level
250 mg/m^3 (as Cr).

Section 3 - Hazards Identification

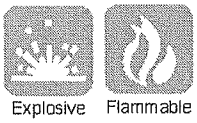


Fire Diamond





ANSI Signal Word
Warning!



☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Steel-gray, lustrous metal powder; odorless. Irritating to eyes/skin/respiratory tract. Chronic Effects: lung fibrosis. Flammable. Explosive in air.

Potential Health Effects

Target Organs: respiratory system
Primary Entry Routes: inhalation, skin absorption, ingestion
Acute Effects

Inhalation: The dust may be discomforting to the upper respiratory tract and may be harmful if inhaled.
Chrome fume is irritating to the respiratory tract and lungs.
Toxic effects result from over-exposure.
Asthmatic conditions may result as a consequence of the sensitizing action of chrome VI compounds.

Eye: The dust may produce eye discomfort and abrasive eye inflammation.

Skin: The material may be mildly discomforting to the skin and is capable of causing skin reactions which may lead to dermatitis.
Chrome fume, as the chrome VI oxide, is corrosive to the skin and may aggravate pre-existing skin conditions such as dermatitis and eczema.
As a potential skin sensitizer, the fume may cause dermatoses to appear suddenly and without warning. Absorption of chrome VI compounds through the skin can cause systemic poisoning effecting the kidneys and liver.

Ingestion: The material is moderately discomforting to the gastrointestinal tract and may be harmful if swallowed in large quantity.

Carcinogenicity: NTP - Listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Not listed; MAK - Not listed.

Chronic Effects: Metallic dusts generated by the industrial process give rise to a number of potential health problems. The larger particles, above 5 micron, are nose and throat irritants. Smaller particles however, may cause lung deterioration. Particles of less than 1.5 micron can be trapped in the lungs and, dependent on the nature of the particle, may give rise to further serious health consequences.

Chromium(III) is considered an essential trace nutrient serving as a component of the "glucose tolerance factor" and a cofactor for insulin action. High concentrations of chromium are also found in RNA. Trivalent chromium is the most common form found in nature.

Chronic inhalation of trivalent chromium compounds produces irritation of the bronchus and lungs, dystrophic changes to the liver and kidney, pulmonary edema, and adverse effects on macrophages. Intratracheal administration of chromium(III) oxide, in rats, increased the incidence of sarcomas, and tumors and reticulum cell sarcomas of the lung. There is inadequate evidence of carcinogenicity of chromium(III) compounds in experimental animals and humans (IARC).

Chronic exposure to hexavalent chromium compounds reportedly produces skin, eye and respiratory tract irritation, yellowing of the eyes and skin, allergic skin and respiratory reactions, diminished sense of smell and taste, blood disorders, liver and kidney damage, digestive disorders and lung damage. There is sufficient evidence of carcinogenicity of chromium(VI) compounds in experimental animals and humans to confirm these as Class 1 carcinogens (IARC).

Exposure to chromium during chrome production and in the chrome pigment industry is associated with cancer of the respiratory tract. A slight increase in gastrointestinal cancer following exposure to chromium compounds has also been reported. The greatest risk is attributed to exposure to acid- soluble, water-insoluble hexavalent chromium which occurs in roasting and refining processes. Animal studies support the idea that the most potent carcinogenic compounds are the slightly soluble hexavalent compounds.

The cells are more active in the uptake of the hexavalent forms compared to trivalent forms and this may explain the difference in occupational effect. It is the trivalent form, however, which is metabolically active and binds with nucleic acid within the cell suggesting that chromium mutagenesis first requires biotransformation of the hexavalent form by reduction.

Hexavalent chromes produce chronic ulceration of skin surfaces (quite independent of other hypersensitivity reactions exhibited by the skin).

Water-soluble chromium(VI) compounds come close to the top of any published "hit list" of contact allergens (eczematogens) producing positive results in 4 to 10% of tested individuals. On the other hand only chromium(III) compounds can bind to high molecular weight carriers such as proteins to form a complete allergen (such as a hapten). Chromium(VI) compounds cannot.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Encourage patient to blow nose to ensure clear breathing passages. Rinse mouth with water. Consider drinking water to remove dust from throat.

Seek medical attention if irritation or discomfort persist.

Eye Contact: Immediately hold the eyes open and flush 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.

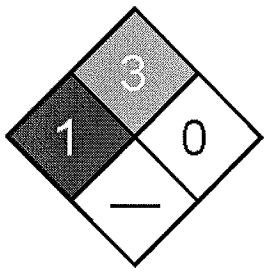
Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

Section 5 - Fire-Fighting Measures

Flash Point: Noncombustible Solid
Autoignition Temperature: 580 °C (cloud)
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: Sand, dry powder extinguishers or other inerts should be used to smother dust fires.
These are the only suitable means for extinguishing metal dust fires.
Do NOT use water.
General Fire Hazards/Hazardous Combustion Products: Sand, dry powder extinguishers or other inerts should be used to smother dust fires.
These are the only suitable means for extinguishing metal dust fires.
Do NOT use water.



Fire Diamond

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
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: Clean up all spills immediately. Avoid contact with skin and eyes.
Wear impervious gloves and safety glasses.
Remove all ignition sources.
Use dry clean-up procedures and avoid generating dust.
Vacuum up or sweep up.
Place spilled material in clean, dry, sealable, labeled container.
Large Spills: Clear area of personnel.
Contact fire department and tell them location and nature of hazard.
Control personal contact by using protective equipment.
Prevent, by any means available, spillage from entering drains or water ways.
Moderate hazard.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so.
Avoid generating dust.
Collect recoverable product into labeled containers for recycling.
Collect residues and seal in labeled drums for disposal.
Wash area down with large quantity of water and prevent runoff into drains.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
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: Limit all unnecessary personal contact.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. When handling DO NOT eat, drink or smoke.
Always wash hands with soap and water after handling.
Avoid physical damage to containers. Use good occupational work practices.
Observe manufacturer's storing and handling recommendations.
Recommended Storage Methods: Packaging as recommended by manufacturer.
Check that containers are clearly labeled.
Store in metal drums or safety cans.
Plastic container.
Metal can.
Metal drum.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Metal dusts must be collected at the source of generation as they are potentially explosive.

1. Vacuum cleaners, of flame-proof design, should be used to minimize dust accumulation.
2. Metal spraying and blasting should, where possible, be conducted in separate rooms. This minimizes the risk of supplying oxygen, in the form of metal oxides, to potentially reactive finely divided metals such as aluminum, zinc, magnesium or titanium.
3. Work-shops designed for metal spraying should possess smooth walls and a minimum of obstructions, such as ledges, on which dust accumulation is possible.
4. Wet scrubbers are preferable to dry dust collectors.
5. Bag or filter-type collectors should be sited outside the workrooms and be fitted with explosion relief doors.
6. Cyclones should be protected against entry of moisture as reactive metal dusts are capable of spontaneous combustion in humid or partially wetted state.
7. Local exhaust systems must be designed to provide a minimum capture velocity at the fume source, away from the worker, of 0. 5 meter/sec.

Special ventilation requirements apply for processes which result in the generation of barium, chromium, lead, or nickel fume and in those processes which generate ozone.

The use of mechanical ventilation by local exhaust systems is required as a minimum in all circumstances (including outdoor work).

(In confined spaces always check that oxygen has not been depleted by excessive rusting of steel or snowflake corrosion of aluminum). Local exhaust systems must be designed to provide a minimum capture velocity at the fume source, away from the worker, of 0. 5 meter/sec.

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: PVC gloves; Safety footwear.
Rubber gloves.

Respiratory Protection:

Exposure Range >1 to 10 mg/m^3: Air Purifying, Negative Pressure, Half Mask
Exposure Range >10 to 100 mg/m^3: Air Purifying, Negative Pressure, Full Face
Exposure Range >100 to <250 mg/m^3: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 250 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: dust/mist filter (use P100 or consult supervisor for appropriate dust/mist filter)

Other: Overalls. Eyewash unit.

Section 9 - Physical and Chemical Properties

Appearance/General Info: A hard, brittle, lustrous, steel-grey metal which is very resistant to corrosion. Soluble in dilute sulphuric and hydrochloric acids. Welding flux grades typical sieve analysis (cumulative retention %):- 200 um 0, 150 um 10-40, 100 50-80, 75 um 80-95, 63 um 90-96, 43 um 97-100.

Physical State: Divided solid
Vapor Pressure (kPa): 0.13 at 1616 °C
Vapor Density (Air=1): 1.79
Formula Weight: 52.00
Specific Gravity (H_2O=1, at 4 °C): 7.2
Evaporation Rate: Not applicable
pH: Not applicable

pH (1% Solution): Not applicable.
Boiling Point: 2642 °C (4788 °F)
Freezing/Melting Point: 1900 °C (3452 °F)
Volatile Component (% Vol): Nil
Decomposition Temperature (°C): Not applicable
Water Solubility: Insoluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Segregate from strong oxidizers, nitric oxide, potassium chlorate, sulfur dioxide, acids and strong alkalis.

Section 11 - Toxicological Information

No relevant toxicological data found at time of research.

See *RTECS* GB 4200000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.
BCF: snails 1 $x10^6$
Biochemical Oxygen Demand (BOD): 62.5 lb/lb, 5 days

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options. Follow applicable federal, state, and local regulations.
Bury residue in an authorized landfill.
Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: None

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed
CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 5000 lb (2268 kg)
SARA 40 CFR 372.65: 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 Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Calcium Cyanide **CAS Number:** 592-01-8
Chemical Formula: C_2CaN_2
Structural Chemical Formula: $Ca(CN)_2$
EINECS Number: 209-740-0
ACX Number: X1005026-5
Synonyms: CALCID; CALCIUM CYANIDE; CALCIUM CYANIDE MIXTURE,SOLID; CALCIUM CYANIDE,SOLID; CALCYAN; CALCYANIDE; CYANIDE OF CALCIUM; CYANOGAS; CYANURE DE CALCIUM; CYMAG; DEGESCH CALCIUM CYANIDE A-DUST; EPA PESTICIDE CHEMICAL CODE 074001
Derivation: Produced by fusing calcium cyanamide with sodium chloride to give a crude mixture of calcium cyanide and sodium cyanide or by treating powdered calcium oxide with boiling anhydrous hydrocyanic acid in the presence of an accelerator such as ammonia or water.
General Use: Used as a rodenticide; fumigant for greenhouses, grain, seed, and citrus fruits; for leaching gold and silver ores; as a stabilizer for cements; and in the manufacture of other cyanides and steel.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Calcium Cyanide	592-01-8	ca 40-58% wt (commercial preparation)

Trace Impurities: May contain up to 3% calcium carbide.

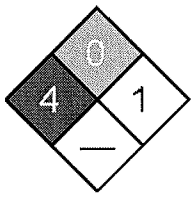
OSHA PEL
TWA: 5 mg/m^3; skin, as CN.

ACGIH TLV
Ceiling: 5 mg/m^3; skin.

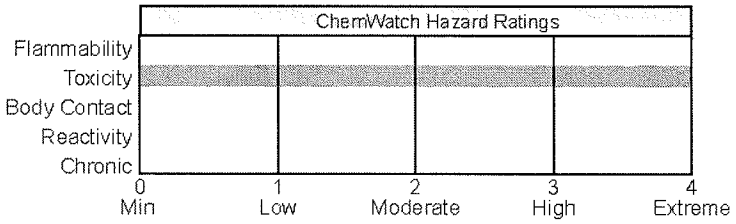
NIOSH REL
Ceiling: 4.7 ppm, 5 mg/m^3; 10 min.

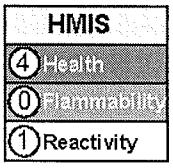
DFG (Germany) MAK
TWA: 2 mg/m^3; PEAK: 2 mg/m^3; skin; measured as inhalable fraction of the aerosol.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


Poison

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless crystals or white powder; slight almond odor. Poison. Other Acute Effects: chemical asphyxiant, bright-pink skin coloration of the skin, death due to respiratory arrest.

Potential Health Effects

Target Organs: Eyes, skin, blood, thyroid, cardiovascular system, central nervous system.
Primary Entry Routes: Inhalation, eye contact, skin contact/absorption, ingestion.
Acute Effects
Inhalation: Irritation of the respiratory tract, flushing, weakness, headache, confusion, dizziness. Heavy exposures can lead to difficulty breathing, convulsions and cardiac difficulties (hypertension, arrythmias, etc.). Death may occur due to respiratory arrest. Inhalation of 200 to 300 ppm can be rapidly fatal. The maximum exposure with documented survival was 500 mg/m^3.
Eye: Irritation.
Skin: Itching, redness, and irritation. Calcium cyanide can be absorbed through the skin in toxic amounts.

Ingestion: Irritation of the gastrointestinal tract, nausea and vomiting, salivation, anxiety, confusion, and dizziness. In severe cases, symptoms may progress to convulsions, paralysis, coma, cardiac arrythmias, and death due to respiratory arrest.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Thyroid disorders.

Chronic Effects: There are reports of enlarged thyroids in workers exposed to cyanide salts. It is thought that the cyanide is metabolized to thiocyanate, which competes with iodine in the body resulting in goiter. Other chronic effects include appetite loss, headache, weakness, vitamin B12 and folate abnormalities, and insomnia.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain or irritation persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water. *Do not* induce vomiting. If available, obtain and prepare the Lilly cyanide antidote kit [Eli Lilly Co. (stock No. M76)] for use. Alternately, break an amyl nitrite ampule in a cloth and hold under nose for 15 seconds.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: If the victim is conscious, bradycardia and absence of cyanosis may be key diagnostic signs. Consider administration of amyl nitrite followed by sodium nitrite and sodium thiosulfate. Obtain blood cyanide levels.

Section 5 - Fire-Fighting Measures

See DOT ERG

Flash Point: Calcium cyanide is nonflammable itself but releases flammable hydrogen cyanide gas upon exposure to heat, water, or acids. Calcium carbide (an impurity in calcium cyanide) also releases flammable acetylene gas on contact with water.

Autoignition Temperature: None reported.

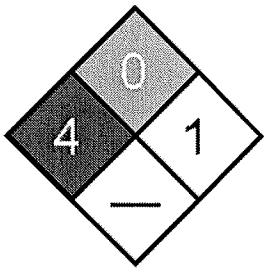
LEL: None reported.

UEL: None reported.

Flammability Classification: Nonflammable solid.

Extinguishing Media: Use agents suitable for surrounding fire, except water. Water should not be used due to formation of flammable hydrogen cyanide gas.

General Fire Hazards/Hazardous Combustion Products: Carbon and nitrogen oxide(s). Release of flammable hydrogen cyanide gas on contact with heat, water, or acids.



Fire Diamond

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing is *not* effective protection against calcium cyanide exposure.

Section 6 - Accidental Release Measures

See DOT ERG

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off all heat and water sources. Cleanup personnel should protect against exposure.

Small Spills: Carefully scoop up or vacuum (with appropriate filter). *Do not* sweep!

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. Damp mop with calcium or sodium hypochlorite solution.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use only with sufficient ventilation to prevent hazardous air levels and wear appropriate PPE. Never eat, drink, or smoke in work areas. Practice good personal hygiene after using calcium cyanide, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in a cool, dry, well-ventilated area away from heat and water sources and incompatibles (Sec. 10).

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where possible, enclose processes to prevent dispersion of dusts into work area. Provide general or local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the central nervous system and thyroid. Educate workers about the hazards of calcium cyanide exposure and train in safe work practices.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. One study has shown butyl rubber or polycarbonate to be suitable materials for PPE. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For <= 25 mg/m^3, wear any supplied-air respirator or any SCBA with a full facepiece. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove calcium cyanide from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless crystals or white powder with a slight bitter almond odor (genetically undetectable by 20 to 60% of the population).

Physical State: Solid

Vapor Pressure (kPa): ~ 0 mm Hg

Formula Weight: 92.12

Specific Gravity (H_2O=1, at 4 °C): 1.853 at 68 °F (20 °C)

Freezing/Melting Point: > 350 °C (decomposes). An estimated M.P. of 640 °C was calculated (extrapolated because of decomposition).

Water Solubility: Soluble (liberates hydrogen cyanide gas).

Other Solubilities: Soluble in alcohol and very weak acids.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Calcium cyanide is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization does not occur. Exposure to heat, water, and incompatibles.

Storage Incompatibilities: Acids and water (releases flammable hydrogen cyanide gas), magnesium, fluorine, nitrates, nitrites, nitric acid; violent explosion when heated with chlorate or nitrite to 842 °F (450 °C).

Hazardous Decomposition Products: Thermal oxidative decomposition of calcium cyanide can produce carbon and nitrogen oxide(s).

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD_{50}: 39 mg/kg.

See *RTECS* EW0700000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: Sunfish, TL_m = 0.12 ppm/96 hr; Cockle, LC_{50} = > 25 ppm/48 hr.

Section 13 - Disposal Considerations

Disposal: Calcium cyanide is *not* a good candidate for incineration. Never treat with acid (hydrogen cyanide gas release). Treat with calcium or sodium hypochlorite to pH 10 to 11.5 and let stand for 24 hr. Dilute with water and await disposal. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Calcium cyanide
ID: UN1575
Hazard Class: 6.1 - Poisonous materials
Packing Group: I - Great Danger
Symbols:
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB7, IP1, N79, N80
Packaging: **Exceptions:** None **Non-bulk:** 211 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 kg **Cargo aircraft only:** 50 kg
Vessel Stowage: **Location:** A **Other:** 26, 40

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed P021
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 10 lb (4.535 kg)
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 Collection
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1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Cadmium **CAS Number:** 7440-43-9
Chemical Formula: Cd
EINECS Number: 231-152-8
ACX Number: X1002486-9
Synonyms: C I 77180; C.I. 77180; CADMIUM; CADMIUM DUST FUME; CADMIUM POWDER; COLLOIDAL CADMIUM; KADMIUM
Derivation: Cadmium is collected as dust or fume from roasting zinc ores, mixed with coal or coke and sodium or zinc chloride, and sintered. The cadmium fume is collected in an electrostatic precipitator, leached, fractionally precipitated, and distilled; collected as sludge from zinc sulfate purification; prepared from direct distillation of cadmium-bearing zinc; obtained by recovery from electrolytic zinc process; may be prepared from cadmium sulfate in the laboratory.
General Use: Cadmium is used as a constituent of easily fusible alloys; soft solder and solder for aluminum; in electroplating; as a deoxidizer for nickel plating; for process engraving; electrodes for cadmium vapor lamps; photoelectric cells; photometry of ultraviolet sun-rays; in Ni-Cd storage batteries; to charge Jones reductors; as an amalgam in dentistry; power transmission wire; TV phosphors; basis of pigments used in ceramic glazing, machinery enamels, baking enamels; Weston-standard-cell control of atomic fission in nuclear reactors; reactor control rods; fungicide; photography and lithography; selenium rectifiers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Cadmium		ca 99.5+% wt

Trace Impurities: < 10 ppm

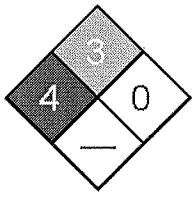
OSHA PEL
TWA: 0.005 mg/m^3.

NIOSH REL
Lowest Feasible Concentration.

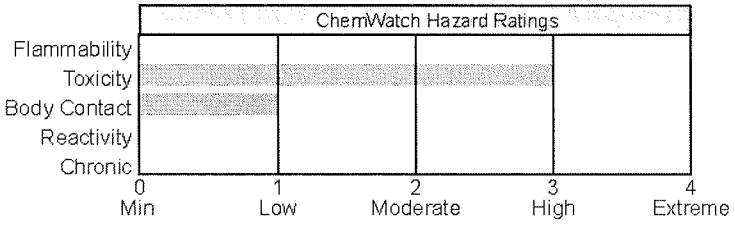
ACGIH TLV
TWA: 0.01 mg/m^3; measured as inhalable fraction of the aerosol;
TWA: 0.002 mg/m^3; measured as respirable fraction of the aerosol.

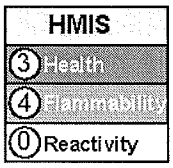
IDLH Level
9 mg/m^3 (as Cd).

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


Explosive Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆
Lustrous metal solid, silver-white to bluish color, odorless. Irritating to skin/respiratory tract. Toxic by inhalation. Chronic Effects: kidney damage, obstructive lung disease, possible carcinogen/teratogen. Dust ignites spontaneously in air. Forms explosive dust-air mixtures.

Potential Health Effects

Target Organs: Respiratory system, kidneys
Primary Entry Routes: Inhalation and ingestion

Acute Effects

Inhalation: Initial signs/symptoms of cadmium poisoning resemble those of the flu. Inhalation of dust or fumes causes throat dryness, cough, headache, vomiting, chest pain, dyspnea (shortness of breath), central nervous system (CNS) effects, extreme restlessness and irritability, pneumonitis, possibly bronchopneumonia, pulmonary edema, and death due to respiratory failure in severe cases. Symptoms may be delayed up to 24 hours. Residual emphysema and fibrosis may result. Note: heating of cadmium may produce cadmium oxide, the inhalation of which can result in metal fume fever, characterized by fever, chills, malaise, headache, myalgias, fatigue, cough, thirst, and abdominal discomfort, with symptom onset about 3 to 10 hours after exposure. Symptoms do not usually last beyond 24 to 48 hours.

Eye: May cause irritation.

Skin: Contact may cause irritation, skin eruptions and pruritus. Significant dermal absorption rarely occurs.

Ingestion: Causes increased salivation, dry mouth, choking, nausea, vomiting, abdominal pain and cramping, blurred vision, anemia, kidney dysfunction, diarrhea, gastroenteritis, and substernal pain.

Carcinogenicity: NTP - Class 2A, Reasonably anticipated to be a carcinogen, limited evidence of carcinogenicity from studies in humans; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B1, Probable human carcinogen based on epidemiologic studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Medical Conditions Aggravated by Long-Term Exposure: Kidney disorders, respiratory disorders.

Chronic Effects: Include chronic obstructive lung disease such as emphysema, kidney damage (renal tubular disorder and proteinuria (low molecular weight)), bone demineralization, microfractures and osteomalacia, respiratory cancer, gastrointestinal symptoms, anosmia (loss of sense of smell), rhinitis and discoloration of the teeth. It is implicated as the causative agent in Itai-Itai disease in Japan.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the conscious and alert person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Consider a chest X-ray after acute exposure.

Section 5 - Fire-Fighting Measures

See DOT ERG

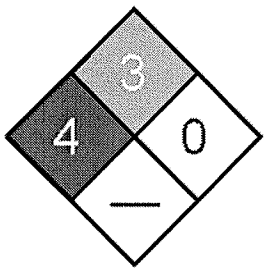
Flash Point: Data not found.

Autoignition Temperature: 482 °F (250 °C) (layer cadmium metal dust)

LEL: Data not found.

UEL: Data not found.

Flammability Classification: Flammable



Fire Diamond

Extinguishing Media: Extinguish with carbon dioxide, dolomite, dry powder, graphite, soda ash, sodium chloride, dry chemical, or sand.

General Fire Hazards/Hazardous Combustion Products: When heated to decomposition, toxic fumes of cadmium are emitted. The finely divided material is pyrophoric. The more finely divided the powder the greater the fire/explosion hazard.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

See DOT ERG

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Cleanup personnel should protect against exposure. Prevent entry into water, sewers, basements or confined areas.

Small Spills: If in solid form, do not sweep! Absorb or cover with dry earth, sand or other noncombustible material. Carefully scoop up or vacuum (with a HEPA filter).

Large Spills: Do not release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120). Also 1910.1027 .

Section 7 - Handling and Storage

Handling Precautions: Wear personal protective clothing and equipment to prevent dust inhalation and any contact with skin or eyes (Sec. 8). Wash thoroughly after handling cadmium.
Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from heat, light, ignition sources, incompatibles, and air. Cadmium slowly oxidizes in air to form cadmium oxide.

Storage Requirements: Areas where cadmium is used or stored must be labeled according to 29 CFR 1910.1027.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid dust dispersion into the work area. Provide general or local exhaust ventilation systems to maintain airborne concentrations below exposure limits (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with this material. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on kidney functions (including urine screening for micro-globulins), lungs and blood. Follow written procedures set forth by OSHA in 29 CFR 1910.1027.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent any skin contact. Butyl rubber, chlorinated polyethylene, and polyvinyl chloride are recommended materials. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not protective eye devices. Appropriate eye protection must be worn instead of, or in conjunction with, contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Select respirator based on exposure range as follows. Exposure range >0.005 to 0.05 mg/m^3 use air purifying respirator, negative-pressure, half-mask; >0.05 to 0.5 mg/m^3 use air purifying respirator, negative-pressure, full-face; >0.5 to 5 mg/m^3/use supplied-air respirator, constant flow/pressure-demand, full-face; >5 mg/m^3/use a SCBA, pressure-demand, full-face. Use a magenta cartridge (P100). For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, cartridge change schedules, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Silver-white, blue-tinged. Odorless.

Physical State: Solid; lustrous metal or granular powder

Vapor Pressure (kPa): 1 mm Hg at 741 °F (394 °C)

Formula Weight: 112.41

Density: 8.642 at 77 °F (25 °C)

Refractive Index: 1.8 at 578 nm and 20 °C

Boiling Point: 1409 °F (765 °C)

Freezing/Melting Point: 609.8 °F (321 °C)

Ionization Potential (eV): 8.99367 eV

Water Solubility: Insoluble

Other Solubilities: Dissolved by acids; ammonium nitrate solution

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Cadmium is stable at room temperature in closed containers under normal storage and handling conditions. It slowly oxidizes in air to form cadmium oxide. Finely divided material is pyrophoric, i.e., it may ignite or explode spontaneously in air. Hazardous polymerization cannot occur. Avoid creation of dust clouds, contact with chemical incompatibles, heat, and sources of ignition.

Storage Incompatibilities: Include acids (reacts readily with dilute nitric acid, slowly with hydrochloric acid); explodes on contact with hydrazoic acid; violent or explosive reaction when heated with ammonium nitrate; tellurium; zinc; ammonia; sulfur; selenium; nitryl fluoride; oxidizing agents; metals.

Hazardous Decomposition Products: Thermal oxidative decomposition of cadmium can produce toxic fumes of cadmium and cadmium oxide.

Section 11 - Toxicological Information

Acute Oral Effects:
Rat, oral, LD_{50}: 2330 mg/kg.
Mouse, oral, LD_{50}: 890 mg/kg.

Acute Inhalation Effects:
Rat, inhalation, LC_{50}: 25 mg/m^3/30 minutes produced dyspnea.
Human, inhalation, LC_{Lo}: 39 mg/m^3/20 minutes produced cardiac changes; respiratory depression.

Acute Skin Effects:
Rabbit, subcutaneous, LD_{Lo}: 6 mg/kg produced toxic effects: Effects on newborn - reduced weight gain and behavioral.

Other Effects:
Reproductive Effects: Rat, female, oral, 23 mg/kg administered on gestational days 1 - 22 produced specific developmental abnormalities - blood and lymphatic system (including spleen and marrow).
Rat, female, oral, 21.5 mg/kg administered to multigenerations produced toxic effects: Effects on fertility - preimplantation mortality; Effects on newborn - germ cell effects in offspring.
Rat, male, oral, 155 mg/kg administered 13 weeks prior to mating produced toxic effects: Effects on newborn - reduced weight gain and behavioral.
Mouse, micronucleus test, cell type - embryo: 6 µmol/L induced mutation.
Hamster, cytogenic analysis, cell type - ovary: 1 µmol/L induced mutation.
Tumorigenic Effects - Woman, inhalation, 129 µg/m^3/20 years, continuous produced toxic effects: carcinogenic by RTECS criteria; Lung, thorax or respiration - tumors.
Human, inhalation, TC_{Lo}: 88 µg/m^3/8.6 years produced proteinuria.
Rat, oral, 546 mg/kg administered for 26 weeks continuously produced toxic effects: changes in serum composition; transminases; weight loss or decreased weight gain.
Rat, oral, 1512 mg/kg administered for 48 weeks continuously produced toxic effects: changes to liver, kidneys, ureter and bladder.
Rat, subcutaneous, 3372 µg/kg produced toxic effects: carcinogenic by RTECS criteria, tumors at site of application.

See *RTECS* EU9800000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: *Dreisena polymorpha,* zebra mussels, chronic LC_{50}: 130 mcg/L; *Rivulus marmoratus*, mangrove fish, LC_{50} in fresh water: 2.96 mg/L; Steelhead trout, LC_{50}: 0.0009 ppm for 96 hours; *Daphnia magna*, 0.1 ppm lethal.

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Cadmium compounds
ID: UN2570
Hazard Class: 6.1 - Poisonous materials
Packing Group: I - Great Danger
Symbols:
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB7, IP1

Packaging:	**Exceptions:** None	**Non-bulk:** 211	**Bulk:** 242
Quantity Limitations:	**Passenger aircraft/rail:** 5 kg		**Cargo aircraft only:** 50 kg
Vessel Stowage:	**Location:** A	**Other:**	

Shipping Name and Description: Cadmium compounds
ID: UN2570
Hazard Class: 6.1 - Poisonous materials
Packing Group: II - Medium Danger
Symbols:
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB8, IP2, IP4
Packaging: **Exceptions:** None **Non-bulk:** 212 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 25 kg **Cargo aircraft only:** 100 kg
Vessel Stowage: **Location:** A **Other:**

Shipping Name and Description: Cadmium compounds
ID: UN2570
Hazard Class: 6.1 - Poisonous materials
Packing Group: III - Minor Danger
Symbols:
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB8, IP3
Packaging: **Exceptions:** 153 **Non-bulk:** 213 **Bulk:** 240
Quantity Limitations: **Passenger aircraft/rail:** 100 kg **Cargo aircraft only:** 200 kg
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed
CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 10 lb (4.535 kg)
SARA 40 CFR 372.65: 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 Collection
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Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Benzo(a)pyrene **CAS Number:** 50-32-8
Chemical Formula: $C_{20}H_{12}$
EINECS Number: 200-028-5
ACX Number: X1002798-4
Synonyms: B(A)P; BAP; BENZO(D,E,F)CHRYSENE; 3,4-BENZOPIRENE; 1,2-BENZOPYRENE; 3,4-BENZOPYRENE; 6,7-BENZOPYRENE; BENZO(A)PYRENE; 3,4-BENZPYREN; 3,4-BENZ(A)PYRENE; 3,4-BENZPYRENE; BENZ(A)PYRENE; BENZ[A]PYRENE; 3,4-BENZYLPYRENE; 3,4-BENZYPYRENE; 3,4-BP; BP; COAL TAR PITCH VOLATILES: BENZO(A)PYRENE
Derivation: Synthesized from pyrene and succinic anhydride.
General Use: Benzo(a)pyrene is no longer used or produced commercially in the US. In its pure form, benzo(a)pyrene may be used as a research laboratory reagent. It also occurs in combustion products of coal, oil, petroleum, wood and other biological matter; in motor vehicle and other gasoline and diesel engine exhaust; in charcoal-broiled foods; in cigarette smoke and general soot and smoke of industrial, municipal, and domestic origin. It occurs naturally in crude oils, shale oils, coal tars, gases and fly ash from active volcanoes and forest fires.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Benzo(a)pyrene	50-32-8	ca 100% wt

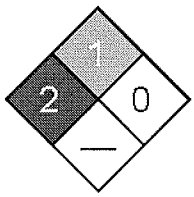
Except in laboratories, benzo(a)pyrene is usually mixed with other coal tar pitch chemicals. Consider exposure limits for coal tar pitch volatiles as a guideline. However, because benzo(a)pyrene is considered a probable carcinogen to humans, it is recommended that exposures to carcinogens be limited to the lowest feasible concentration.

OSHA PEL
TWA: 0.2 mg/m^3.

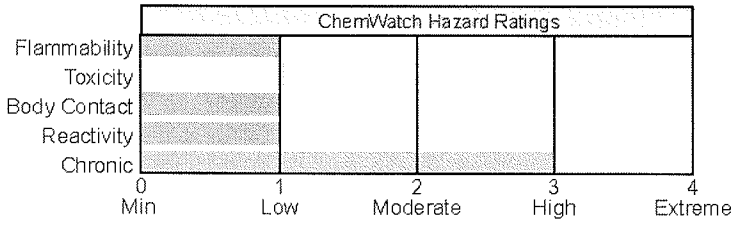
NIOSH REL

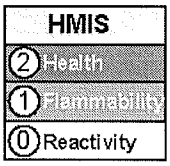
ACGIH TLV
Exposure by all routes should be carefully controlled to levels as low as possible.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Pale yellow, crystalline solid or powder. Irritating to skin, eyes, respiratory tract. Chronic Effects: carcinogen, mutagen. Handle with extreme caution!

Potential Health Effects

Target Organs: Respiratory system, bladder, kidneys, skin.
Primary Entry Routes: Inhalation, ingestion.

Acute Effects

Inhalation: Respiratory tract irritation. Pregnant women may be especially susceptible to exposure effects of benzo(a)pyrene; exposure may damage the fetus. In general, polyaromatic hydrocarbons such as benzo(a)pyrene tend to localize primarily in body fat and fatty tissues (for ex. breasts) and are excreted in breast milk. Benzo(a)pyrene may also affect the male reproductive system (testes and sperm).

Eye: Irritation and/or burns on contact.

Skin: Irritation with burning sensation, rash, and redness; dermatitis on prolonged exposure. Sunlight enhances effects (photosensitization).

Ingestion: None reported.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Medical Conditions Aggravated by Long-Term Exposure: Respiratory system, bladder, kidney, and skin disorders.

Chronic Effects: Inhalation: Cough and bronchitis. Eye: Photosensitivity and irritation. Skin: Skin changes such as thickening, darkening, pimples, loss of color, reddish areas, thinning of the skin, and warts. Sunlight enhances effects (photosensitization). Other: Gastrointestinal (GI) effects include leukoplakia (a pre-cancerous condition characterized by thickened white patches of epithelium on mucous membranes, especially of the mouth). Cancer of the lung, skin, kidneys, bladder, or GI tract is also possible. Smoking in combination with exposure to benzo(a)pyrene increases the chances of developing lung cancer. Persons with a high degree of inducibility of the enzyme aryl hydrocarbon hydroxylase may be a high risk population.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of tepid water for at least 15 min. Consult an ophthalmologist if irritation or pain persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water (less than 15 min). Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Inducing vomiting is not necessary since benzo(a)pyrene has a low acute toxicity and therefore, is generally an unnecessary procedure. Consider activated charcoal/cathartic.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Monitor CBC and arterial blood gases, conduct liver, renal, and pulmonary function tests (if respiratory tract irritation is present), and urinalysis. Biological monitoring techniques testing for metabolites in blood or urine, or DNA adducts in blood or tissues are useful for epidemiological studies that determine if exposure has occurred. Because neither normal nor toxic levels have been established, those techniques may not be useful for evaluating individual patients.

Special Precautions/Procedures: Emergency personnel should protect against exposure.

Section 5 - Fire-Fighting Measures

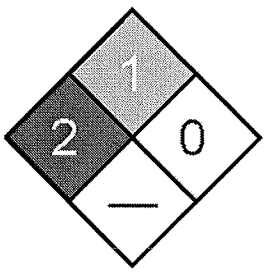
See DOT ERG

Flash Point: None reported. Benzo(a)pyrene may burn, but does *not* readily ignite.

Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.



Fire Diamond

Extinguishing Media: For small fires, use dry chemical, sand, water spray, or foam. For large fires, use water spray, fog, or foam.

General Fire Hazards/Hazardous Combustion Products: Carbon monoxide and carbon dioxide.

Fire-Fighting Instructions: Isolate hazard and deny entry. If feasible and without undue risk, move containers from fire hazard area. Otherwise, cool fire-exposed containers with water spray until well after fire is extinguished. Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode and full protective clothing.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel of large spills, remove heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and skin or eye contact. Clean up spills promptly.

See DOT ERG

Small Spills: Carefully scoop up spilled material and place into appropriate containers for disposal. For liquid spills, take up with a noncombustible, inert absorbent and place into appropriate containers for disposal.

Large Spills: For large spills, dike far ahead of liquid spill or contain dry spill for later disposal. Do not release into sewers or waterways. *Do not* dry sweep! Use a vacuum with a HEPA filter or a wet method to reduce dust. After cleanup is complete, thoroughly decontaminate all surfaces. *Do not* reuse contaminated cleaning materials.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Handle with extreme caution and take all necessary measures to avoid exposure to benzo(a)pyrene because it is a carcinogen and mutagen. Follow good personal hygiene procedures and thoroughly wash hands with soap and water after handling. Use safety pipettes for all pipetting.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed and properly labeled containers in a cool, well-ventilated area.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use a Class I, Type B, biological safety hood when working with benzo(a)pyrene in a laboratory. Decrease the rate of air extraction, so that benzo(a)pyrene can be handled without powder being blown around the hood. Keep glove boxes under negative pressure. Use vertical laminar-flow, 100% exhaust, biological safety cabinets for containment of in vitro procedures. The exhaust air flow should be sufficient to provide an inward air flow at the face opening of the cabinet. Ensure contaminated air sheaths that are under positive pressure are leak-tight. Never use horizontal laminar-flow hoods or safety cabinets where filtered air is blown across the working area towards the operator. Test cabinets before work begins to ensure they are functioning properly. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical examinations with emphasis on the oral cavity, bladder, kidneys, skin, and respiratory tract. Conduct urinalysis including specific gravity, albumin, glucose, and microscopic examination of centrifuged sediment for red blood cells. Also, include 14" x 17" chest roentgenogram, FVC + FEV1, and CBC to detect any leukemia or aplastic anemia. It is recommended that this exam be repeated on an annual basis and semiannual basis for employees 45 yr of age or older or with 10 or more years of exposure to coal tar pitch volatiles. Train workers about the hazards of benzo(a)pyrene and the necessary protective measures to prevent exposure. Periodically inspect lab atmospheres, surfaces such as walls, floors, and benches, and interior of fume hoods and air ducts for contamination. Post appropriate signs and labels on doors leading into areas where benzo(a)pyrene is used.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. In animal laboratories, wear protective suits (disposable, one-piece and close-fitting at ankles and wrists), gloves, hair covering, and overshoes. In chemical laboratories, wear gloves and gowns. Wear protective eyeglasses or chemical safety, gas-proof goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendations are for coal tar pitch volatiles. For any unknown concentration, wear any SCBA with a full facepiece and operated in a pressure- demand or other positive pressure mode, or any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive pressure mode. For escape, wear any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter, or any appropriate escape-type SCBA. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Shower and change clothes after exposure or at the end of the workshift. Separate contaminated work clothes from street clothes. Launder before reuse. Remove benzo(a)pyrene from your shoes and clean personal protective equipment. Use procedures to ensure laundry personnel are not exposed. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Pale yellow monoclinic needles with a faint, aromatic odor.

Physical State: Solid

Vapor Pressure (kPa): >1 mm Hg at 68 °F (20 °C)

Formula Weight: 252.30

Specific Gravity (H_2O=1, at 4 °C): 1.351

Boiling Point: >680 °F (>360 °C); 590 °F (310 °C) at 10 mm Hg

Freezing/Melting Point: 354 °F (179 °C)

Water Solubility: Insoluble; 0.0038 mg (+/- 0.00031 mg) in 1 L at 77 °F (25 °C)

Other Solubilities: Ether, benzene, toluene, xylene, concentrated hydrosulfuric acid; sparingly soluble in alcohol, methanol.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Benzo(a)pyrene is stable at room temperature in closed containers under normal storage and handling conditions. It undergoes photo-oxidation when exposed to sunlight or light in organic solvents and is also oxidized by chromic acid and ozone. Hazardous polymerization cannot occur. Avoid heat and ignition sources and incompatibles.

Storage Incompatibilities: Strong oxidizers (chlorine, bromine, fluorine) and oxidizing chemicals (chlorates, perchlorates, permanganates, and nitrates).

Hazardous Decomposition Products: Thermal oxidative decomposition of benzo(a)pyrene can produce carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral: 15 mg/kg produced gastrointestinal and musculoskeletal tumors.

Irritation Effects:

Mouse: 14 µg caused mild irritation.

Other Effects:

Rat, oral: 40 mg/kg on the 14th day of pregnancy caused changes in the extra embryonic structures.

Rat, oral: 2 g/kg administered 28 days prior to mating and 1-22 days of pregnancy produced a stillbirth.

Tumorgenicity, mouse, oral: 75 mg/kg administered to the female during the 12- 14 day of pregnancy produced biochemical and metabolic effects on the newborn.

Mouse, inhalation: 200 ng/m^3/6 hr administered intermittently over 13 weeks produced tumors of the lungs.

Human, HeLa cell: 1500 nmol/L caused DNA inhibition.

Human, lung cell: 1 µmol/L caused DNA damage.

Human, liver cell: 100 nmol/L caused DNA damage.

Rabbit, skin: 17 mg/kg administered intermittently over 57 weeks produced tumors of the skin and appendages.

See *RTECS* DJ3675000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to water, benzo(a)pyrene adsorbs very strongly to particulate matter and sediments, bioconcentrates in aquatic organisms which cannot metabolize it, but does not hydrolyze. Direct photolysis at the water surface, evaporation, or biodegradation may be important, but adsorption may significantly retard these processes. Adsorption to particulates may also retard direct photolysis when benzo(a)pyrene is released to air. Benzo(a)pyrene may be removed from air by reaction with nitrogen dioxide (half-life, 7 days) or ozone (half-life, 37 min), or photochemically produced hydroxyl radicals (estimated half-life, 21.49 hr). It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils. It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils.

Ecotoxicity: Oysters, BCF (bioconcentration factor): 3000; rainbow trout, BCF: 920; *Daphnia pulex*, BCF: 13,000.

BCF: Some marine organisms such as phytoplankton, certain zooplankton, scallops (*Placopecten sp*), snails (*Littemia littorea*), and mussels (*Mytilus edulis*) lack a metabolic detoxification enzyme system to metabolize benzo(a)pyrene and therefore, tend to accumulate benzo(a)pyrene. Humic acid in solution may decrease bioconcentration.

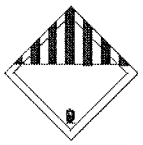
Octanol/Water Partition Coefficient: log K_{ow} = 6.04

Section 13 - Disposal Considerations

Disposal: Small quantities: 10 mL of a solution containing 0.3 mol/L of potassium permanganate and 3 mol/L of sulfuric acid will degrade 5 mg of benzo(a)pyrene. Also, can treat with sodium dichromate in strong sulfuric acid (1-2 days). Benzo(a)pyrene is also a good candidate for fluidized bed incineration at a temperature range of 842 to 1796 °F (450 to 980 °C) or rotary kiln incineration at 820 to 1600°C. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):



Shipping Name and Description: Environmentally hazardous substances, solid, n.o.s.
ID: UN3077
Hazard Class: 9 - Miscellaneous hazardous material
Packing Group: III - Minor Danger
Symbols: G - Technical Name Required
Label Codes: 9 - Class 9
Special Provisions: 8, 146, B54, IB8, N20
Packaging: **Exceptions:** 155 **Non-bulk:** 213 **Bulk:** 240
Quantity Limitations: **Passenger aircraft/rail:** No limit **Cargo aircraft only:** No limit
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U022 Toxic Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 1 lb (0.454 kg)
SARA 40 CFR 372.65: 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 Collection
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(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Benzene
CAS Number: 71-43-2
Chemical Formula: C_6H_6
Structural Chemical Formula: C_6H_6
EINECS Number: 200-753-7
ACX Number: X1001488-9
Synonyms: Benzene; BENZENE; (6)ANNULENE; BENZEEN; BENZEN; BENZIN; BENZINE; BENZOL; BENZOL 90; BENZOLE; BENZOLENE; BENZOLO; BICARBURET OF HYDROGEN; CARBON OIL; COAL NAPHTHA; CYCLOHEXATRIENE; EPA PESTICIDE CHEMICAL CODE 008801; FENZEN; MINERAL NAPHTHA; MOTOR BENZOL; NITRATION BENZENE; PHENE; PHENYL HYDRIDE; POLYSTREAM; PYROBENZOL; PYROBENZOLE
General Use: Manufacture of chemicals including styrene, dyes, and many other organic chemicals. Has been used in artificial leather, linoleum, oil cloth, airplane dopes, lacquers; as solvent for waxes, resins, oils etc.
May also be a minor component of gasoline, petrol.
Exposure should be minimized by use in closed systems.
Handling procedures and control measures should be evaluated for exposure before commencement of use in plant operations.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
benzene	71-43-2	99.9

OSHA PEL
TWA: 1 ppm; STEL: 5 ppm.

NIOSH REL
TWA: 0.1 ppm; STEL: 1 ppm.

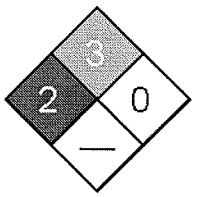
DFG (Germany) MAK
Skin.

ACGIH TLV
TWA: 0.5 ppm; STEL: 2.5 ppm; skin.

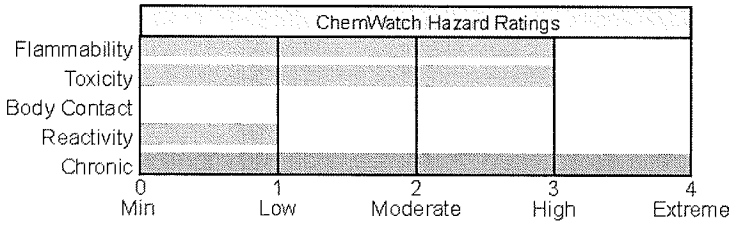
IDLH Level
500 ppm.

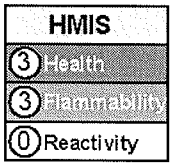
EU OEL
TWA: 1 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Toxic. Other Acute Effects: headache, dizziness, drowsiness. Absorbed through skin. Chronic Effects: dermatitis, leukemia, bone marrow damage. Carcinogen. Reproductive effects. Flammable.

Potential Health Effects

Target Organs: blood, central nervous system (CNS), bone marrow, eyes, upper respiratory system, skin
Primary Entry Routes: inhalation, skin contact
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract and lungs and may be harmful if inhaled.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.
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.
Inhalation hazard is increased at higher temperatures.
The symptoms of acute exposure to high vapor concentrations include confusion, dizziness, tightening of the leg muscles and pressure over the forehead followed by a period of excitement. If exposure continues the casualty quickly becomes stupefied and lapses into a coma with narcosis.
Effects of inhalation may include nausea, vomiting headache, dizziness, drowsiness, weakness, sometimes preceded by brief periods of exhilaration, or euphoria, irritability, malaise, confusion, ataxia, staggering, weak and rapid pulse, chest pain and tightness with breathlessness, pallor, cyanosis of the lips and fingertips and tinnitus. Severe exposures may produce blurred vision, shallow, rapid breathing, delirium, cardiac arrhythmias, unconsciousness, deep anesthesia, paralysis and coma characterized by motor restlessness, tremors and hyperreflexia (occasionally preceded by convulsions). Polyneuritis and persistent nausea, anorexia, muscular weakness, headache, drowsiness, insomnia and agitation may also occur. Two-three weeks after the exposure, nervous irritability, breathlessness and unsteady gait may still persist; cardiac distress and an unusual dicoloration of the skin may be evident for up to four weeks.
Hemotoxicity is not normally a feature of acute exposures although anemia, thrombocytopenia, petechial hemorrhage, and spontaneous internal bleeding have been reported. Fatal exposures may result from asphyxia, central nervous system depression, cardiac and respiratory failure and circulatory collapse; sudden ventricular fibrillation may also be fatal.
Death may be sudden or may be delayed for 24 hours. Central nervous system, respiratory or hemorrhagic complications may occur up to five days after the exposure and may be lethal; pathological findings include respiratory inflammation with edema, and lung hemorrhage, renal congestion, cerebral edema and extensive petechial hemorrhage in the brain, pleurae, pericardium, urinary tract, mucous membrane and skin.
Exposure to toxic levels has also produced chromosome damage.

Eye: The liquid is highly discomforting to the eyes, may be harmful following absorption and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.
The vapor is moderately discomforting to the eyes.
The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.
Defatting and/or drying of the skin may lead to dermatitis. Open cuts, abraded or irritated skin should not be exposed to this material.
Toxic effects may result from skin absorption.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: The liquid is discomforting to the gastrointestinal tract and may be harmful if swallowed.
Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class A, Human carcinogen; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

Chronic Effects: Liquid is an irritant and may cause burning and blistering of skin on prolonged exposure.
Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes.
Benzene is a myelotoxicant known to suppress bone-marrow cell proliferation and to induce hematologic disorders in humans and animals.
Signs of benzene-induced aplastic anemia include suppression off leukocytes (leukopenia), red cells (anemia), platelets (thromocytopenia) or all three cell types (pancytopenia). Classic symptoms include weakness, purpura, and hemorrhage. The most significant toxic effect is insidious and often irreversible injury to the blood forming tissue. Leukemia may develop.

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 flush 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.
Do NOT induce vomiting. Give a glass of water.

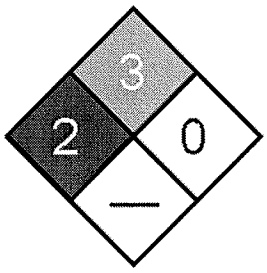
After first aid, get appropriate in-plant, paramedic, or community medical support.

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. Consider complete blood count. Evaluate history of exposure.

Section 5 - Fire-Fighting Measures

Flash Point: -11 °C Closed Cup
Autoignition Temperature: 562 °C
LEL: 1.3% v/v
UEL: 7.1% v/v

See DOT ERG



Fire Diamond

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.

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: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor 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.
Equipment should be thoroughly decontaminated after use.

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: Pollutant - contain spillage. Clear area of personnel and move upwind.
Contact 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 waterways. Consider evacuation.
No smoking, bare 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 labeled 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 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.

Storage Requirements: Store in original containers in approved flame-proof area.
No smoking, bare lights, heat or ignition sources.
DO NOT store in pits, depressions, basements or areas where vapors may be trapped. Keep containers securely sealed.
Store away from incompatible materials in a cool, dry well ventilated area.
Protect containers against physical damage and check regularly for leaks.
Observe manufacturer's storing and handling recommendations.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation usually required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Nitrile gloves; Neoprene gloves.
Safety footwear.
Do NOT use this product to clean the skin.

Respiratory Protection:
Exposure Range >1 to 10 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >10 to 100 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >100 to 1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range >1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Note: must change cartridge at beginning of each shift

Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

Glove Selection Index:
PE/EVAL/PE ..... Best selection
PVA ..... Best selection
TEFLON ..... Best selection

VITON	Best selection
VITON/NEOPRENE	Best selection
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion
NITRILE	Poor to dangerous choice for other than short-term immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion
NATURAL RUBBER	Poor to dangerous choice for other than short-term immersion
BUTYL/NEOPRENE	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, highly flammable liquid; floats on water. Characteristic aromatic odor. Highly volatile. Mixes with alcohol, chloroform, ether, carbon disulfide, carbon tetrachloride, glacial acetic acid, acetone and oils.

Physical State: Liquid
Odor Threshold: 4.68 ppm
Vapor Pressure (kPa): 9.95 at 20 °C
Vapor Density (Air=1): 2.77
Formula Weight: 78.12
Specific Gravity (H_2O=1, at 4 °C): 0.879 at 20 °C
Evaporation Rate: Fast

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 80.1 °C (176 °F)
Freezing/Melting Point: 5.5 °C (41.9 °F)
Volatile Component (% Vol): 100
Water Solubility: 0.18 g/100 g of water at 25 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

Toxicity
Oral (man) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 930 mg/kg
Inhalation (rat) LC_{50}: 10000 ppm/7h
Inhalation (human) LC_{Lo}: 2000 ppm/5m
Inhalation (man) TC_{Lo}: 150 ppm/1y - I
Inhalation (human) TC_{Lo}: 100 ppm
Reproductive effector in rats

Irritation
Skin (rabbit): 20 mg/24 hr - mod
Eye (rabbit): 2 mg/24 hr - SEVERE

See *RTECS* CY 1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. It may be subject to biodegradation based on reported biodegradation of 24% and 47% of the initial 20 ppm in a base-rich para-brownish soil in 1 and 10 weeks, respectively. It may be subject to biodegradation in shallow, aerobic groundwaters, but probably not under anaerobic conditions. If released to water, it will be subject to rapid volatilization; the half-life for evaporation in a wind-wave tank with a moderate wind speed of 7.09 m/sec was 5.23 hours; the estimated half-life for volatilization from a model river one meter deep flowing 1 m/sec with a wind velocity of 3 m/sec is estimated to be 2.7 hours at 20 °C. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation based on a reported biodegradation half-life of 16 days in an aerobic river die-away test. In a marine ecosystem biodegradation occurred in 2 days after an acclimation period of 2 days and 2 weeks in the summer and spring, respectively, whereas no degradation occurred in winter. According to one experiment, it has a half-life of 17 days due to photodegradation which could contribute to removal in situations of cold water, poor nutrients, or other conditions less conductive to microbial degradation. If released to the atmosphere, it will exist predominantly in the vapor phase. Gas-phase will not be subject to direct photolysis but it will react with photochemically produced hydroxyl radicals with a half-life of 13.4 days calculated using an experimental rate constant for the reaction. The reaction time in polluted atmospheres which contain nitrogen oxides or sulfur dioxide is accelerated with the half-life being reported as 4-6 hours. Products of photooxidation include phenol, nitrophenols, nitrobenzene, formic acid, and peroxyacetyl nitrate. It is fairly soluble in water and is removed from the atmosphere in rain.

Ecotoxicity: LC_{50} Clawed toad (3-4 wk after hatching) 190 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (bass) 5.8 to 10.9 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Poecilia reticulata (guppy) 63 ppm/14 days /Conditions of bioassay not specified; LC_{50} Salmo trutta (brown trout yearlings) 12 mg/l/1 hr (static bioassay); LD_{50} Lepomis macrochirus (bluegill sunfish) 20 mg/l/24 to 48 hr /Conditions of bioassay not specified; LC_{100} Tetrahymena pyriformis (ciliate) 12.8 mmole/l/24 hr /Conditions of bioassay not specified; LC_{50} Cancer magister (crab larvae) stage 1, 108 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 20 ppm/96 hr /Conditions of bioassay not specified

Henry's Law Constant: 5.3×10^{-3}

BCF: eels 3.5

Biochemical Oxygen Demand (BOD): 1.2 lb/lb, 10 days

Octanol/Water Partition Coefficient: $\log K_{ow} = 2.13$

Soil Sorption Partition Coefficient: K_{oc} = woodburn silt loam 31 to 143

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Benzene
ID: UN1114
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:** 40

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U019 Toxic Waste, Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a), per CAA Section 112 10 lb (4.535 kg)
SARA 40 CFR 372.65: 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 Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Arsenic **CAS Number:** 7440-38-2
Chemical Formula: As
Structural Chemical Formula: As_4
EINECS Number: 231-148-6
ACX Number: X1002785-7
Synonyms: ARSEN; ARSENIA; ARSENIC; ARSENIC-75; ARSENIC BLACK; ARSENICALS; COLLOIDAL ARSENIC; GRAY ARSENIC; GREY ARSENIC; METALLIC ARSENIC
General Use: In metallurgy for hardening copper, lead alloys. In the manufacture of certain types of glass.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Arsenic		>98

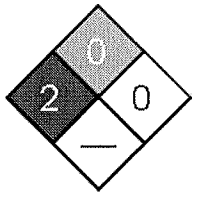
OSHA PEL
TWA: 0.01 mg/m^3.

NIOSH REL
Ceiling: 0.002 mg/m^3 (15-minute).

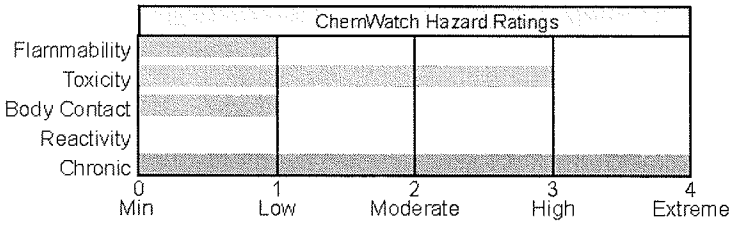
ACGIH TLV
TWA: 0.01 mg/m^3.

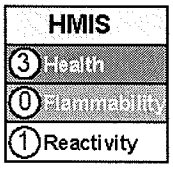
IDLH Level
5 mg/m^3 (as As).

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆
Brittle, crystalline, silvery-black metal. Irritating to eyes/skin/respiratory tract. Chronic Effects: damage to blood-forming organs, nervous/cardiovascular systems effects. Cancer hazard. Powder is flammable.

Potential Health Effects

Target Organs: liver, kidneys, skin, lungs, lymphatic system
Primary Entry Routes: inhalation, ingestion of dust and fumes, skin absorption
Acute Effects
Inhalation: The dust is toxic and discomforting to the upper respiratory tract and lungs.
Acute inhalation exposure can cause cough, chest pain, shortness of breath, dizziness, headache, pulmonary edema and extreme general weakness.
Prolonged or repeated exposure can cause perforation of the nasal septum.
High exposures can cause poor appetite, nausea, vomiting and muscle cramps. Heart effects with abnormal EKG can also occur with very high exposures.
Eye: The dust may produce eye discomfort causing smarting, pain and redness.
Skin: The material is moderately discomforting to the skin and may be harmful.
Exposure may result in abnormal redness (caused by capillary congestion), burning, itching, swelling, skin eruptions and dermatitis.
Toxic effects may result from skin absorption.
Repeated skin contact can cause thickened skin and/or patchy areas of darkening and loss of pigment. Some persons develop white lines on the nails.

Ingestion: The solid/dust is discomforting to the gastrointestinal tract and is toxic and may be fatal if swallowed. Symptoms of acute poisoning by ingestion, which develop within 4 hours include epigastric pain, vomiting and watery diarrhea. Blood may appear in vomitus and stools. If amount ingested is sufficiently high, shock may develop, followed by death within 24 hours.

Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A1, Confirmed human carcinogen; EPA - Class A, Human carcinogen; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

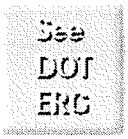
Chronic Effects: Symptoms of chronic poisoning by inhalation include weight loss, nausea and diarrhea alternating with constipation, pigmentation and eruption of the skin, loss of hair, peripheral neuritis, blood disorders (anemia), striations on fingernails and toenails.

Long-term exposure can cause an ulcer or hole in the `bone' dividing the inner nose. Hoarseness and sore eyes also occur.

High or repeated exposure can cause nerve damage with `pins and needles', burning, numbness, and later weakness of arms and legs. Repeated exposure can also damage the liver, causing narrowing of the blood vessels, or interfere with the bone marrow's ability to make red blood cells.

Many cases of skin cancer have been reported among people exposed to arsenic through medical treatment with inorganic trivalent arsenic compounds. In some instances skin cancers have occurred in combination with other cancers, such as liver angiosarcoma, intestinal and urinary bladder carcinomas and meningioma. Epidemiological studies of cancer after medical treatment have shown an excess of skin cancers but no clear association with other cancers has been shown. An association between environmental exposure to arsenic through drinking water and skin cancer has been observed and confirmed. Epidemiological studies in areas where drinking water contained 0.35-1.14 mg/l arsenic elevated risks for cancers of the bladder, kidney, skin, liver, lung and colon in both men and women. Occupational exposure to inorganic arsenic, especially in mining and copper smelting, has consistently been associated with an increased risk of cancer. An almost tenfold increase in the incidence of lung cancer was found in workers most heavily exposed to arsenic and relatively clear dose-response relationships have been obtained with regard to cumulative exposure. Other smelter worker populations have been shown to have consistent increases in lung cancer incidence, as well as increases of about 20% in the incidence of gastrointestinal cancer and of 30% for renal cancer and hematolymphatic malignancies.

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.

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: Quickly but gently, wipe material off skin with a dry, clean cloth.

Immediately remove all contaminated clothing, including footwear.

Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

Ingestion: Contact a Poison Control Center.

If swallowed, and if more than 15 minutes from a hospital, induce vomiting, preferably using Ipecac Syrup APF.

Note: DO NOT INDUCE VOMITING in an unconscious person

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short term repeated exposures to arsenic, soluble compounds:

Treat as per arsenic poisoning.

1. Acute skin lesions such as contact dermatitis usually do not require other treatment than removal from exposure.
2. If more severe symptoms of the respiratory system, the skin or the gastrointestinal tract occur, British Anti-Lewisite (BAL, dimercaprol) may be given. Prompt administration in such cases is vital; to obtain maximum benefit such treatment should be administered within 4 hours of poisoning.
3. In addition, general treatment such as prevention of further absorption from the gastrointestinal tract are mandatory.
4. General supportive therapy such as maintenance of respiration and circulation, maintenance of water and electrolyte balance and control of nervous system effects, as well as elimination of absorbed poison through dialysis and exchange transfusion, may be used if feasible.
5. Dimercaprol is given by deep intramuscular injection as a 5% solution in peanut oil (or a 10% solution with benzyl-benzoate in vegetable oil). It is usually given in a dose of 3 mg/kg, 4-hourly, for the first two days, or twice daily for up to seven days.
6. BAL Therapy is effective for hematological manifestations of chronic arsenic poisoning but not for neurological symptoms. Watch for side effects (e.g. urticaria, burning sensation in the lips, mouth and throat, fever, conjunctivitis etc).
7. Some relief results from administration of diphenhydramine (Benadryl) (1.5 mg/kg intramuscularly or by mouth every 6 hour).

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Inorganic arsenic metabolites in urine	50 ug/g creatinine	End of workweek	B

B: Background levels occur in specimens collected from subjects NOT exposed

Consult specific documentation.

Section 5 - Fire-Fighting Measures

Flash Point: Noncombustible solid

Extinguishing Media: Use fire fighting procedures suitable for surrounding area.

See DOT ERG

General Fire Hazards/Hazardous Combustion Products: Solid which exhibits difficult combustion or is difficult to ignite.

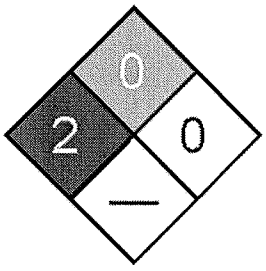
Avoid generating dust, particularly clouds of dust in a confined or unventilated space.

Dust may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion.

Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport. Build-up of electrostatic charge may be prevented by bonding and grounding.

Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Decomposes on heating and produces toxic fumes of arsenic oxides (AsO_x).



Fire Diamond

Fire Incompatibility: Avoid contact with acids, oxidizing agents, halogens.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

Wear breathing apparatus plus protective gloves for fire only. Prevent, by any means available, spillage from entering drains or waterways.

Use fire fighting procedures suitable for surrounding area.

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.

Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Wear protective clothing, impervious gloves and safety glasses. Increase ventilation.

See DOT ERG

Use a vacuum or a wet method to reduce dust during clean-up. DO NOT dry sweep.

Place in suitable containers for disposal.

Wash area down with large quantity of water and prevent runoff into drains.

Large Spills: POLLUTANT -contain spillage. Clear area of personnel and move upwind.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

If contamination of drains or waterways occurs, advise emergency services.

Shut off all possible sources of ignition and increase ventilation.

Stop leak if safe to do so.

Contain spill with sand, earth or vermiculite.

Use dry clean up procedures and avoid generating dust.

Collect recoverable product into labeled containers for recycling. Collect residues and seal in labeled drums for disposal.

Wash area down with large quantity of water and prevent runoff into drains.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Use good occupational work practice.

Avoid contact with skin and eyes.

Avoid generating and breathing dust.

Use in a well-ventilated area.
Wear protective clothing when risk of exposure occurs.
Avoid sources of heat. Avoid contact with incompatible materials. Avoid physical damage to containers.
Keep containers securely sealed when not in use.
When handling, DO NOT eat, drink or smoke.
Wash hands with soap and water after handling.
Work clothes should be laundered separately: NOT at home.

Recommended Storage Methods: Glass container. Plastic drum. Polyethylene or polypropylene container. Steel drum. Metal drum.
Check that containers are clearly labeled.

Storage Requirements: Observe manufacturer's storing and handling recommendations.
Store in a cool, dry place. Store in a well-ventilated area. Store away from sources of heat or ignition/bare lights.
Avoid storage at temperatures higher than 60 °C. Store away from incompatible materials. Store away from foodstuff containers.
Protect containers against physical damage.
Keep containers securely sealed.
Check regularly for spills and leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required.
Use ventilated helmet or air-line hood to provide clean air at the breathing zone.
If risk of overexposure exists, wear NIOSH approved respirator. Correct fit is essential to obtain adequate protection.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses. Chemical goggles.
Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Impervious, gauntlet length gloves; Rubber gloves. Neoprene gloves.
Rubber boots.

Respiratory Protection:
Exposure Range >0.01 to 0.1 mg/m^3: Air Purifying, Negative Pressure, Half Mask
Exposure Range >0.1 to 1 mg/m^3: Air Purifying, Negative Pressure, Full Face
Exposure Range >1 to <5 mg/m^3: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range 5 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: magenta (P100)

Other: Overalls. PVC apron. PVC protective suit may be required if exposure severe.
Eyewash unit. Ensure there is ready access to a safety shower.
* Preplacement and periodic medical examinations are essential for workers exposed to arsenic. Preplacement physical examinations should give particular attention to allergic and chronic skin lesions, eye disease, psoriasis, chronic eczematous dermatitis, hyperpigmentation of the skin, keratosis and warts, baseline weight, baseline blood and hemoglobin counts, baseline urinary arsenic determinations.
Annual physical examinations should give attention to general health, weight, skin condition, and any evidence of excessive exposure or absorption of arsenic.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Grey, shiny, brittle, metallic-looking rhombohedral crystals. Can be heated to burn in air with a bluish flame, giving off an odor of garlic and dense white fumes of arsenic trioxide. Loses its luster on exposure to air. Converted by nitric acid or hot sulfuric acid into arsenous or arsenic acid.

Brinell hardness: 147
Mohs' scale: 3.5

Physical State: Divided solid
Vapor Pressure (kPa): Not applicable
Vapor Density (Air=1): Not applicable
Formula Weight: 74.92
Specific Gravity (H_2O=1, at 4 °C): 5.73
Evaporation Rate: Not applicable

pH: Not applicable
pH (1% Solution): Not applicable
Boiling Point: Sublimes
Freezing/Melting Point: 817 °C (1502.6 °F) at 28 atm
Volatile Component (% Vol): Not applicable
Water Solubility: Insoluble

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Contact with acids liberates toxic gases. Presence of heat source and ignition source.
Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from oxidizing agents, halogens.
Contact with acids produces toxic fumes.

Section 11 - Toxicological Information

Toxicity
Oral (man) TD_{Lo}: 7857 mg/kg/55 years
Oral (rat) LD_{50}: 763 mg/kg
Tumorigenic - Carcinogenic by RTECS criteria.

Irritation
Nil reported

See *RTECS* CG 0525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: Food chain concentration potential: Bioaccumulated by fresh water and marine aquatic organisms
BCF: bioaccumulated by aquatic organisms
Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Follow all federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Arsenic
ID: UN1558
Hazard Class: 6.1 - Poisonous materials
Packing Group: II - Medium Danger
Symbols:
Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB8, IP2, IP4
Packaging: **Exceptions:** None **Non-bulk:** 212 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 25 kg **Cargo aircraft only:** 100 kg
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed
CERCLA 40 CFR 302.4: Listed per CWA Section 307(a), per CAA Section 112 1 lb (0.454 kg)
SARA 40 CFR 372.65: 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.

ALCONOX MSDS

Section 1 : MANUFACTURER INFORMATION

Product name: Alconox

Supplier: Same as manufacturer.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2005/03/09

D.O.T. Classification: Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE
497-19-8	7-13	SODIUM CARBONATE	NOT AVAILABLE	4090 MG/KG RAT ORAL 6600 MG/KG MOUSE ORAL	2300 MG/M3/2H RAT INHALATION 1200 MG/M3/2H MOUSE INHALATION
7722-88-5	10-30	TETRASODIUM PYROPHOSPHATE	5 MG/M3	4000 MG/KG RAT ORAL 2980 MG/KG MOUSE ORAL	NOT AVAILABLE
7758-29-4	10-30	SODIUM PHOSPHATE	NOT AVAILABLE	3120 MG/KG RAT ORAL 3100 MG/KG MOUSE ORAL >4640 MG/KG RABBIT DERMAL	NOT AVAILABLE

Section 2A : ADDITIONAL INGREDIENT INFORMATION

Note: (supplier).
CAS# 497-19-8: LD50 4020 mg/kg - rat oral.
CAS# 7758-29-4: LD50 3100 mg/kg - rat oral.

Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS

Physical state: Solid

Appearance & odor: Almost odourless.
White granular powder.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): Not applicable.

Vapour density (air=1): Not applicable.

By weight: Not available.

Evaporation rate (butyl acetate = 1): Not applicable.

Boiling point (°C): Not applicable.

Freezing point (°C): Not applicable.

pH: (1% aqueous solution).
9.5

Specific gravity @ 20 °C: (water = 1).
0.85 - 1.10

Solubility in water (%): 100 - > 10% w/w

Coefficient of water\oil dist.: Not available.

VOC: None

Section 4 : FIRE AND EXPLOSION HAZARD DATA

Flammability: Not flammable.

Conditions of flammability: Surrounding fire.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.

Auto-ignition temperature: Not available.

Flash point (°C), method: None

Lower flammability limit (% vol): Not applicable.

Upper flammability limit (% vol): Not applicable.

Not available.

Sensitivity to mechanical impact: Not applicable.

Hazardous combustion products: Oxides of carbon (COx).
Hydrocarbons.

Rate of burning: Not available.

Explosive power: None

Section 5 : REACTIVITY DATA

Chemical stability:	Stable under normal conditions.
Conditions of instability:	None known.
Hazardous polymerization:	Will not occur.
Incompatible substances:	Strong acids. Strong oxidizers.
Hazardous decomposition products:	See hazardous combustion products.

Section 6 : HEALTH HAZARD DATA

Route of entry:	Skin contact, eye contact, inhalation and ingestion.
Effects of Acute Exposure	
Eye contact:	May cause irritation.
Skin contact:	Prolonged contact may cause irritation.
Inhalation:	Airborne particles may cause irritation.
Ingestion:	May cause vomiting and diarrhea. May cause abdominal pain. May cause gastric distress.
Effects of chronic exposure:	Contains an ingredient which may be corrosive.
LD50 of product, species & route:	> 5000 mg/kg rat oral.
LC50 of product, species & route:	Not available for mixture, see the ingredients section.
Exposure limit of material:	Not available for mixture, see the ingredients section.
Sensitization to product:	Not available.
Carcinogenic effects:	Not listed as a carcinogen.
Reproductive effects:	Not available.
Teratogenicity:	Not available.
Mutagenicity:	Not available.
Synergistic materials:	Not available.
Medical conditions aggravated by exposure:	Not available.
First Aid	
Skin contact:	Remove contaminated clothing. Wash thoroughly with soap and water. Seek medical attention if irritation persists.
Eye contact:	Check for and remove contact lenses. Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.
Inhalation:	Remove victim to fresh air. Seek medical attention if symptoms persist.
Ingestion:	Dilute with two glasses of water. Never give anything by mouth to an unconscious person. Do not induce vomiting, seek immediate medical attention.

Section 7 : PRECAUTIONS FOR SAFE HANDLING AND USE

Leak/Spill: Contain the spill.
Recover uncontaminated material for re-use.
Wear appropriate protective equipment.
Contaminated material should be swept or shoveled into appropriate waste container for disposal.

Waste disposal: In accordance with municipal, provincial and federal regulations.

Handling procedures and equipment: Protect against physical damage.
Avoid breathing dust.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Launder contaminated clothing prior to reuse.

Storage requirements: Keep containers closed when not in use.
Store away from strong acids or oxidizers.
Store in a cool, dry and well ventilated area.

Section 8 : CONTROL MEASURES

Precautionary Measures

Gloves/Type:

Neoprene or rubber gloves.

Respiratory/Type:

If exposure limit is exceeded, wear a NIOSH approved respirator.

Eye/Type:

Safety glasses with side-shields.

Footwear/Type: Safety shoes per local regulations.

Clothing/Type: As required to prevent skin contact.

Other/Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: p-Xylene **CAS Number:** 106-42-3
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_4(CH_3)_2$
EINECS Number: 203-396-5
ACX Number: X1001539-1
Synonyms: BENZENE,1,4-DIMETHYL-; CHROMAR; 1,4-DIMETHYLBENZENE; P-DIMETHYLBENZENE; P-METHYLTOLUENE; SCINTILLAR; 1,4-XYLENE; P-XYLENE; 4-XYLENE; P-XYLENE; PARA-XYLENE; P-XYLOL
General Use: Used as a general solvent.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
p-xylene	106-42-3	100

OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

NIOSH REL
TWA: 100 ppm (435 mg/m^3); STEL: 150 ppm (655 mg/m^3).

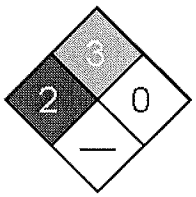
DFG (Germany) MAK
TWA: 100 ppm; PEAK: 200 ppm; skin.

ACGIH TLV
TWA: 100 ppm; STEL: 150 ppm.

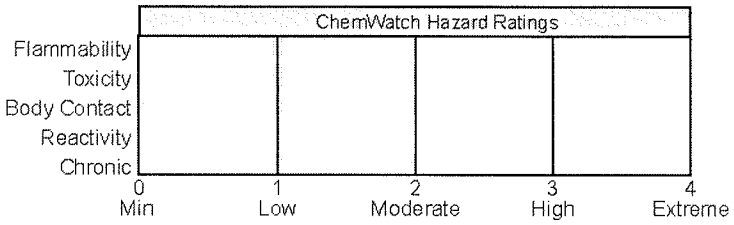
IDLH Level
900 ppm.

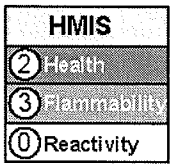
EU OEL
TWA: 50 ppm; STEL: 100 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, sweet smelling liquid. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, nausea, drowsiness. Chronic Effects: dermatitis, kidney/liver/peripheral nerve damage, may cause birth defects (animal data). Flammable.

Potential Health Effects

Target Organs: central nervous system (CNS), eyes, gastrointestinal (GI) tract, liver, kidneys, skin
Primary Entry Routes: inhalation, skin absorption (slight), eye contact, ingestion
Acute Effects

Inhalation: Xylene is a central nervous system depressant. The vapor is discomforting to the upper respiratory tract and may be harmful if inhaled.
Inhalation hazard is increased at higher temperatures.
Toxic effects are increased by consumption of alcohol.
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.

Headache, fatigue, lassitude, irritability and gastrointestinal disturbances (e.g., nausea, anorexia and flatulence) are the most common symptoms of xylene overexposure. Injury to the heart, liver, kidneys and nervous system has also been noted among workers. Transient memory loss, renal impairment, temporary confusion and some evidence of disturbance of liver function was reported in three workers overcome by gross exposure to xylene (10000 ppm). One worker died and autopsy revealed pulmonary congestion, edema, and focal alveolar hemorrhage.

Volunteers inhaling xylene at 100 ppm for 5 to 6 hours showed changes in manual coordination, reaction time and slight ataxia. Tolerance developed during the workweek but was lost over the weekend. Physical exercise may antagonize this effect. Xylene body burden in humans exposed to 100 or 200 ppm xylene in air depends on the amount of body fat with 4% to 8% of total absorbed xylene accumulating in human adipose tissues.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is highly discomforting to the eyes.

Corneal changes have been reported in furniture polishers exposed to xylene.

Skin: The liquid is highly discomforting to the skin and may cause drying of the skin, which may lead to dermatitis and it is absorbed by the skin.

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 skin condition.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid is highly discomforting and toxic if swallowed.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; 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.

Small excess risks of spontaneous abortion and congenital malformation was reported among women exposed to xylene in the first trimester of pregnancy. In all cases however the women had also been exposed to other substances. Evaluation of workers chronically exposed to xylene has demonstrated a lack of genotoxicity. Exposure to xylene has been associated with increased risks of hemopoietic malignancies but, again simultaneous exposure to other substances (including benzene) complicate the picture. A long-term gavage study of mixed xylenes (containing 17% ethyl benzene) found no evidence of carcinogenic activity in rats and mice of either sex.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush 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. 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 xylene:

1. Gastrointestinal absorption is significant with ingestions.

For ingestions exceeding 1-2 mL (xylene)/kg, intubation and lavage with cuffed endotracheal tube is recommended.

The use of charcoal and cathartics is equivocal.

2.Pulmonary absorption is rapid with about 60-65% retained at rest.

3.Primary threat to life from ingestion and/or inhalation is respiratory failure.

4.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.

5.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.

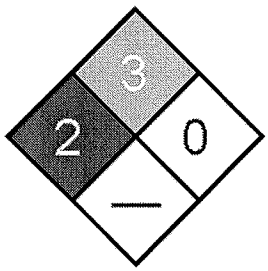
6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Methylhippuric acids in urine	1.5 gm/gm creatinine	End of shift	
	2 mg/min	Last 4 hrs of shift.	

Section 5 - Fire-Fighting Measures

Flash Point: 27 °C Closed Cup
Autoignition Temperature: 528 °C
LEL: 1.1% v/v
UEL: 7.0% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
Other combustion products include carbon dioxide (CO_2).
Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Fire-Fighting Instructions: Contact 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 waterways.
If safe, switch off electrical equipment until vapor 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.

See DOT ERG



Fire Diamond

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.
Large Spills: Clear area of personnel and move upwind.
Contact 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 waterways.
No smoking, bare 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 labeled 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).

See DOT ERG

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of overexposure 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 or ignition sources.
Avoid generation of static electricity. DO NOT use plastic buckets.
Ground all lines and equipment. Use spark-free tools when handling.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
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.
Plastic containers may only be used if approved for flammable liquids.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
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.
General exhaust is adequate under normal operating conditions.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
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; Butyl rubber gloves or Neoprene gloves or PVC gloves.
Safety footwear.
Do NOT use this product to clean the skin.
Respiratory Protection:
Exposure Range >100 to <900 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 900 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Other: Overalls. Impervious protective clothing.
Eyewash unit.
Ensure there is ready access to an emergency shower.
Glove Selection Index:
PVA ..... Best selection
VITON ..... Best selection
NITRILE ..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless liquid with sweet, aromatic odor. Miscible in most organic solvents. Odor threshold 0.05 ppm.

Physical State: Liquid
Odor Threshold: Detection 0.05 ppm
Vapor Pressure (kPa): 0.90 at 20 °C
Vapor Density (Air=1): 3.66 at 15 °C
Formula Weight: 106.18
Specific Gravity (H_2O=1, at 4 °C): 0.86
Evaporation Rate: 9.9 Ether=1

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 138.37 °C (281 °F)
Freezing/Melting Point: 13.3 °C (55.94 °F)
Volatile Component (% Vol): 100
Water Solubility: Insoluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 5000 mg/kg
Inhalation (rat) LC_{50}: 4550 ppm/4h

Irritation
Nil reported

See *RTECS* ZE 2625000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Most is released into the atmosphere where it may photochemically degrade by reaction with hydroxyl radicals (half-life 1.7-18 hr). The dominant removal process in water is volatilization. It is moderately mobile in soil and may leach into groundwater where it is known to persist for several years despite some evidence that it biodegrades in both soil and groundwater. Bioconcentration is not expected to be significant.
Ecotoxicity: LC_{50} Poecilia reticulata (guppy) 35 ppm/7 day /Conditions of bioassay not specified; LC_{50} Morone saxatilis (bass) 2.0 ppm/96 hr /Conditions of bioassay not specified; LC_{100} Tetrahymena pyriformis (ciliate) 3.77 mmole/l/24 hr /Conditions of bioassay not specified; LD_{50} Goldfish 18 mg/l/24 hr /Modified ASTM D 1345 method; LC_{50} Crangon franciscorum (shrimp) 2.0 ppm/96 hr /Conditions of bioassay not specified
Henry's Law Constant: 0.314
BCF: eels 1.37
Biochemical Oxygen Demand (BOD): 0 lb/lb, 5 days
Octanol/Water Partition Coefficient: log K_{ow} = 3.15
Soil Sorption Partition Coefficient: K_{oc} = 3.15

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Xylenes
ID: UN1307
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:**

Shipping Name and Description: Xylenes
ID: UN1307
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: III - Minor Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: B1, IB3, T2, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 203 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 60 L **Cargo aircraft only:** 220 L
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 100 lb (45.35 kg)
SARA 40 CFR 372.65: 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.

Attachment D

Incident/Near Miss Investigation Report

ARCADIS BBL
Infrastructure, environment, facilities

Incident/Near-Miss Investigation Report

☐ OSHA Recordable	☐ First Aid Injury	☐ Fire	Date of Incident:
☐ Lost Workday Injury	☐ Vehicle Accident	☐ Spill / Leak	
☐ Restricted Duty Injury	☐ Equipment Damage	☐ Near Miss	Incident Number:

Every employee injury, accident, and near miss must be reported within 24 hours of the injury. If the incident results in hospitalization, an immediate report must be made by telephone to the Project Manager and the Health and Safety Officer.

Project Information

Project Name: | Project #:

Location of Incident:

Employee

Name: | Employee Number:

Employment Status: ☐ Regular ☐ Part Time | How long in present job?

Injury or Illness Information

Where did the incident / near miss occur? (number, street, city, state, zip):

Employee's specific activity at the time of the incident / near miss:

Equipment, materials, or chemicals the employee was using when the incident / near miss occurred (e.g., the equipment employee struck against or that struck the employee; the vapor inhaled or material swallowed; what the employee was lifting, pulling, etc.):

Describe the specific injury or illness (e.g., cut, strain, fracture, etc.):

Body part(s) affected (e.g., back, left wrist, right eye, etc.):

Name and address of treatment provider (e.g., physician or clinic): | Phone No.:

If hospitalized, name and address of hospital: | Phone No.:

Date of injury or onset of illness: / / | Time of event or exposure: ☐ AM ☐ PM

Did employee miss at least one full shift's work? ☐ No ☐ Yes, 1st date absent (MM/DD/YYYY) / /

Has employee returned to work? ☐ Regular Work ☐ Restricted Work ☐ No

☐ Yes, date returned (MM/DD/YYYY) / /

To whom reported: | Other workers injured / made ill in this event? ☐ Yes ☐ No

Description of Incident / Near Miss (Describe what happened and how it happened)

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Incident/Near-Miss Investigation Report

Motor Vehicle Accident (MVA)							
				Company Vehicle?	☐ Yes ☐ No		
Accident Location (street, city, state)							
Vehicle Towed?	☐ Yes ☐ No	Other Vehicle?	☐ Yes ☐ No	# Vehicles Towed:		# of Injuries:	

Spill		
Material Spilled:	Quantity:	Source:
Agency Notifications:		
Cost of Incident $		

Third Party Incidents		
Name of Owner:	Address:	Telephone:
Description of Damage:		
Witness Name:	Address:	Telephone:
Witness Name:	Address:	Telephone:

#	Root Cause and Contributing Factors: Conclusion (Describe in Detail Why Incident / Near Miss Occurred)
1	
2	
3	
4	
5	

Explanation of Root Cause(s) Analysis Numbers (RCA No):

1. Lack of SKILL or KNOWLEDGE (XOM#1)	2. Lack of or inadequate operational PROCEDURES or work standards (XOM#5)
3. Inadequate COMMUNICATION OF EXPECTATIONS regarding procedures or acceptable practices (XOM#6)	4. Inadequate TOOLS or EQUIPMENT (XOM#7)
5. Doing the job according to procedures or acceptable practices takes more TIME or EFFORT (XOM#2)	6. Short-cutting procedures or acceptable practices is POSITIVELY REINFORCED or TOLERATED, rewarded or appreciated (XOM#3)
7. IN THE PAST, did not follow procedures or acceptable practices and NO INCIDENT occurred (XOM#4)	8. EXTERNAL factors (XOM#8)

#	RCA #	Solution(s): How to Prevent Incident / Near Miss From Reoccurring	Person Responsible	Due Date	Closure Date

Investigation Team Members		
Name:	Job Title:	Date:

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Incident/Near-Miss Investigation Report

Results of Solution Verification and Validation		
Reviewed By		
Name:	Job Title:	Date:
	Project Manager	
	Health and Safety Reviewer	

Attachment E

Loss Prevention Observation Form

ARCADIS BBL
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Loss Prevention Observation (LPO) Form

(page 1 – LPO Information)

Observer Name:	Observer Title:	Project / Project Number:
Date / Time:	Project Type / Task Observed:	

Background Information

List Critical Work Procedures

List Issue / Items Requiring Corrective Action

Explanation of Root Cause(s) Analysis Numbers (RCA No):

1. Lack of SKILL or KNOWLEDGE (XOM#1)	2. Lack of or inadequate operational PROCEDURES or work standards (XOM#5)
3. Inadequate COMMUNICATION OF EXPECTATIONS regarding procedures or acceptable practices (XOM#6)	4. Inadequate TOOLS or EQUIPMENT (XOM#7)
5. Doing the job according to procedures or acceptable practices takes more TIME or EFFORT (XOM#2)	6. Short-cutting procedures or acceptable practices is POSITIVELY REINFORCED or TOLERATED, rewarded or appreciated (XOM#3)
7. IN THE PAST, did not follow procedures or acceptable practices and NO INCIDENT occurred (XOM#4)	8. EXTERNAL factors (XOM#8)

Criterion #	RCA #	Corrective Action Identified	Responsible Individual	Due Date	Closure Date

Results of Corrective Action

Reviewed by:	Date:	Reviewed by:	Date:

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Loss Prevention Observation (LPO) Form

(page 2 - Environmental Operations)

Pre-Task Preparation		Correct	Questionable	Comments
1.	Health and Safety Plan / MSDSs on site	☐	☐	
2.	Employee familiar / trained on task	☐	☐	
3.	OSHA-required training/medical surveillance	☐	☐	
4.	Utility mark out / check performed	☐	☐	
5.	Traffic hazard addressed / work area marked	☐	☐	
6.	Walking / working surfaces free of hazards	☐	☐	
7.	Tailgate safety meeting performed	☐	☐	
8.	Impact on nearby residence / business evaluated	☐	☐	
9.	Communicates intentions to other personnel	☐	☐	
10.	Knowledge of emergency procedures	☐	☐	
11.	Distance between equipment and power lines	☐	☐	
12.	Personal protective equipment	☐	☐	
13.	Air monitoring equipment on site, calibrated	☐	☐	
14.	First aid kit / fire extinguisher on site	☐	☐	
15.	One person trained in first aid / CPR	☐	☐	
16.	Work zones established and marked	☐	☐	
Performing Task		**Correct**	**Questionable**	**Comments**
17.	Employee trained in task to be performed	☐	☐	
18.	Correct body positioning	☐	☐	
19.	Proper lifting / pushing / pulling techniques	☐	☐	
20.	Keep hands / body away from pinch points	☐	☐	
21.	Walking / working surfaces kept clear of debris	☐	☐	
22.	Faces traffic as appropriate	☐	☐	
23.	Vehicles / barricades to protect against traffic	☐	☐	
24.	Drill rig located properly, blocked / chocked	☐	☐	
25.	Drill rig moved only with derrick lowered	☐	☐	
26.	Excavator located on stable ground	☐	☐	
27.	Eye contact made with equipment operator	☐	☐	
28.	Spoil at least 2 feet back from edge of excavation	☐	☐	
29.	Excavation shored / sloped / benched	☐	☐	
30.	Excavation entry controlled	☐	☐	
31.	Equipment / tools used properly	☐	☐	
32.	Electrical equipment connected through GFCI	☐	☐	
33.	Power tools handled properly	☐	☐	
34.	Electrical cords inspected / in good condition	☐	☐	
35.	Follows lockout / tagout procedures	☐	☐	
36.	Air monitoring conducted / action levels understood	☐	☐	
37.	Equipment decontaminated properly	☐	☐	
38.	Personnel decon prior to eating / drinking / smoking	☐	☐	
39.	Decontamination effective	☐	☐	
Post-Task		**Correct**	**Questionable**	**Comments**
40.	Procedures / JSA adequate	☐	☐	
41.	Equipment / tools stored properly	☐	☐	
42.	Proper storage of soil / water / waste material	☐	☐	
43.	Work area secured	☐	☐	
44.	Other	☐	☐	

Attachment F

Bloodborne Pathogen Standard
Operating Procedures

Standard Operating Procedure: Bloodborne Pathogens

I. Scope and Application

ARCADIS BBL is committed to operate in a manner that will protect the health and safety of its employees and will abide by applicable state and federal agency regulations. In order to protect employees of the Firm from the hazards posed by bloodborne pathogens (BBP), this procedure presents health and safety requirements for personnel who may be exposed to these hazards, particularly voluntary first aid and cardiopulmonary resuscitation (CPR) care providers. In order to meet the requirements of Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulation (CFR) 1910.1030, at least one person on a project site will be adequately trained in first aid and CPR and in the requirements of the Bloodborne Pathogens Standard as listed in 29 CFR 1910.1030, and in the contents of this procedure. This procedure serves as ARCADIS BBL's Exposure Control Plan.

II. Personnel Qualifications

The following outlines the **responsibilities** of various personnel:

Officers/Division Heads/Project Managers

1. Verify that affected staff have received the appropriate training and equipment and are properly identified and addressed within a project work plan, site health and safety plan (HASP) and/or other project documents.

2. Verify that employees designated as First-aiders have experience, training, and authority to fulfill the requirements of the position.

3. Verify that first-aid and personal protective equipment is available for use by affected employees.

Corporate Health and Safety (CHS)

1. Review and revise this procedure as required to meet regulatory requirements.

2. Provide technical assistance regarding BBP and universal precautions.

3. Audit project specific excavation activities for compliance with this procedure.

4. Review and revise, as appropriate, site-specific health and safety plans to include requirements for first-aid, emergency response and activities that could result in exposure to BBP.

Corporate Training Division

1. Provide certified Red Cross (or equivalent) approved First-aid, CPR and BBP training.

2. Maintain training records and distribute training certification documents.

Affected Employees:

Employees Trained in First-Aid and CPR or, with potential exposure to BBP (working in a Sanitary Sewer or other setting with potential exposure)

1. Must be capable of recognizing existing or predictable hazards and working conditions associated with BBP exposure

2. Understand universal precautions all safety requirements outlined in this SOP and 29 CFR 1910.1030 to be utilized during activities with potential exposure to BBP.

3. Attend annual CPR and BBP refresher training.

4. Notify CHS of any potential exposure BBP exposure incidents and receive appropriate vaccinations or document refusal.

III. Equipment List

The following are specific personal protective equipment (PPE) items that shall be utilized when administering first aid, rescue breathing, CPR or other activities which may present a potential exposure to BBP (inspect all PPE prior to use to ensure it is intact and in good working order):

- Hand protection (i.e., latex or nitrile surgical gloves). Do not reuse gloves once removed; use different gloves for each patient/activity. After use, remove gloves from top to bottom inside-out, not allowing unprotected skin to contact the exterior of the gloves;

- Eye protection (i.e., safety glasses, goggles); and

- Appropriate mouthpiece or ventilation barrier device.

IV. Cautions

All employees have the potential for exposure to bloodborne pathogens. ARCADIS BBL policy requires employees that work on Hazwoper sites or are involved in Confined Space Entry will receive First-Aid and CPR (FA/CPR) training. All employees that are FA/CPR trained must also receive bloodborne pathogens training.

Any employees that believe they may be at risk of exposure to bloodborne pathogens must follow the requirement of this procedure.

V. Health and Safety Considerations

Means of Transmission

The primary activity that may expose site employees to bloodborne pathogens is the response and care of on-site personal injuries or decontamination of equipment/surfaces contaminated by blood or other potentially infectious materials during an incident. Employees could be subject to bloodborne pathogens during rendering of first aid or CPR by accidental exposure due to:

1. Punctures through the skin with a contaminated sharp object;

2. Contact with blood or blood-contaminated objects which may permit absorption through open or broken skin (i.e., cuts, scratches, rashes); or

3. Blood splashes to the eyes, nose, or mouth.

Workers can reduce their risk of exposure by implementing the work practices outlined in this plan before, during, and after responding to emergency medical incidents involving personal injuries.

VI. Procedure

This procedure is designed to limit occupational exposure of site workers to blood materials and body fluids which may contain infectious pathogenic agents. The contents of this procedure are intended to protect employees trained in first aid and CPR who may administer medical assistance to site workers. The following definitions apply to this procedure:

Definitions:

Bloodborne Pathogens

Bloodborne pathogens (BBP) are agents (i.e., bacteria, virus, fungi) found in blood, blood components, and certain body fluids. Exposure may result from direct contact with blood and body fluids, or contact with materials, objects, or surfaces that have had contact with blood or body fluids. Bloodborne pathogens are capable of causing human disease or death to unprotected people who come into contact with blood or blood-affected items. Diseases caused by bloodborne pathogens include, but are not limited to, hepatitis B virus (HBV), human immunodeficiency virus (HIV), hepatitis C, malaria, and syphilis.

Exposure

Any contact with blood or body fluids, or contact with equipment/surfaces contaminated by blood or other potentially infectious materials, is considered exposure. Significant exposure involves contact or absorption of blood or blood-contaminated objects through open or broken skin (i.e., cuts, scratches, rashes); punctures through the skin with a contaminated sharp object; or blood splashes to the eyes, nose, or mouth.

Hepatitis B Virus (HBV)

HBV is the major bloodborne pathogenic hazard that first aid/CPR care providers are likely to encounter. The HBV can remain infectious for up to 10 days even in dried blood. The virus adversely affects 8,000 to 10,000 workers annually, resulting in approximately 200 deaths each year.

HBV Exposure Symptoms

Hepatitis means "inflammation of the liver" and can cause severe liver damage or cirrhosis. Exposure symptoms include fever, fatigue, nausea, vomiting, muscle aches, loss of appetite, and jaundice (yellowing of the eyes or skin). Hepatitis diagnosis is difficult because some symptoms are similar to the flu and may remain

mild for an extended period of time. Presently, no cure exists for hepatitis. It can be prevented with a vaccination.

Human Immunodeficiency Virus (HIV)

HIV attacks and deteriorates the body's immune system and eventually weakens it to the point that infection sets in, causing the disease Acquired Immune Deficiency Syndrome (AIDS). HIV is transmitted through contact with blood and body fluids. HIV is not transmitted by touching or working with people who are HIV-positive.

HIV Exposure Symptoms

HIV can lead to suppression of the immune system to a degree sufficient to permit the onset of neurological problems, cancer, pneumonia, and death. People may carry the virus for many years without experiencing any symptoms. Upon development, symptoms may include weight loss, skin lesions, dry cough, fever, fatigue, diarrhea, or swelling of the lymph glands. Presently, no cure exists for HIV or AIDS, and no vaccination is currently available.

Voluntary First Aid Provider

An individual trained in first aid/CPR who may be called on to render first aid/CPR.

Procedure Implementation

All ARCADIS BBL employees will implement the following controls during work activities that may result in exposure to bloodborne pathogens or infectious materials.

Protective Measures

The establishment of work practice controls is an integral part of an effective exposure control plan. These work practices are designed to protect employees from reasonably foreseeable occupational exposures to bloodborne pathogens from blood and other potentially infectious material. The work practice controls outlined in this section are applicable to the administration of first aid in emergency situations and subsequent cleanup.

Universal Precautions

Universal precautions is an approach to infection control which operates on the assumption that all human blood, bodily fluids, and sharps or other medical waste are to be treated as if they are known to be contaminated with HIV, HBV, or other infectious diseases. Universal precautions shall be implemented whenever there exists a foreseeable potential for contact with blood or bodily fluids.

Work Practice Controls

Work practice controls shall be instituted whenever foreseeable potential contact with, or exposure to, blood and bodily fluid exists. Examples of situations in which these controls are to be implemented include, but are not limited to, accidents or injuries in which administration of first aid is required; application of bandages to minor cuts and abrasions of another person; and contact with sores, wounds, or broken skin. Working in a sanitary sewer or other project sites may also present a potential exposure to BBP.

Since many work sites are in remote locations, providing hand-washing facilities is difficult. For instances where hand-washing facilities cannot be provided, ARCADIS BBL will provide employees with antiseptic towelettes or an antiseptic hand cleaner and clean cloth or paper towels.

The following are specific work practice controls that shall be implemented to control exposure to BBP:

- Open wounds or cuts will be promptly bandaged.
- Wash hands and face as soon as possible after administering first aid or CPR. If wash facilities are not readily available, disposable one-time use towelettes are acceptable.
- PPE must be removed immediately upon leaving the work area and placed in an appropriate container for storage, washing, decontamination, or disposal.
- No eating, drinking, or smoking is allowed in any work area where a potential exists for occupational exposure to bloodborne pathogens.
- Non-disposable equipment or materials that have or may have blood or infectious fluid contact must be washed immediately after their use. A fresh solution of bleach and water (1 to 10%) is recommended for proper decontamination.
- Any clothing that comes in contact with blood or infectious fluids shall be removed as soon as possible after administering first aid or CPR. Clothing must be placed in an appropriate container for storage until it can be laundered.
- No personal clothing that comes in contact with blood or infectious fluids shall be laundered offsite.
- Equipment first-aid kits with two pairs of surgical gloves and CPR mouth pieces.

If a ARCADIS BBL employee believes that they have been exposed to BBP through administration of First-Aid/CPR or contact with infectious materials they will be offered a Hepatitis B vaccine at no cost. All incidents of potential exposure should be reported on the ARCADIS BBL Near-Miss/Incident Investigation Form.

Minimization of Contact

Direct contact with blood and bodily fluids should be kept to an absolute minimum, as required in a particular situation. In situations where direct contact is likely, PPE shall be worn to help prevent infection.

Based on professional judgment, an employee may choose to temporarily forego the use of PPE if he determines that the use of PPE will further jeopardize his well-being or that of the injured worker. This limited application must be carefully evaluated by the employee.

VII. Waste Management

Disposable items that have or may have blood contact must be bagged separately from other trash. These wastes must be placed in leak-proof containers or bags and labeled as a "BIOHAZARD."

Wastes used in medical emergency treatment (i.e., gloves, towels, gauze) must be disposed in an infectious waste container(s). The container will be replaced as needed; if the outside of the container becomes contaminated, an additional outside container will be used.

The waste will remain onsite in approved container(s) until an approved disposal facility capable of receiving medical wastes is identified. Disposal of the infectious waste container(s) shall be in accordance with applicable local, state, and federal regulations.

VIII. Data Recording and Management

Documentation of the exposure incident shall be recorded as soon as possible and include the route(s) of exposure, the circumstances surrounding the incident, identification of the source individuals, and identification of potentially exposed persons. Additionally, each incident involving voluntary first aid providers shall be placed on the "first aid incident list" attached to the location OSHA Log of Occupational Injuries and Illnesses.

Medical records for employees must include documentation of HBV vaccination status, medical follow-up, post-exposure testing, and a medical professional's written evaluation.

IX. Quality Assurance

Incident Reporting

An incident that occurs as a result of rendering emergency medical care will be reported to the health and safety staff and recorded on the OSHA 300 log as OSHA if applicable.

X. References

Code of Federal Regulations 29 CFR 1910.1030 – Bloodborne Pathogens

Attachment G

Air Monitoring Log

ARCADIS BBL
Infrastructure, environment, facilities

Air Monitoring Log

Project: **Date:**
Monitoring Instruments: **Activity:**
Air Monitor:
Level of Protection:

Time	Location	Instrument Reading	Comments

Attachment H

Health and Safety Inspection Form

ARCADIS BBL
Infrastructure, environment, facilities

Health and Safety Inspection Form

Project Name:	**Date:**
Project Number:	**Location:**
Prepared By:	**Project Manager:**
Auditor:	**HSS On Site:**

General	Yes	No	N/A	Comments
Is the HASP on site?	☐	☐	☐	
Is the HASP finalized and approved?	☐	☐	☐	
Is the OSHA poster displayed?	☐	☐	☐	
Are emergency telephone numbers posted?	☐	☐	☐	
Is emergency eyewash immediately available?	☐	☐	☐	
Is an emergency shower immediately available?	☐	☐	☐	
Are emergency notification means available (radio, telephone)?	☐	☐	☐	
Is a first-aid kit immediately available?	☐	☐	☐	
Is the first-aid kit adequately stocked?	☐	☐	☐	
Is there a proper sanitation facility on site?	☐	☐	☐	

Documentation and Recordkeeping	Yes	No	N/A	Comments
Are only personnel listed and approved in the HASP on site?	☐	☐	☐	
Are all personnel properly trained? (Check company-issued wallet cards.)	☐	☐	☐	
Is the daily field log kept by the Site Manager?	☐	☐	☐	
Are levels of PPE recorded?	☐	☐	☐	
Are contaminant levels recorded?	☐	☐	☐	
Are site surveillance records kept by HSS?	☐	☐	☐	
Are copies of current fit test records on site?	☐	☐	☐	
Are calibration records maintained for air monitoring equipment?	☐	☐	☐	
Are accident / incident forms on site?	☐	☐	☐	
Are field team review sheets signed?	☐	☐	☐	
Are additional hospital route directions available?	☐	☐	☐	
Is the visitors' logbook being accurately maintained?	☐	☐	☐	
Are MSDSs available for all chemicals on site?	☐	☐	☐	
Are HASP revisions recorded?	☐	☐	☐	
Is the first-aid kit inspected weekly?	☐	☐	☐	
Are daily safety meetings held?	☐	☐	☐	
Are emergency procedures discussed during safety meetings?	☐	☐	☐	

ARCADIS BBL
infrastructure, environment, facilities

Health and Safety Inspection Form

Emergency Responses	Yes	No	N/A	Comments
Is a vehicle available on site for transportation to the hospital?	☐	☐	☐	
Are fire extinguishers on site and immediately available at designated work areas?	☐	☐	☐	
Is at least one person trained in CPR and first aid on site at all times during work activities?	☐	☐	☐	
Do all personnel know who is trained in CPR / first aid?	☐	☐	☐	
Personal Protective Equipment (PPE)	**Yes**	**No**	**N/A**	**Comments**
Is proper PPE being worn as specified in HASP?	☐	☐	☐	
Level of PPE being worn.				
Is PPE adequate for work conditions?	☐	☐	☐	
If not, give reason.				
Upgrade / downgrade to PPE level.	☐	☐	☐	
Does any employee have facial hair that would interfere with respirator fit?	☐	☐	☐	
If yes, willing to shave, as necessary?	☐	☐	☐	
Fit-tested within the last year? (Documentation present)	☐	☐	☐	
If Level B, is a back-up / emergency person suited up (except for air)?	☐	☐	☐	
Does the HSS periodically inspect PPE and equipment?	☐	☐	☐	
Is the PPE not in use properly stored?	☐	☐	☐	
Is all equipment required in the HASP on site?	☐	☐	☐	
Properly calibrated?	☐	☐	☐	
In good condition?	☐	☐	☐	
Used properly?	☐	☐	☐	
Other equipment needed?	☐	☐	☐	
List.				
Is monitoring equipment covered with plastic to minimize contamination?	☐	☐	☐	
Personnel and Equipment Decontamination	**Yes**	**No**	**N/A**	**Comments**
Is the decontamination area properly designated?	☐	☐	☐	
Is appropriate cleaning fluid used for known or suspected contaminants?	☐	☐	☐	
Are appropriate decontamination procedures used?	☐	☐	☐	
Are decontamination personnel wearing proper PPE?	☐	☐	☐	
Is the equipment decontaminated?	☐	☐	☐	
Are sample containers decontaminated?	☐	☐	☐	
Are disposable items replaced as required?	☐	☐	☐	

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Health and Safety Inspection Form

Work Practices	Yes	No	N/A	Comments
Was proper collection and disposal of potentially contaminated PPE performed?	☐	☐	☐	
Was proper collection and disposal of decontamination fluid performed?	☐	☐	☐	
Is water available for decontamination?	☐	☐	☐	
Is the buddy system used?	☐	☐	☐	
Is equipment kept off drums and the ground?	☐	☐	☐	
Is kneeling or sitting on drums or the ground prohibited?	☐	☐	☐	
Do personnel avoid standing or walking through puddles or stained soil?	☐	☐	☐	
Are work zones established?	☐	☐	☐	
If night work is conducted, is there adequate illumination?	☐	☐	☐	
Is smoking, eating, or drinking in the exclusion zone or CRZ prohibited?	☐	☐	☐	
To the extent feasible, are contaminated materials handled remotely?	☐	☐	☐	
Is contact lenses use prohibited on site?	☐	☐	☐	
Is entry into excavations not allowed unless properly shored or sloped?	☐	☐	☐	
Is a competent person on site during excavation?	☐	☐	☐	
Are all unusual situations on site listed in HASP?	☐	☐	☐	
If not, when?				
Action taken?				
HASP revised?				
Confined Space Entry	**Yes**	**No**	**N/A**	**Comments**
Are employees trained according to 1910.146 – Confined Space Entry?	☐	☐	☐	
Are all confined spaces identified? If not, list:	☐	☐	☐	
Is all appropriate equipment available and in good working order?	☐	☐	☐	
Is equipment properly calibrated?	☐	☐	☐	
Are confined space permits used?	☐	☐	☐	
Are confined space permits completely and correctly filled out?	☐	☐	☐	

Attachment I

Daily Safety Meeting Log

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Safety Meeting Log

Project:	**Location:**
Date / Time:	**Activity:**

1. Work Summary

2. Physical / Chemical Hazards: Has JSA been reviewed / modified to address changing conditions?

3. Protective Equipment / Procedures

4. Emergency Procedures

Is there anyone with any medical conditions that they would like the team to know about? For example: Medic Alert, allergic to bee stings, nitro for chest pains, etc.

Location of medical equipment: fire extinguishers, first aid kit, route to hospital, auto-injectors, etc.

5. Signatures of Attendees

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Health and Safety Plan Acknowledgment

I have read the Site-Specific Health and Safety Plan, or its contents have been presented to me, and I understand the contents and I agree to abide by its requirements.

Name (Print)	Signature	Representing	Date

Attachment J

Con Edison Contractor Injury Report Form

MAINTENANCE AND CONSTRUCTION SERVICES
CONTRACTOR INJURY REPORT

Injury Date: _____ *Time of Injury:* _____ *Work Location:* _____

Date Reported: _____ *Time Reported:* _____

Name of Injured: _____ *Contractor Co:* _____

Home Address: _____

Date of Birth: _____ *SS# (Last 4 digits):* _____ *Length of Svce:* _____

Supervisor: _____ *Phone:* _____ *Shift:* _____

PART OF BODY
Be as specific as possible (e.g. right index finger, left foot, etc.)

_____ 1. Head	_____ 15. Chest
_____ 2. Nose	_____ 16. Abdomen
_____ 3. Ears	_____ 17. Back
_____ 4. Eyes	_____ 18. Hip
_____ 5. Mouth	_____ 19. Knee
_____ 6. Face	_____ 20. Ankle
_____ 7. Jaw	_____ 21. Leg
_____ 8. Neck	_____ 22. Foot
_____ 9. Shoulder	_____ 23. Toe
_____ 10. Elbow	_____ 24. Body
_____ 11. Wrist	_____ 25. Heart
_____ 12. Arm	_____ 26. Lungs
_____ 13. Hand	_____ 27. Skin
_____ 14. Finger	_____ 28. Throat

NATURE OF INJURY / ILLNESS

_____ 1. Laceration	_____ 9. Burns
_____ 2. Puncture	_____ 10. Shock
_____ 3. Contusion / Bruise	_____ 11. Inhalation
_____ 4. Sprain / Strain	_____ 12. Infection
_____ 5. Fracture / Dislocation	_____ 13. Hernia
_____ 6. Concussion	_____ 14. Skin Disorder
_____ 7. Amputation	_____ 15. Irritation
_____ 8. Foreign Matter	_____ 16. Unconsciousness

INJURY CLASSIFICATION

Medical Treatment _____
Restrictions (if yes, please describe): _____
Lost Time _____
First Aid _____
Non-recordable (FYI) _____

TYPE OF INCIDENT

_____ 1. Animal	_____ 10. Falling Objects	_____ 19. Stepped In	_____ 28. Steam
_____ 2. Insect	_____ 11. Gas / Fumes	_____ 20. Caught Between	_____ 29. Heat
_____ 3. Electric flash	_____ 12. Handling Objects	_____ 21. Altercation	_____ 30. Sun
_____ 4. Electric contact	_____ 13. Pushing Objects	_____ 22. Improper Body Pos	_____ 31. Chemicals
_____ 5. Burns (Other)	_____ 14. Pulling Objects	_____ 23. Vehicle Accident	_____ 32. Plants
_____ 6. Slip	_____ 15. Lifting Objects	_____ 24. Improper Tool Use	_____ 33. Carrying Obj
_____ 7. Trip	_____ 16. Striking Objects	_____ 25. Flames	_____ 34. Hearing Loss
_____ 8. Fall	_____ 17. Struck By Objects	_____ 26. Smoke	_____ 35. Repetitive Motion
_____ 9. Flying Objects	_____ 18. Stepped On	_____ 27. Vapors	_____ 36. Other

Describe nature, extent and type of injury (if not listed above): _____

Describe fully how injury was sustained: _____

Witnesses (Name & Address): 1) _____
2) _____

Hospital: _____ Address: _____
Physician: _____ Admitted to Hospital: _____YES _____NO
Treatment Received: _____

Report Prepared By:	_____	Emp #: _____	Phone: _____	Date: _____
CCI / Supervisor:	_____	Emp #: _____	Phone: _____	
EH&S Rep:	_____	Emp #: _____	Phone: _____	

Please fax completed report to:
EHS&T - M&CS
917-534-4490

Appendix E

DNAPL Contingency Plan

Consolidated Edison Company of New York, Inc.
Former Woodworth Avenue Works
Yonkers, New York

DNAPL Contingency Plan

I. General

This document specifies procedures to be followed during subsurface investigation activities at the Consolidated Edison Company of New York, Inc. (Con Edison) former Woodworth Avenue Works Site (the Site) to limit the potential for remobilization and downward migration of DNAPL. These procedures apply to all soil borings, test pits, and monitoring wells to be completed for the site characterization (SC) field investigation effort.

Split-spoon and/or macrocore samples will be recovered continuously during drilling operations. Sampling procedures and soil-characterization requirements are outlined in the FSP. These procedures include geologic descriptions and field screening using a PID to evaluate the relative concentrations of organic vapors in soil samples. In addition, the field geologist will carefully examine each sample for the presence of sheens, staining, and NAPL. Indications that soil may be MGP-impacted will be documented in the field notes.

If NAPL is observed, the field staff will first determine if the NAPL is lighter or denser than water (i.e., LNAPL or DNAPL). If an easy determination cannot be made, one representative sample will be selected for a NAPL shake test. In addition, NAPL shake testing will be performed if PID headspace screening results are greater than 50 parts per million (ppm). 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. The shake test will provide a reasonable basis for determining the presence of light or dense NAPL by observing whether the NAPL floats or sinks.

If the NAPL is determined to be denser than water, the field staff will make a qualitative judgment to determine if the apparent volume of DNAPL is mobile or immobile (residual). The presence of a DNAPL pool would be suggested by an apparent DNAPL volume of greater than 5% to 10% of the total soil sample volume.

If it is determined that the DNAPL may be mobile, then 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 subsurface structure. If DNAPL is encountered immediately above a potential confining unit or subsurface structure, one of the following four possible actions will be taken upon consultation with Con Edison and the NYSDEC:

1. If deeper drilling and characterization are desired at 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 installing a permanent casing grouted at least two feet into the confining layer. (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 mobile DNAPL 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 locations where DNAPL is present in a former MGP-related or other subsurface structure is identified (e.g., gas holder floor), then 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, the borehole will be properly abandoned by tremie-grouting from the bottom of the borehole to ground surface.

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

If a confining unit or former subsurface structure is not observed, drilling should be discontinued when approximately six feet of clean soil (or the top of bedrock) has been observed below the DNAPL-impacted interval. One of the four actions discussed above will be taken under this scenario.

II. NAPL Monitoring

If intervals containing NAPL are encountered during drilling operations, NAPL monitoring wells may be installed at these locations, based on the soil boring's location and the nature of the NAPL-impacted interval. The determination of the presence 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, NAPL recovery tests will be performed to assess the recoverability of the NAPL. The schedule and protocol for NAPL recovery (if required) will be agreed upon between Con Edison and the NYSDEC prior to completing the SC field activities. Con Edison will also contact the NYSDEC to discuss requirements for collecting groundwater samples for laboratory analysis from groundwater monitoring wells that contain NAPL.